



LUMA EDUCATIONAL APPS

NBCRNA NCE Practice Question Bank

540 board-style questions with detailed rationales

2026 Edition | Aligned to the 2024-2026 NCE Outline
All Four Domains · Answers and Rationales in the Back

How to Use This Practice Bank

This practice bank contains 540 unique board-style questions aligned to the NBCRNA NCE Content Outline (2024-2026). Questions span all four domains. Complete blocks of questions before reviewing answers.

Answers with full rationales and distractor explanations appear in the back of this document. Created through Luma Educational Apps. Visit <https://lumaeducationalapps.com/>.

Domain Blueprint

Domain	Share	Questions
Domain I: Basic Sciences	~22%	Q1-Q120 (120)
Domain II: Equipment, Instrumentation & Technology	~22%	Q121-Q240 (120)
Domain III: General Principles of Anesthesia	~32%	Q241-Q415 (175)
Domain IV: Surgical Procedures & Special Populations	~23%	Q416-Q540 (125)

Contents

1. Practice Questions (Q1-Q540)
2. Quick Answer Key
3. Full Rationales (all 540 items)

Scoring Guide

Award 1 point per correct answer. Suggested targets:

- Below 65% - Intensive review needed across weak domains
- 65-74% - Targeted review by domain
- 75%+ - Well prepared
- 85%+ - Exceptional preparation

Tip: Work in timed sets (for example 50 questions). Cover the options, answer first, then check the rationale section. Track misses by domain.

Note: This resource is for education and self-assessment. It is not affiliated with NBCRNA. Always verify current outlines, dosing, and institutional protocols.

PRACTICE QUESTIONS

Questions 1–540

Select the single best answer for each item. Review answers only after completing a full set.

DOMAIN I: BASIC SCIENCES

Anatomy, physiology, pathophysiology, pharmacology, chemistry, physics, and mathematics. | Questions 1-120 (120 items)

Question 1

Domain I - Pharmacology

A 68-year-old patient with end-stage renal disease receives rocuronium 0.6 mg/kg for intubation. The patient remains in the OR for 4 hours. Which reversal agent is MOST appropriate and why?

- A. Neostigmine 0.05 mg/kg with glycopyrrolate - standard reversal at 4 hours
- B. Sugammadex 2 mg/kg - at T2 recovery, regardless of renal status
- C. Sugammadex 4 mg/kg - renal failure prolongs rocuronium but sugammadex is still preferred over neostigmine
- D. Neostigmine alone - glycopyrrolate should be avoided in renal failure

Question 2

Domain I - Pharmacology

A CRNA administers bupivacaine 0.5% epidurally and the patient develops sudden cardiovascular collapse with a wide-complex dysrhythmia. Which intervention is MOST critical to initiate immediately?

- A. Defibrillation at 200J biphasic
- B. Intralipid 20% 1.5 mL/kg IV bolus
- C. Sodium bicarbonate 1-2 mEq/kg IV
- D. Amiodarone 300 mg IV push

Question 3

Domain I - Anatomy & Physiology

During one-lung ventilation in the left lateral decubitus position, a patient develops significant hypoxemia. The non-dependent (right, operative) lung is being deflated. Which mechanism BEST explains the initial compensatory response to reduce V/Q mismatch?

- A. Increased cardiac output to the dependent lung
- B. Hypoxic pulmonary vasoconstriction (HPV) in the non-dependent lung
- C. Increased tidal volume to the dependent lung via mechanical ventilation
- D. Reflex bronchodilation in the non-dependent lung

Question 4

Domain I - Pharmacology

A CRNA is administering sevoflurane 2% with a fresh gas flow of 1 L/min. After 45 minutes, the CO₂ absorbent becomes desiccated. Which MOST dangerous compound is likely produced?

- A. Carbon dioxide
- B. Compound A
- C. Carbon monoxide
- D. Hydrogen fluoride

Question 5

Domain I - Physiology

A 72-year-old man with a known PFO (patent foramen ovale) is undergoing posterior fossa craniotomy in the sitting position. During the procedure, the ETCO₂ suddenly drops from 38 to 22 mmHg and a mill-wheel murmur is heard. What is the MOST dangerous complication of this situation specific to the PFO?

- A. Increased intracranial pressure
- B. Paradoxical air embolism causing stroke or coronary air embolism
- C. Tension pneumothorax
- D. Systemic air embolism from arterial line

Question 6

Domain I - Pharmacology

Which of the following correctly describes the mechanism of action of succinylcholine-induced hyperkalemia and which patients are at HIGHEST risk?

- A. Upregulation of extrajunctional acetylcholine receptors leading to massive potassium efflux; highest risk in burn patients >72 hours after injury
- B. Direct inhibition of the Na/K ATPase pump; highest risk in patients with hypokalemia
- C. Competitive blockade of nicotinic receptors; highest risk in renal failure
- D. Phase II block causing prolonged channel opening; highest risk in liver failure

Question 7

Domain I - Pathophysiology

A patient with hypertrophic obstructive cardiomyopathy (HOCM) develops sudden severe hypotension during induction with propofol. Which vasopressor is MOST appropriate?

- A. Dopamine 5 mcg/kg/min
- B. Epinephrine 10 mcg IV
- C. Phenylephrine 100 mcg IV bolus
- D. Dobutamine 5 mcg/kg/min

Question 8

Domain I - Pharmacology

A CRNA is planning to use desflurane for a 2-hour abdominal case. The CRNA notices the vaporizer temperature display is not illuminated and the gas cannot be dialed in. Which is the MOST likely reason?

- A. The vaporizer is out of desflurane
- B. The vaporizer heating element has not reached operating temperature (~39 degrees C)
- C. The oxygen pipeline pressure is below 45 psig
- D. The vaporizer is tilted and cannot be used for 30 minutes

Question 9

Domain I - Pharmacology

A patient is receiving a remifentanyl infusion at 0.2 mcg/kg/min for a 4-hour spine surgery. What is the PRIMARY concern during emergence from anesthesia?

- A. Prolonged sedation due to remifentanyl accumulation
- B. Acute opioid-induced hyperalgesia and severe pain on awakening
- C. Respiratory depression lasting 6-8 hours postoperatively
- D. Re-narcotization requiring naloxone reversal

Question 10

Domain I - Pathophysiology

A 28-year-old pregnant woman at 32 weeks gestation undergoes emergency appendectomy under general anesthesia. During induction, she develops tachycardia, bronchospasm, urticaria, and hypotension. What is the CORRECT treatment sequence?

- A. Epinephrine 0.3 mg IM to the lateral thigh, then diphenhydramine 50 mg IV
- B. Epinephrine 10-100 mcg IV bolus immediately, then airway management and diphenhydramine
- C. Hydrocortisone 200 mg IV, diphenhydramine, then epinephrine if no response
- D. Albuterol MDI for bronchospasm, then epinephrine IM

Question 11

Domain I - Physics

A CRNA is calculating the remaining oxygen supply in an E-cylinder that reads 1000 psig. The patient requires 3 L/min O₂. Approximately how long will the oxygen last?

- A. ~100 minutes
- B. ~50 minutes
- C. ~67 minutes
- D. ~150 minutes

Question 12

Domain I - Pharmacology

Which of the following drug interactions represents the GREATEST concern when using ketamine for procedural sedation in a patient taking an MAOI antidepressant?

- A. Ketamine + MAOI -> malignant hyperthermia
- B. Ketamine + MAOI -> serotonin syndrome and severe hypertensive crisis
- C. Ketamine + MAOI -> prolonged neuromuscular blockade
- D. Ketamine + MAOI -> rapid respiratory depression

Question 13

Domain I - Pathophysiology

A patient with known cirrhosis receives vecuronium. Which statement BEST explains the expected pharmacokinetic change?

- A. Faster elimination due to compensatory renal clearance
- B. Prolonged neuromuscular blockade due to reduced hepatic metabolism and biliary excretion
- C. Unchanged duration because vecuronium uses Hofmann elimination
- D. Reduced potency due to increased volume of distribution from ascites

Question 14

Domain I - Pharmacology

An 80 kg patient with no liver or kidney disease requires succinylcholine for rapid sequence intubation. The CRNA calculates the correct dose. What is it?

- A. 80 mg (1 mg/kg)
- B. 120 mg (1.5 mg/kg)
- C. 160 mg (2 mg/kg)
- D. 40 mg (0.5 mg/kg)

Question 15

Domain I - Pathophysiology

A 45-year-old woman with COPD and known CO₂ retention (baseline PaCO₂ 55 mmHg) presents for elective knee arthroplasty under spinal anesthesia. Postoperatively, she is given supplemental O₂ at 4 L/min by nasal cannula. Her SpO₂ is 96% but she becomes increasingly somnolent. The MOST likely mechanism is:

- A. Propofol residual effect causing sedation
- B. Nitrous oxide diffusion hypoxia
- C. Hyperoxia-induced suppression of the hypoxic ventilatory drive, causing CO₂ retention
- D. Neuraxial opioid-induced respiratory depression

Question 16

Domain I - Pharmacology

Which pharmacokinetic property BEST explains why propofol provides smoother, faster emergence compared to barbiturates after a 3-hour infusion?

- A. Lower volume of distribution
- B. Higher protein binding
- C. Organ-independent elimination via Hofmann mechanism
- D. Short context-sensitive half-time due to redistribution and rapid hepatic clearance

Question 17

Domain I - Pathophysiology

A 55-year-old male with a history of MH susceptibility requires emergency surgery. Which anesthetic plan is MOST appropriate?

- A. Total intravenous anesthesia (TIVA) with propofol + remifentanyl; MH-prepared machine
- B. Sevoflurane with succinylcholine for intubation; dantrolene on standby
- C. Spinal anesthesia with bupivacaine; volatile backup if spinal fails
- D. Sevoflurane only; avoid succinylcholine since it is the more dangerous trigger

Question 18

Domain I - Pharmacology

A CRNA gives a patient metoclopramide 10 mg IV preoperatively. Which patient would you be MOST concerned about a serious adverse reaction?

- A. A patient with a history of peptic ulcer disease
- B. A patient with a history of Parkinson's disease
- C. A patient with a history of GERD
- D. A patient with a history of nausea and vomiting after prior surgery

Question 19

Domain I - Pharmacology

Which of the following correctly describes the pharmacodynamic interaction between volatile anesthetics and non-depolarizing neuromuscular blocking agents (NDNMBs)?

- A. Volatile agents competitively antagonize NDNMBs at the nicotinic receptor
- B. Volatile agents potentiate NDNMBs by enhancing post-junctional sensitivity and reducing muscle spindle activity
- C. Volatile agents prolong NDNMB action by inhibiting plasma cholinesterase
- D. Volatile agents have no significant effect on NDNMB requirement

Question 20

Domain I - Pharmacology

A patient on buprenorphine (Suboxone 16 mg/day) for opioid use disorder requires emergent laparotomy for a perforated viscus. Which pain management strategy is MOST appropriate perioperatively?

- A. Discontinue buprenorphine immediately and switch to full agonist opioids
 - B. Continue buprenorphine through surgery; rely on regional anesthesia and non-opioid multimodal analgesia; supplement with high-dose full agonist opioids if needed
 - C. Administer naloxone to clear buprenorphine, then use standard opioid dosing
 - D. Use meperidine exclusively since it is not blocked by buprenorphine
- DOMAIN II: Equipment, Instrumentation & Technology - Questions 21-40

Question 21

Domain I -- Anatomy & Physiology

A patient's cardiac output falls acutely when PEEP is increased to 15 cmH₂O during mechanical ventilation. Which mechanism MOST directly explains the decrease in cardiac output?

- A. Reflex bradycardia from carotid baroreceptor stimulation
- B. Reduced venous return from elevated intrathoracic pressure
- C. Increased left ventricular preload from pulmonary congestion
- D. Direct negative inotropic effect of PEEP on the myocardium

Question 22

Domain I -- Anatomy & Physiology

During carotid endarterectomy, surgical manipulation of the carotid sinus causes sudden bradycardia and hypotension. Which afferent nerve carries the signal responsible for this reflex?

- A. Facial nerve (CN VII)
- B. Glossopharyngeal nerve (CN IX)
- C. Hypoglossal nerve (CN XII)
- D. Vagus nerve (CN X)

Question 23

Domain I -- Anatomy & Physiology

A healthy 70 kg adult has a hemoglobin of 15 g/dL and SaO₂ of 98% with a PaO₂ of 95 mmHg. Which component contributes the LARGEST portion of total arterial oxygen content?

- A. Dissolved oxygen in plasma
- B. Oxygen bound to plasma proteins
- C. Oxygen carried as bicarbonate
- D. Oxygen bound to hemoglobin

Question 24

Domain I -- Physiology

A patient hyperventilates to a PaCO₂ of 20 mmHg during controlled ventilation. What is the MOST likely effect on cerebral blood flow?

- A. Cerebral blood flow decreases due to vasoconstriction
- B. Cerebral blood flow increases due to a rise in cerebral metabolic rate
- C. Cerebral blood flow is unchanged because of autoregulation
- D. Cerebral blood flow increases due to vasodilation

Question 25

Domain I -- Physiology

A patient in the operating room has a measured mixed venous oxygen saturation (SvO₂) of 55%. Assuming stable oxygen consumption and hemoglobin, which change is the MOST likely cause?

- A. Left shift of the oxyhemoglobin dissociation curve
- B. Decreased oxygen extraction by tissues
- C. Decreased cardiac output
- D. Increased cardiac output

Question 26

Domain I -- Anatomy & Physiology

A patient develops a tension pneumothorax during laparoscopy. Which finding BEST distinguishes tension pneumothorax from a simple pneumothorax?

- A. Decreased breath sounds on the affected side
- B. Hyperresonance to percussion on the affected side
- C. Hypotension with tracheal deviation away from the affected side
- D. Increased peak inspiratory pressures

Question 27

Domain I -- Physiology

A patient's functional residual capacity (FRC) decreases markedly after induction of general anesthesia and paralysis in the supine position. Which consequence is MOST likely?

- A. More rapid arterial desaturation during apnea
- B. Increased time to desaturation during apnea
- C. Increased anatomic dead space
- D. Decreased venous admixture

Question 28

Domain I -- Anatomy & Physiology

Which structure must a spinal needle pass through LAST before entering the subarachnoid space during a midline lumbar spinal?

- A. Ligamentum flavum
- B. Dura mater
- C. Arachnoid mater
- D. Posterior longitudinal ligament

Question 29

Domain I -- Physiology

A patient's urine output falls to 15 mL/hr intraoperatively. Which physiologic response to surgical stress MOST directly contributes to intraoperative oliguria in an otherwise euvolemic patient?

- A. Increased ADH and aldosterone secretion
- B. Suppression of the renin-angiotensin system
- C. Decreased antidiuretic hormone (ADH) secretion
- D. Increased atrial natriuretic peptide release

Question 30

Domain I -- Physiology

Which portion of the nephron is the PRIMARY site of action for loop diuretics such as furosemide?

- A. Collecting duct
- B. Distal convoluted tubule
- C. Proximal convoluted tubule
- D. Thick ascending limb of the loop of Henle

Question 31

Domain I -- Pathophysiology

A patient with type 1 diabetes presents for emergency surgery with a glucose of 480 mg/dL, pH 7.18, and positive serum ketones. Which is the MOST appropriate initial intervention?

- A. Give a bolus of 50% dextrose to prevent hypoglycemia
- B. Proceed immediately with a rapid insulin bolus and no fluids
- C. Administer intravenous insulin and isotonic fluid resuscitation
- D. Administer sodium bicarbonate to correct the pH

Question 32

Domain I -- Pathophysiology

A patient undergoing adrenalectomy for pheochromocytoma develops severe hypertension during tumor manipulation. Which drug is the MOST appropriate first-line agent to control the acute blood pressure surge?

- A. Phentolamine
- B. Phenylephrine
- C. Ephedrine
- D. Esmolol

Question 33

Domain I -- Pathophysiology

A patient with advanced liver cirrhosis is scheduled for surgery. Which physiologic change MOST increases the free (unbound) fraction of highly protein-bound drugs such as diazepam?

- A. Increased hepatic blood flow
- B. Increased biliary excretion
- C. Decreased albumin production
- D. Increased alpha-1 acid glycoprotein levels

Question 34

Domain I -- Pathophysiology

A patient with untreated primary hyperaldosteronism (Conn syndrome) is likely to present with which electrolyte and acid-base pattern?

- A. Hyperkalemia and metabolic acidosis
- B. Hyperkalemia and metabolic alkalosis
- C. Hypokalemia and metabolic alkalosis
- D. Hypokalemia and metabolic acidosis

Question 35

Domain I -- Pathophysiology

A patient with chronic kidney disease and a serum potassium of 6.8 mEq/L shows peaked T waves on the ECG. Which intervention MOST rapidly stabilizes the cardiac membrane?

- A. Nebulized albuterol
- B. Intravenous regular insulin with dextrose
- C. Intravenous calcium gluconate
- D. Sodium polystyrene sulfonate

Question 36

Domain I -- Pathophysiology

A patient with severe aortic stenosis (valve area 0.7 cm²) becomes hypotensive after spinal anesthesia. Which hemodynamic goal is MOST important in managing this patient?

- A. Induce tachycardia to increase cardiac output
- B. Maintain adequate systemic vascular resistance and preload
- C. Allow permissive hypotension to reduce myocardial work
- D. Aggressively reduce afterload with a vasodilator

Question 37

Domain I -- Physiology

According to the oxyhemoglobin dissociation curve, which condition causes a RIGHTWARD shift, favoring oxygen unloading at the tissues?

- A. Alkalosis
- B. Increased 2,3-DPG
- C. Hypothermia
- D. Decreased PaCO₂

Question 38

Domain I -- Pharmacology

Which volatile anesthetic has the LOWEST blood-gas partition coefficient, producing the FASTEST onset and offset of anesthesia?

- A. Isoflurane
- B. Sevoflurane
- C. Halothane
- D. Desflurane

Question 39

Domain I -- Pharmacology

A patient breathes 70% nitrous oxide during induction with sevoflurane. The alveolar concentration of sevoflurane rises faster than expected. Which phenomenon BEST explains this finding?

- A. Diffusion hypoxia
- B. Concentration effect
- C. Low-flow rebreathing
- D. Second gas effect

Question 40

Domain I -- Pharmacology

Which volatile anesthetic is MOST likely to sensitize the myocardium to catecholamines and predispose to dysrhythmias in a patient receiving epinephrine?

- A. Desflurane
- B. Halothane
- C. Sevoflurane
- D. Isoflurane

Question 41

Domain I -- Pharmacology

A patient receiving nitrous oxide for a middle ear procedure is at risk of which complication due to the physical properties of the gas?

- A. Decreased pressure in air-filled spaces
- B. Expansion of closed air-filled spaces
- C. Reduced risk of postoperative nausea
- D. Decreased pulmonary vascular resistance

Question 42

Domain I -- Pharmacology

A patient undergoing TIVA with propofol develops greenish discoloration of the urine. What is the MOST appropriate interpretation of this finding?

- A. A benign effect of propofol metabolites
- B. Acute kidney injury requiring immediate dialysis
- C. Rhabdomyolysis from propofol infusion syndrome
- D. Hemolysis from the lipid emulsion

Question 43

Domain I -- Pharmacology

Etomidate is often selected for induction in hemodynamically unstable patients but carries which notable endocrine adverse effect?

- A. Syndrome of inappropriate ADH secretion
- B. Adrenocortical suppression
- C. Hyperglycemia from insulin suppression
- D. Thyroid storm

Question 44

Domain I -- Pharmacology

A patient with a history of severe egg and soy allergy requires induction. Which concern is MOST relevant when selecting propofol?

- A. Propofol must be avoided because soybean oil triggers anaphylaxis in all soy-allergic patients
- B. Propofol is absolutely contraindicated in all egg allergy
- C. Propofol contains active egg albumin, the usual allergen
- D. The lipid emulsion contains egg lecithin and soybean oil, but reactions are rare

Question 45

Domain I -- Pharmacology

Ketamine produces dissociative anesthesia primarily through which receptor action?

- A. Alpha-2 adrenergic agonism
- B. GABA-A receptor agonism
- C. Mu opioid receptor agonism
- D. NMDA receptor antagonism

Question 46

Domain I -- Pharmacology

Dexmedetomidine provides sedation and analgesia without significant respiratory depression through agonism at which receptor?

- A. Peripheral alpha-1 adrenergic receptors
- B. Central alpha-2 adrenergic receptors
- C. NMDA receptors
- D. Beta-1 adrenergic receptors

Question 47

Domain I -- Pharmacology

A patient receives morphine for postoperative analgesia and develops prolonged sedation and respiratory depression. The patient has end-stage renal disease. Which factor BEST explains the exaggerated effect?

- A. Increased plasma protein binding of morphine
- B. Reduced hepatic conjugation of morphine
- C. Enhanced first-pass metabolism
- D. Accumulation of the active metabolite morphine-6-glucuronide

Question 48

Domain I -- Pharmacology

Which opioid is MOST associated with serotonin syndrome when combined with a monoamine oxidase inhibitor and should be avoided in these patients?

- A. Hydromorphone
- B. Meperidine
- C. Morphine
- D. Fentanyl

Question 49

Domain I -- Pharmacology

A patient develops chest wall rigidity ('wooden chest') after a rapid, high-dose fentanyl bolus during induction. Which intervention MOST directly reverses the rigidity to allow ventilation?

- A. Increase the volatile anesthetic concentration
- B. Administer intravenous calcium
- C. Apply continuous positive airway pressure only
- D. Administer a neuromuscular blocking agent or naloxone

Question 50

Domain I -- Pharmacology

A 30-year-old healthy patient receives cisatracurium for a case with anticipated renal and hepatic dysfunction. Which property makes cisatracurium advantageous in organ failure?

- A. Extensive hepatic metabolism to inactive products
- B. Elimination by Hofmann degradation independent of organ function
- C. Rapid renal excretion of unchanged drug
- D. Plasma cholinesterase hydrolysis

Question 51

Domain I -- Pharmacology

During neuromuscular monitoring with a train-of-four (TOF), a patient shows fade with the fourth twitch weaker than the first. This pattern is characteristic of which type of block?

- A. Nondepolarizing (competitive) block
- B. Normal baseline with no blockade
- C. Complete recovery of neuromuscular function
- D. Phase I depolarizing block

Question 52

Domain I -- Pharmacology

A patient received rocuronium and now has a train-of-four count of 2 twitches at the end of surgery. Which reversal strategy is MOST appropriate for rapid, reliable reversal?

- A. Sugammadex 16 mg/kg
- B. Sugammadex 2 mg/kg
- C. No reversal; allow spontaneous recovery
- D. Neostigmine 70 mcg/kg alone

Question 53

Domain I -- Pharmacology

A patient with atypical (pseudo)cholinesterase deficiency who is homozygous receives succinylcholine. What is the MOST likely clinical consequence?

- A. Immediate resistance to succinylcholine requiring higher doses
- B. Malignant hyperthermia
- C. Markedly prolonged neuromuscular blockade lasting hours
- D. No change in duration of action

Question 54

Domain I -- Pharmacology

A dibucaine number of 20 in a patient given succinylcholine indicates which of the following?

- A. Malignant hyperthermia susceptibility
- B. Normal plasma cholinesterase and normal duration
- C. Homozygous atypical plasma cholinesterase and prolonged block
- D. Heterozygous plasma cholinesterase with mildly prolonged block

Question 55

Domain I -- Pharmacology

Neostigmine is administered with glycopyrrolate rather than atropine for reversal of neuromuscular blockade primarily because glycopyrrolate:

- A. Prevents recurarization
- B. Directly reverses the aminosteroid at the receptor
- C. Has a similar onset and does not cross the blood-brain barrier
- D. Provides a longer duration of neuromuscular reversal

Question 56

Domain I -- Pharmacology

Which property of a local anesthetic MOST determines its potency?

- A. Vasodilating activity
- B. Lipid solubility
- C. Protein binding
- D. pKa

Question 57

Domain I -- Pharmacology

A local anesthetic with a pKa closer to physiologic pH (7.4) will have which characteristic?

- A. Longer duration due to increased protein binding
- B. Greater potency due to increased lipid solubility
- C. Slower onset because less drug is un-ionized
- D. Faster onset because a greater fraction is un-ionized

Question 58

Domain I -- Pharmacology

Why does injecting a local anesthetic into infected, acidic tissue often result in poor block quality?

- A. Infection destroys the sodium channels
- B. The acidic environment increases the un-ionized fraction
- C. The acidic environment increases the ionized fraction, reducing membrane penetration
- D. Acidosis increases lipid solubility of the drug

Question 59

Domain I -- Pharmacology

Which local anesthetic is an ESTER that is metabolized by plasma cholinesterase and carries a higher risk of allergic reactions due to PABA?

- A. Ropivacaine
- B. Bupivacaine
- C. Lidocaine
- D. Chloroprocaine

Question 60

Domain I -- Pharmacology

A patient develops perioral numbness, tinnitus, and metallic taste after a large local anesthetic injection. Which is the MOST appropriate immediate action?

- A. Stop the injection and prepare for possible local anesthetic systemic toxicity
- B. Administer epinephrine 1 mg IV immediately
- C. Give a beta blocker to control heart rate
- D. Continue the injection because symptoms are minor

Question 61

Domain I -- Pharmacology

Which local anesthetic is considered the MOST cardiotoxic due to its tight, prolonged binding to cardiac sodium channels?

- A. Chloroprocaine
- B. Bupivacaine
- C. Mepivacaine
- D. Lidocaine

Question 62

Domain I -- Pharmacology

Epinephrine is added to a lidocaine solution for peripheral nerve block. What is the PRIMARY benefit of this addition?

- A. Local vasoconstriction that prolongs duration and reduces peak plasma levels
- B. Direct antagonism of sodium channels
- C. Increased systemic absorption to speed onset
- D. Neutralization of the anesthetic to reduce toxicity

Question 63

Domain I -- Pharmacology

A hypotensive patient with a heart rate of 50 bpm and low cardiac output needs a single agent that increases both heart rate and contractility. Which agent is MOST appropriate?

- A. Phenylephrine
- B. Ephedrine
- C. Nitroglycerin
- D. Vasopressin

Question 64

Domain I -- Pharmacology

Which vasoactive agent primarily works through V1 receptors and is useful for refractory hypotension in vasodilatory shock, including cases resistant to catecholamines?

- A. Dobutamine
- B. Vasopressin
- C. Milrinone
- D. Norepinephrine

Question 65

Domain I -- Pharmacology

Milrinone improves cardiac output in decompensated heart failure through which mechanism?

- A. Phosphodiesterase-3 inhibition increasing intracellular cAMP
- B. Beta-1 adrenergic receptor agonism
- C. Alpha-1 adrenergic receptor agonism
- D. Calcium channel blockade

Question 66

Domain I -- Physics & Chemistry

A full oxygen E-cylinder contains approximately 660 L of oxygen at a pressure of about 1900-2200 psig. Which gas law explains why the cylinder pressure gauge reading is directly proportional to the remaining volume of oxygen?

- A. Boyle's law
- B. Dalton's law
- C. Gay-Lussac's (the third gas) law
- D. Charles's law

Question 67

Domain I -- Physics & Chemistry

A full nitrous oxide E-cylinder reads 745 psig. As nitrous oxide is used, the gauge pressure remains near 745 psig until most of the contents are gone. Which property explains this behavior?

- A. Nitrous oxide obeys Boyle's law as a pure gas
- B. Nitrous oxide has a very high critical temperature above room temperature
- C. Nitrous oxide exists as a liquid and vapor in equilibrium in the cylinder
- D. The cylinder gauge is faulty

Question 68

Domain I -- Physics & Chemistry

A variable-bypass vaporizer is moved from sea level to a high-altitude facility. Assuming the dial is set to 2%, how does the delivered PARTIAL PRESSURE of the anesthetic compare, and what is the clinical implication?

- A. The vaporizer stops working at altitude
- B. Partial pressure falls to zero
- C. Partial pressure delivered is roughly maintained, so clinical effect is preserved
- D. Delivered volume percent increases dramatically, causing overdose

Question 69

Domain I -- Physics & Chemistry

Desflurane requires a heated, pressurized vaporizer rather than a conventional variable-bypass design. Which physical property of desflurane MOST explains this requirement?

- A. Its boiling point near room temperature (about 22-23 C) and high vapor pressure
- B. Its high molecular weight
- C. Its low minimum alveolar concentration
- D. Its low blood-gas partition coefficient

Question 70

Domain I -- Physics & Chemistry

A Thorpe tube (variable-orifice) flowmeter is used on an anesthesia machine. At LOW flows, gas flow past the bobbin behaves like flow through a tube where which property is MOST important?

- A. Temperature only
- B. Viscosity, because flow is laminar
- C. Density, because flow is turbulent
- D. Molecular weight, because flow is transitional

Question 71

Domain I -- Physics & Chemistry

The oxygen flush valve on an anesthesia machine delivers oxygen at a high flow. Which hazard is MOST associated with using the oxygen flush during positive-pressure ventilation?

- A. Hypoxic gas mixture delivery
- B. Delivery of volatile anesthetic overdose
- C. Rapid cooling of the breathing circuit
- D. Barotrauma from high flow and pressure bypassing the vaporizer

Question 72

Domain I -- Physics & Chemistry

According to the Venturi principle used in some oxygen delivery and suction devices, when gas flows through a constriction its velocity increases and its lateral pressure:

- A. Remains unchanged
- B. Decreases
- C. Increases
- D. Becomes equal to atmospheric only

Question 73

Domain I -- Physics & Chemistry

A pin index safety system (PISS) on an E-cylinder yoke is designed to prevent which error?

- A. Connecting a cylinder to the wrong gas-specific yoke
- B. Excessive fresh gas flow
- C. Reverse flow of gas into the pipeline
- D. Overfilling the cylinder

Question 74

Domain I -- Physics & Chemistry

Laminar gas flow through an endotracheal tube follows Poiseuille's law. If the radius of the tube is halved, resistance to laminar flow increases by a factor of approximately:

- A. 4
- B. 2
- C. 16
- D. 8

Question 75

Domain I -- Physics & Chemistry

When a gas at high pressure is rapidly released from a cylinder through a regulator, it cools. This adiabatic cooling is described by which effect?

- A. Joule-Thomson effect
- B. Coanda effect
- C. Magnus effect
- D. Bernoulli effect

Question 76

Domain I -- Physics & Chemistry

Which soda lime component is MOST responsible for the generation of Compound A and carbon monoxide when volatile anesthetics contact desiccated absorbent?

- A. Silica
- B. Strong bases such as sodium hydroxide and potassium hydroxide
- C. Water
- D. Calcium hydroxide

Question 77

Domain I -- Physics & Chemistry

Which volatile anesthetic combined with a DESICCATED absorbent poses the GREATEST risk of clinically significant carbon monoxide production?

- A. Isoflurane
- B. Nitrous oxide
- C. Desflurane
- D. Sevoflurane

Question 78

Domain I -- Physics & Chemistry

Compound A production during sevoflurane anesthesia is MOST increased under which condition?

- A. High fresh gas flows and hydrated absorbent
- B. High oxygen flush frequency
- C. Low fresh gas flows with warm, potent absorbent
- D. Use of a non-rebreathing circuit

Question 79

Domain I -- Physics & Chemistry

An exhausted soda lime canister often changes color due to a pH indicator. A common indicator turns the granules which color when the absorbent is spent?

- A. White to purple/violet
- B. Pink to white
- C. Green to yellow
- D. White to blue

Question 80

Domain I -- Mathematics

A 40-year-old patient is anesthetized with a mixture delivering 0.5 MAC of sevoflurane and 0.5 MAC of nitrous oxide. What is the approximate total MAC delivered, and is this generally adequate to prevent movement in 50% of patients?

- A. 0.5 MAC total; inadequate
- B. 2.0 MAC total; excessive
- C. 1.0 MAC total; adequate to prevent movement in about 50%
- D. 1.5 MAC total; excessive

Question 81

Domain I -- Mathematics

The MAC of isoflurane is about 1.15%. To provide 1.3 MAC for a healthy adult, approximately what end-tidal isoflurane concentration should be targeted?

- A. 1.5%
- B. 2.3%
- C. 1.15%
- D. 0.9%

Question 82

Domain I -- Mathematics

MAC-BAR (blocking adrenergic response) is approximately what multiple of MAC?

- A. 1.7-2.0 MAC
- B. 1.3 MAC
- C. 0.3-0.4 MAC
- D. 1.0 MAC

Question 83

Domain I -- Mathematics

At sea level (barometric pressure 760 mmHg), an anesthetic gas is delivered at 2 volume percent. What is its approximate partial pressure?

- A. 15.2 mmHg
- B. 7.6 mmHg
- C. 152 mmHg
- D. 1.5 mmHg

Question 84

Domain I -- Mathematics

A patient breathes room air (F_{iO_2} 0.21) at sea level. Using the alveolar gas equation with P_{aCO_2} 40 mmHg and a respiratory quotient of 0.8, what is the approximate alveolar oxygen tension (P_{AO_2})? (PB 760, P_{H_2O} 47)

- A. About 50 mmHg
- B. About 150 mmHg
- C. About 100 mmHg
- D. About 250 mmHg

Question 85

Domain I -- Mathematics

A vaporizer output is 1 MAC of desflurane (MAC about 6%). If nitrous oxide 60% is added and reduces the desflurane requirement, the effect on total anesthetic requirement demonstrates which relationship among inhaled agents?

- A. Synergistic (supra-additive)
- B. Independent with no interaction
- C. Antagonistic
- D. Additive

Question 86

Domain I -- Mathematics

A patient is 1.7 m tall and weighs 98 kg. What is the approximate body mass index (BMI), and which category does it fall into?

- A. 34 kg/m²; obese (class I)
- B. 29 kg/m²; overweight
- C. 41 kg/m²; obese (class III)
- D. 24 kg/m²; normal

Question 87

Domain I -- Mathematics

A norepinephrine infusion is prepared as 4 mg in 250 mL (16 mcg/mL). For an 80 kg patient, an infusion running at 15 mL/hr delivers approximately what dose in mcg/kg/min?

- A. 1.0 mcg/kg/min
- B. 0.5 mcg/kg/min
- C. 0.1 mcg/kg/min
- D. 0.05 mcg/kg/min

Question 88

Domain I -- Mathematics

A patient has a systolic blood pressure of 120 mmHg and a diastolic pressure of 60 mmHg. What is the approximate mean arterial pressure (MAP)?

- A. 90 mmHg
- B. 80 mmHg
- C. 60 mmHg
- D. 100 mmHg

Question 89

Domain I -- Mathematics

A patient has a MAP of 90 mmHg, a central venous pressure of 6 mmHg, and a cardiac output of 6 L/min. What is the approximate systemic vascular resistance (SVR) in dynes-sec-cm-5?

- A. About 2400
- B. About 1600
- C. About 560
- D. About 1120

Question 90

Domain I -- Mathematics

A propofol infusion is set at 150 mcg/kg/min for a 70 kg patient. Using a standard concentration of 10 mg/mL, what is the approximate infusion rate in mL/hr?

- A. 63 mL/hr
- B. 32 mL/hr
- C. 95 mL/hr
- D. 126 mL/hr

Question 91

Domain I -- Mathematics

A pediatric patient weighs 15 kg and requires a maintenance IV fluid rate using the 4-2-1 rule. What is the approximate hourly maintenance rate?

- A. 50 mL/hr
- B. 60 mL/hr
- C. 75 mL/hr
- D. 25 mL/hr

Question 92

Domain I -- Mathematics

A dopamine infusion order is written to run at a 'renal dose' of 3 mcg/kg/min. For a 60 kg patient using a bag of 400 mg in 250 mL (1600 mcg/mL), what is the approximate pump rate?

- A. About 21 mL/hr
- B. About 28 mL/hr
- C. About 14 mL/hr
- D. About 7 mL/hr

Question 93

Domain I -- Mathematics

A blood loss of 500 mL is estimated in a 70 kg adult whose estimated blood volume is 70 mL/kg. What percentage of the patient's blood volume has been lost?

- A. About 5%
- B. About 20%
- C. About 10%
- D. About 30%

Question 94

Domain I -- Mathematics

A nitroglycerin infusion contains 50 mg in 250 mL (200 mcg/mL) and runs at 15 mL/hr. What is the approximate delivered dose in mcg/min?

- A. 100 mcg/min
- B. 75 mcg/min
- C. 25 mcg/min
- D. 50 mcg/min

Question 95

Domain I -- Mathematics

An obese patient weighs 120 kg with an ideal body weight of 60 kg. Succinylcholine for rapid sequence intubation should be dosed using which weight, and what is the approximate dose at 1.5 mg/kg?

- A. Ideal body weight; about 45 mg
- B. Lean body weight; about 60 mg
- C. Total body weight; about 180 mg
- D. Ideal body weight; about 90 mg

Question 96

Domain I -- Pharmacology

Which drug is a selective beta-1 antagonist with an ultra-short duration of action ideal for treating intraoperative tachycardia?

- A. Metoprolol
- B. Labetalol
- C. Propranolol
- D. Esmolol

Question 97

Domain I -- Pharmacology

Atropine is administered to treat symptomatic bradycardia. Which mechanism explains its increase in heart rate?

- A. Inhibition of acetylcholinesterase
- B. Antagonism of muscarinic receptors at the sinoatrial node
- C. Direct calcium channel activation
- D. Beta-1 adrenergic receptor agonism

Question 98

Domain I -- Pharmacology

Adenosine is given to terminate a stable, narrow-complex supraventricular tachycardia. Which describes its mechanism and expected effect?

- A. It is a long-acting beta blocker
- B. It blocks sodium channels, slowing ventricular conduction
- C. It transiently blocks AV nodal conduction, often causing a brief asystole
- D. It increases AV nodal conduction to break the rhythm

Question 99

Domain I -- Pharmacology

A patient with acute decompensated heart failure and pulmonary edema is given intravenous nitroglycerin. At low-to-moderate doses, its predominant hemodynamic effect is:

- A. Positive inotropy
- B. Increased heart rate through beta-1 stimulation
- C. Arterial vasoconstriction increasing afterload
- D. Venodilation reducing preload

Question 100

Domain I -- Pharmacology

Which antihypertensive agent used intraoperatively is a direct arterial and venous dilator that can cause cyanide toxicity with prolonged high-dose infusion?

- A. Hydralazine
- B. Clevidipine
- C. Nicardipine
- D. Sodium nitroprusside

Question 101

Domain I -- Pharmacology

A patient taking an ACE inhibitor chronically develops refractory hypotension under general anesthesia that responds poorly to phenylephrine and ephedrine. Which agent is MOST likely to be effective?

- A. Nitroglycerin
- B. Esmolol
- C. Vasopressin
- D. Additional phenylephrine boluses

Question 102

Domain I -- Physiology

Which physiologic change explains the reduced anesthetic requirement (lower MAC) seen in elderly patients?

- A. Increased number of central neurons
- B. Age-related decline in central nervous system neuronal density and neurotransmitter activity
- C. Increased volume of distribution for volatile agents
- D. Increased hepatic and renal clearance

Question 103

Domain I -- Physiology

The Bohr effect describes which physiologic relationship important for oxygen delivery?

- A. Decreased 2,3-DPG decreases oxygen affinity
- B. Increased CO₂ and H⁺ decrease hemoglobin oxygen affinity, enhancing unloading
- C. Increased temperature increases hemoglobin oxygen affinity
- D. Increased oxygen decreases CO₂ carriage by hemoglobin

Question 104

Domain I -- Physiology

During the cardiac cycle, coronary blood flow to the left ventricle occurs PREDOMINANTLY during which phase, and why?

- A. Isovolumic contraction, because of maximal wall tension
- B. Equally throughout the cycle
- C. Systole, because aortic pressure is highest
- D. Diastole, because intramyocardial compression is lowest

Question 105

Domain I -- Physiology

A patient with a large pulmonary shunt fails to improve oxygenation despite increasing FiO₂ to 1.0. Which concept BEST explains this finding?

- A. A simple V/Q mismatch fully responsive to oxygen
- B. Dead space ventilation is the cause
- C. A diffusion limitation corrected by 100% oxygen
- D. Blood bypassing ventilated alveoli cannot be oxygenated regardless of FiO₂

Question 106

Domain I -- Pharmacology

Which benzodiazepine reversal agent is a competitive antagonist at the GABA-A benzodiazepine site, and what is a key caution with its use?

- A. Flumazenil; may precipitate seizures in benzodiazepine-dependent patients
- B. Naloxone; may precipitate opioid withdrawal
- C. Physostigmine; may cause bradycardia only
- D. Sugammadex; may cause anaphylaxis

Question 107

Domain I -- Pharmacology

A patient develops severe hypertension and tachycardia after receiving an intravascular epinephrine-containing test dose during epidural placement. This response is used to detect which complication?

- A. Subarachnoid (intrathecal) injection
- B. Epidural hematoma
- C. Intravascular catheter placement
- D. Subdural spread

Question 108

Domain I -- Pathophysiology

A patient with myasthenia gravis is scheduled for thymectomy. Which statement about neuromuscular blocker sensitivity is correct?

- A. They are resistant to nondepolarizing agents and sensitive to succinylcholine
- B. They should never receive any reversal agent
- C. They respond normally to all neuromuscular blockers
- D. They are sensitive to nondepolarizing agents and relatively resistant to succinylcholine

Question 109

Domain I -- Pathophysiology

A patient with carcinoid syndrome undergoing tumor resection develops flushing and severe hypotension during manipulation. Which agent is MOST appropriate to control a carcinoid crisis?

- A. Octreotide
- B. Ephedrine
- C. Histamine
- D. Epinephrine

Question 110

Domain I -- Physics & Chemistry

A pulse oximeter uses two wavelengths of light (660 nm red and 940 nm infrared). Which principle allows it to distinguish oxygenated from deoxygenated hemoglobin?

- A. They have different magnetic properties
- B. They emit different colors of light
- C. They absorb the two wavelengths differently (Beer-Lambert law)
- D. They reflect ultrasound differently

Question 111

Domain I -- Physics & Chemistry

Capnography measures exhaled carbon dioxide based on which physical principle?

- A. Electrochemical oxidation of CO₂
- B. Paramagnetic behavior of CO₂
- C. CO₂ reflection of ultraviolet light
- D. CO₂ absorption of infrared light

Question 112

Domain I -- Physics & Chemistry

An oxygen analyzer in the anesthesia circuit commonly uses which physical property of oxygen for measurement?

- A. Its paramagnetic property
- B. Its infrared absorption
- C. Its ultraviolet fluorescence
- D. Its high density

Question 113

Domain I -- Mathematics

A patient requires a phenylephrine infusion at 0.5 mcg/kg/min. The patient weighs 70 kg and the bag is mixed at 100 mcg/mL. What is the approximate pump rate in mL/hr?

- A. About 21 mL/hr
- B. About 32 mL/hr
- C. About 42 mL/hr
- D. About 11 mL/hr

Question 114

Domain I -- Mathematics

A heparin infusion is ordered at 18 units/kg/hr for an 80 kg patient using a bag of 25,000 units in 250 mL (100 units/mL). What is the approximate pump rate?

- A. About 7 mL/hr
- B. About 14 mL/hr
- C. About 22 mL/hr
- D. About 29 mL/hr

Question 115

Domain I -- Mathematics

A patient has an arterial pH of 7.25, PaCO₂ of 30 mmHg, and HCO₃ of 13 mEq/L. Which primary acid-base disturbance is present?

- A. Metabolic alkalosis
- B. Metabolic acidosis with respiratory compensation
- C. Respiratory acidosis
- D. Respiratory alkalosis

Question 116

Domain I -- Pharmacology

Which inhaled anesthetic has the LOWEST potency, reflected by the HIGHEST minimum alveolar concentration?

- A. Sevoflurane
- B. Nitrous oxide
- C. Desflurane
- D. Isoflurane

Question 117

Domain I -- Pharmacology

Which property BEST explains why a single bolus of thiopental produces rapid awakening despite the drug's long elimination half-life?

- A. Rapid renal excretion of unchanged drug
- B. Immediate metabolism to inactive products at the neuromuscular junction
- C. Rapid hepatic clearance of the entire dose
- D. Redistribution from the brain to muscle and fat

Question 118

Domain I -- Physiology

Which structure is responsible for the majority of airway resistance in a normal, spontaneously breathing adult?

- A. The medium-sized bronchi
- B. The alveolar ducts
- C. The small bronchioles
- D. The trachea alone

Question 119

Domain I -- Pathophysiology

A patient with chronic obstructive pulmonary disease has air trapping and dynamic hyperinflation during mechanical ventilation. Which ventilator adjustment BEST reduces intrinsic PEEP (auto-PEEP)?

- A. Prolong the expiratory time (lower rate, shorter inspiratory time)
- B. Increase tidal volume markedly
- C. Increase the respiratory rate
- D. Add high extrinsic PEEP of 15 cmH₂O

Question 120

Domain I -- Pharmacology

Sugammadex reverses rocuronium by which mechanism, and which patient counseling point is important for women?

- A. Increased renal clearance of acetylcholine; monitor potassium
- B. Acetylcholinesterase inhibition; no special counseling
- C. Direct receptor agonism; avoid grapefruit juice
- D. Encapsulation (chelation) of the aminosteroid; hormonal contraceptives may be less effective for up to 7 days

DOMAIN II: EQUIPMENT, INSTRUMENTATION & TECHNOLOGY

Anesthesia machine, airway devices, monitors, safety systems, and related technology. | Questions 121-240 (120 items)**Question 121**

Domain II - Anesthetic Machine

During a machine check, a CRNA fills the isoflurane vaporizer with sevoflurane by mistake using an agent-specific filling device that was improperly stored. Which safety system was bypassed?

- A. Pin Index Safety System (PISS)
- B. Diameter Index Safety System (DISS)
- C. Agent-specific keyed filling device (Selectatec) system
- D. Proportioning system

Question 122

Domain II - Monitoring

A patient's arterial line waveform shows a sharp spike systolic pressure that is 40 mmHg higher than the NIBP reading. The diastolic pressure is similar on both. What does this waveform pattern suggest?

- A. Overdamping of the arterial line
- B. Underdamping (resonance artifact) causing systolic overshoot
- C. Arterial vasospasm at the radial artery
- D. Aortic regurgitation

Question 123

Domain II - Airway Equipment

A CRNA attempts direct laryngoscopy with a Macintosh 3 blade and obtains a Cormack-Lehane grade 3 view (epiglottis only visible). Which device would MOST improve the likelihood of successful intubation?

- A. Switch to a Miller 2 blade
- B. Apply backward, upward, rightward pressure (BURP) while using a bougie through the existing view
- C. Attempt blind nasal intubation
- D. Immediately perform a cricothyrotomy

Question 124

Domain II - Monitoring

A patient's BIS monitor reads 35 during maintenance of anesthesia with sevoflurane 1.5 MAC. The CRNA considers reducing the anesthetic. Which statement BEST explains the appropriate response?

- A. A BIS of 35 is optimal for surgical anesthesia; no change needed
- B. A BIS of 35 is dangerously low and indicates brain suppression - reduce to 0.5 MAC immediately
- C. A BIS of 35 is below the target range of 40-60; consider reducing volatile to bring BIS to 40-60
- D. BIS is unreliable with volatile anesthetics and should be disregarded

Question 125

Domain II - Anesthetic Machine

Which of the following is the MOST reliable indicator that an endotracheal tube is correctly placed in the trachea immediately after intubation?

- A. Bilateral breath sounds on auscultation
- B. Visible chest rise during ventilation
- C. Consistent ETCO₂ waveform on capnography over multiple breaths
- D. Tube seen passing through the vocal cords under direct vision

Question 126

Domain II - Equipment

During a case using a circle system at 2 L/min fresh gas flow, the exhaled CO₂ readings begin rising progressively over 45 minutes. The peak flow alarm activates. What is the MOST likely cause?

- A. Endobronchial intubation
- B. CO₂ absorbent exhaustion
- C. Bronchospasm
- D. Ventilator disconnection

Question 127

Domain II - Monitoring

A CRNA is monitoring a patient with a pulmonary artery (Swan-Ganz) catheter. The measured PCWP is 22 mmHg. In the context of a patient with flash pulmonary edema, this finding most likely represents:

- A. Normal left heart filling pressure
- B. Elevated LVEDP suggesting left ventricular failure or volume overload
- C. Elevated right ventricular preload only
- D. Pulmonary hypertension from hypoxic vasoconstriction

Question 128

Domain II - Airway Equipment

A 4-year-old child (18 kg) requires intubation for emergency appendectomy. Using the age-based formula, what is the correct uncuffed ETT size, and what is the cuff pressure limit if a cuffed tube is used?

- A. 5.0 uncuffed; cuff pressure <25 cmH₂O
- B. 5.0 uncuffed; cuff pressure <30 cmH₂O
- C. 4.5 uncuffed; cuff pressure <20 cmH₂O
- D. 5.5 uncuffed; cuff pressure <25 cmH₂O

Question 129

Domain II - Monitoring

During a posterior fossa craniotomy in the sitting position, the TEE suddenly shows bubbles in the right atrium. ETCO₂ drops from 38 to 18 mmHg. Which immediate intervention will MOST reduce ongoing air entrainment?

- A. Apply positive end-expiratory pressure (PEEP)
- B. Flood the surgical field with saline and notify the surgeon to occlude the wound
- C. Administer epinephrine 100 mcg IV
- D. Perform carotid sinus massage

Question 130

Domain II - Equipment

A CRNA performing spinal anesthesia for a cesarean section uses a 25-gauge Whitacre (pencil-point) needle. Which statement BEST describes why this needle design reduces postdural puncture headache (PDPH)?

- A. The pencil-point tip cuts fewer nerve fibers
- B. The side-opening design and pencil-point tip separate, rather than cut, dural fibers, allowing them to recoil and self-seal
- C. The smaller gauge alone prevents CSF leakage
- D. The pencil point creates a larger opening that allows CSF to drain slowly

Question 131

Domain II - Equipment

A CRNA is using the Mapleson D (Bain) circuit for controlled ventilation in a 70 kg patient. The patient's minute ventilation is 7 L/min. Approximately what fresh gas flow is needed to prevent rebreathing?

- A. 7 L/min (equal to minute ventilation)
- B. 3.5 L/min (half of minute ventilation)
- C. 14 L/min (2x minute ventilation)
- D. 21 L/min (3x minute ventilation)

Question 132

Domain II - Monitoring

During a laparoscopic cholecystectomy, peak airway pressure suddenly increases from 22 to 45 cmH₂O but plateau pressure remains at 20 cmH₂O. The ETCO₂ is 42. What is the MOST likely cause?

- A. Development of pneumothorax
- B. Endotracheal tube obstruction (kink, secretions, or patient biting)
- C. Development of pulmonary edema
- D. Ventilator malfunction

Question 133

Domain II - Equipment

A CRNA is using a standard pulse oximeter on a patient who was found unconscious at a house fire with suspected carbon monoxide (CO) poisoning. The SpO₂ reads 97%. What is the MOST important interpretation of this reading?

- A. SpO₂ 97% confirms adequate oxygenation; CO poisoning is unlikely
- B. SpO₂ 97% is falsely normal - standard pulse oximetry cannot distinguish oxyhemoglobin from carboxyhemoglobin
- C. SpO₂ 97% confirms normal CO-Hgb as CO poisoning would read <85%
- D. SpO₂ 97% indicates the device is malfunctioning in a smoky environment

Question 134

Domain II - Equipment

A nurse anesthetist checks the oxygen E-cylinder before transporting a patient. The cylinder gauge reads 500 psig. The transport will require 3 minutes at 4 L/min O₂ flow. Is there sufficient oxygen?

- A. No - 500 psig provides only 100 liters, which lasts 25 minutes at 4 L/min
- B. Yes - 500 psig provides 150 liters, which lasts 37.5 minutes at 4 L/min
- C. No - 500 psig is below the minimum safe threshold of 1000 psig
- D. Yes - 500 psig provides 150 liters, more than enough for 3 minutes

Question 135

Domain II - Monitoring

During a craniotomy with neuromonitoring (SSEPs and MEPs), the neurophysiologist reports a 50% drop in MEP amplitude. Which anesthetic agent change is MOST likely responsible?

- A. Increasing propofol infusion from 75 to 100 mcg/kg/min
- B. Increasing sevoflurane from 0.5 to 1.0 MAC
- C. Adding fentanyl 100 mcg IV bolus
- D. Increasing dexmedetomidine from 0.3 to 0.5 mcg/kg/hr

Question 136

Domain II - Equipment

A CRNA needs to perform rapid sequence intubation in the emergency department where the only available agent is rocuronium 1.2 mg/kg. Sugammadex is unavailable. Which statement is MOST accurate regarding this plan?

- A. Rocuronium at 1.2 mg/kg is an acceptable RSI dose but sugammadex should be present before proceeding
- B. Rocuronium 0.6 mg/kg should be used instead since 1.2 mg/kg cannot be reversed without sugammadex
- C. Succinylcholine is absolutely required for RSI; rocuronium cannot be used without sugammadex available
- D. Rocuronium 1.2 mg/kg provides RSI conditions equivalent to succinylcholine; however, the provider must be committed to the airway - consider CICO plan

Question 137

Domain II - Equipment

Which mechanism explains why a Bain circuit is described as 'coaxial'?

- A. It uses two separate breathing bags for inhalation and exhalation
- B. The fresh gas supply tube runs inside the outer corrugated exhalation limb
- C. Fresh gas flows in the outer tube while exhaled gas exits through the inner tube
- D. It has two CO₂ absorber canisters arranged coaxially

Question 138

Domain II - Monitoring

A patient undergoing a right total hip replacement in lateral decubitus develops SpO₂ of 88% 30 minutes after positioning. Breath sounds are decreased on the right. What is the MOST likely explanation?

- A. Dependent lung (left) atelectasis
- B. Pneumothorax of the right (non-dependent, operative) lung
- C. Endobronchial intubation into the left mainstem bronchus, ventilating only the dependent lung
- D. Right pleural effusion from IV overload

Question 139

Domain II - Equipment

During machine checkout, the CRNA performs a low-pressure leak test and identifies a leak. What is the MOST common cause of this type of leak?

- A. Faulty oxygen cylinder yoke
- B. Cracked or improperly seated vaporizer O-ring or filler cap
- C. Malfunctioning pressure regulator
- D. Broken pipeline inlet check valve

Question 140

Domain II - Monitoring

A TEE exam is performed on an intubated patient after induction. Which of the following findings would be MOST concerning for acute myocardial ischemia?

- A. Trace mitral regurgitation
 - B. Left ventricular wall motion abnormality (regional hypokinesis) in the distribution of the LAD
 - C. Hyperdynamic left ventricle with decreased end-systolic volume
 - D. Mild aortic valve calcification with preserved leaflet excursion
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Question 141

Domain II - Anesthesia Machine

During the anesthesia machine checkout, a CRNA closes the oxygen cylinder valve, empties the pipeline, and observes the oxygen flowmeter fall while the nitrous oxide flowmeter also falls to zero as oxygen pressure drops. Which safety feature is being demonstrated?

- A. Second-stage pressure regulator
- B. Fail-safe (oxygen pressure failure) device
- C. Diameter Index Safety System
- D. Oxygen ratio proportioning (hypoxic guard) system

Question 142

Domain II - Anesthesia Machine

On a contemporary anesthesia machine, the oxygen flow control knob is distinguished from other gas knobs by all of the following EXCEPT which feature?

- A. It is larger in diameter than the other knobs
- B. It is located on the far right of the flowmeter bank in US machines
- C. It projects farther out than the other knobs
- D. It is fluted (has a distinctive touch-coded surface)

Question 143

Domain II - Anesthesia Machine

A CRNA performs the machine checkout and needs to verify the low-pressure system for leaks on a machine with a check valve upstream of the common gas outlet. Which test is MOST appropriate?

- A. Positive-pressure leak test by occluding the Y-piece and squeezing the bag
- B. Vaporizer overfill test
- C. Oxygen flush high-pressure test
- D. Negative-pressure (suction bulb) leak test

Question 144

Domain II - Anesthesia Machine

The oxygen flush valve on a standard anesthesia machine delivers oxygen at what approximate flow rate, and from where in the circuit does this oxygen originate?

- A. 35-75 L/min from upstream of the flowmeters and vaporizers
- B. 100-120 L/min from the second-stage regulator
- C. 10-15 L/min from the oxygen cylinder only
- D. 1-5 L/min from downstream of the vaporizers

Question 145

Domain II - Anesthesia Machine

A hypoxic mixture can still be delivered despite a functioning oxygen ratio (proportioning) system under which circumstance?

- A. Using a fresh gas flow above 5 L/min
- B. Activation of the fail-safe device
- C. A leak downstream of the flow control valves or use of a third gas such as helium
- D. Setting oxygen flow to 100%

Question 146

Domain II - Anesthesia Machine

In the United States, a full oxygen E-cylinder contains approximately 660 L and reads about 2000 psig. A patient is being transported with oxygen running at 4 L/min and the cylinder gauge reads 1000 psig. Approximately how long can oxygen be delivered?

- A. About 40 minutes
- B. About 165 minutes
- C. About 80 minutes
- D. About 20 minutes

Question 147

Domain II - Anesthesia Machine

Unlike an oxygen E-cylinder, a nitrous oxide E-cylinder gauge reads a nearly constant pressure of about 745 psig until most of the contents are gone. What is the reason?

- A. Nitrous oxide exists as both liquid and vapor, so pressure stays constant until the liquid is exhausted
- B. Nitrous oxide is stored as a compressed gas that obeys Boyle law
- C. The nitrous oxide regulator masks the true pressure
- D. Nitrous oxide cylinders have a much larger internal volume

Question 148

Domain II - Anesthesia Machine

In the US color-coding system for medical gas cylinders, which color correctly matches its gas?

- A. Nitrous oxide - green
- B. Carbon dioxide - blue
- C. Oxygen - green
- D. Air - brown

Question 149

Domain II - Anesthesia Machine

The Pin Index Safety System (PISS) and the Diameter Index Safety System (DISS) prevent misconnections at which points, respectively?

- A. PISS at the cylinder-to-hanger yoke; DISS at the pipeline threaded connections
- B. PISS at the vaporizer filler; DISS at the scavenger
- C. PISS at the pipeline; DISS at the cylinder yoke
- D. Both only at the flowmeter

Question 150

Domain II - Anesthesia Machine

During machine checkout the pipeline oxygen pressure gauge reads 50 psig and the oxygen cylinder is turned off with its gauge reading 1800 psig. Why is it recommended to keep backup cylinders CLOSED during normal pipeline use?

- A. To avoid overpressurizing the flowmeters
- B. To keep the fail-safe device from activating
- C. Because open cylinders raise the FiO₂ dangerously
- D. To prevent the cylinder from being silently depleted if the pipeline pressure falls

Question 151

Domain II - Anesthesia Machine

A modern agent-specific variable-bypass vaporizer maintains a constant output concentration despite changes in fresh gas flow. Which design feature is chiefly responsible for temperature compensation?

- A. An electric heater held at 39 degrees C
- B. A pressurized sump that injects liquid agent
- C. A bimetallic strip (or expansion element) that adjusts the bypass-to-vaporizing chamber flow split
- D. A wick that increases surface area for vaporization

Question 152

Domain II - Anesthesia Machine

Desflurane requires a heated, pressurized vaporizer (measured-flow design) rather than a conventional variable-bypass vaporizer. Which physical property of desflurane MOST directly explains this requirement?

- A. Its boiling point near 22-23 degrees C and high vapor pressure near 1 atmosphere
- B. Its very low minimum alveolar concentration
- C. Its low molecular weight
- D. Its high blood-gas partition coefficient

Question 153

Domain II - Anesthesia Machine

A conventional variable-bypass sevoflurane vaporizer is used at high altitude where ambient pressure is significantly reduced. Compared with sea level, how is the delivered PARTIAL PRESSURE of anesthetic (the clinically relevant dose) affected at a fixed dial setting?

- A. The volume percent increases but partial pressure falls to near zero
- B. The delivered partial pressure increases substantially
- C. The delivered partial pressure remains approximately the same as at sea level
- D. The vaporizer stops delivering agent

Question 154

Domain II - Anesthesia Machine

The desflurane (measured-flow, heated) vaporizer differs from a variable-bypass vaporizer at high altitude because it delivers a constant CONCENTRATION rather than a constant partial pressure. What is the clinical implication at high altitude?

- A. The dial setting should be decreased
- B. No change is needed because partial pressure is preserved
- C. The dial setting should be increased to maintain the same partial pressure (anesthetic effect)
- D. The vaporizer must be turned off

Question 155

Domain II - Anesthesia Machine

A CRNA discovers that a variable-bypass isoflurane vaporizer was tipped during transport and liquid agent may have entered the bypass channel. What is the MOST appropriate action?

- A. Fill it completely to dilute the agent
- B. Use it immediately at a low setting
- C. Flush the vaporizer with a high fresh gas flow at a high dial setting, with no patient connected, until output is stable
- D. Invert the vaporizer to drain the bypass

Question 156

Domain II - Anesthesia Machine

The 'pumping effect' that can cause a variable-bypass vaporizer to deliver a higher-than-set concentration is MOST associated with which condition?

- A. Continuous high fresh gas flows
- B. Low fresh gas flows with intermittent back-pressure from positive-pressure ventilation or oxygen flush
- C. Use at high altitude
- D. A completely empty vaporizing chamber

Question 157

Domain II - Anesthesia Machine

If a modern agent-specific variable-bypass vaporizer designed for a less volatile agent were erroneously filled with a MORE volatile agent (higher vapor pressure), what would be the MOST likely consequence?

- A. Delivery of a lower-than-intended concentration
- B. Delivery of a higher-than-intended anesthetic concentration (overdose)
- C. No change because vaporizers are agent independent
- D. Immediate vaporizer shutdown

Question 158

Domain II - Anesthesia Machine

During a case using a circle system, a CRNA notices that turning ON a second vaporizer is impossible while the first is on. Which safety feature accounts for this?

- A. The fail-safe device
- B. The oxygen ratio controller
- C. The scavenging interface
- D. The interlock (exclusion) system

Question 159

Domain II - Anesthesia Machine

According to the classic Mapleson efficiency ranking, which Mapleson circuit is MOST efficient (requires the lowest fresh gas flow to prevent rebreathing) during SPONTANEOUS ventilation?

- A. Mapleson D
- B. Mapleson B
- C. Mapleson E
- D. Mapleson A (Magill)

Question 160

Domain II - Anesthesia Machine

The Bain circuit is a modification of which Mapleson system, and what is its defining structural feature?

- A. Mapleson C; a valveless T-piece
- B. Mapleson D; a coaxial design with fresh gas flowing through an inner tube to the patient end
- C. Mapleson A; the fresh gas enters near the bag
- D. Mapleson E; an open-ended reservoir

Question 161

Domain II - Anesthesia Machine

A CRNA is using a Bain (coaxial Mapleson D) circuit and suspects a disconnected or kinked INNER fresh-gas tube. Which finding would MOST support this problem?

- A. Sudden loss of the capnograph tracing to zero
- B. Progressive hypercarbia and rebreathing despite adequate fresh gas flow
- C. High peak airway pressures with normal EtCO₂
- D. A leak audible at the APL valve

Question 162

Domain II - Anesthesia Machine

Compared with a Mapleson (open/semi-open) system, the primary advantage of a circle breathing system is:

- A. Conservation of heat, humidity, and anesthetic agent by allowing rebreathing with CO₂ absorption
- B. Elimination of the need for a CO₂ absorbent
- C. Complete elimination of dead space
- D. Freedom from the risk of valve incompetence

Question 163

Domain II - Anesthesia Machine

In a circle system, an incompetent (stuck-open) EXPIRATORY unidirectional valve would MOST likely produce which clinical picture?

- A. Loss of the scavenging function
- B. Rebreathing of exhaled CO₂ with a rising inspired CO₂ baseline
- C. Vaporizer overdose
- D. A sudden increase in fresh gas flow requirement only

Question 164

Domain II - Anesthesia Machine

A CRNA notices the color indicator in the CO₂ absorbent canister has turned violet (from white). What does this MOST likely indicate and what is the appropriate response?

- A. The canister is overfilled and should be tapped down
- B. The absorbent is fresh and fully active
- C. The absorbent is desiccated but still effective
- D. The absorbent is exhausted and should be replaced

Question 165

Domain II - Anesthesia Machine

Which combination of factors MOST increases the risk of dangerous degradation products (such as carbon monoxide with desflurane, or Compound A with sevoflurane) in a circle system?

- A. Use of a heat and moisture exchanger
- B. Fresh, well-hydrated absorbent at low fresh gas flow
- C. Use of a Mapleson circuit
- D. Desiccated absorbent containing strong bases (KOH/NaOH), especially with high fresh gas flows for CO

Question 166

Domain II - Anesthesia Machine

During controlled ventilation with a circle system, the adjustable pressure-limiting (APL) valve is typically:

- A. Fully closed to build pressure
- B. Fully open (or removed from the pressure path) so the ventilator controls pressure
- C. Set to 20 cmH₂O
- D. Bypassed by the scavenger

Question 167

Domain II - Anesthesia Machine

A CRNA using manual ventilation cannot ventilate the patient; the reservoir bag is over-distended and airway pressure is climbing dangerously. Which single action is the MOST likely immediate cause to check and correct?

- A. An empty vaporizer
- B. A disconnected capnograph line
- C. A depleted CO₂ absorbent
- D. A closed (or occluded) APL valve

Question 168

Domain II - Anesthesia Machine

A CRNA is setting up an active, closed (balancing valve) scavenging interface. Which hazard is UNIQUE to a scavenging system and could cause negative pressure to be transmitted to the breathing circuit and patient?

- A. Excessive fresh gas flow
- B. Occlusion of the positive-pressure relief valve combined with excessive vacuum
- C. Blockage causing only positive-pressure buildup
- D. Reversed unidirectional valves

Question 169

Domain II - Airway Equipment

A CRNA wants to keep endotracheal tube cuff pressure within a safe range to minimize tracheal mucosal ischemia. Which target range is BEST?

- A. 40-50 cmH₂O
- B. 5-10 cmH₂O
- C. 60-70 cmH₂O
- D. 20-30 cmH₂O

Question 170

Domain II - Airway Equipment

During a case using nitrous oxide, a CRNA notices the endotracheal tube cuff pressure rising steadily. What is the MOST likely mechanism?

- A. Kinking of the pilot balloon tube
- B. Diffusion of nitrous oxide into the air-filled cuff
- C. Leak of cuff air into the trachea
- D. Contraction of the cuff from cooling

Question 171

Domain II - Airway Equipment

A second-generation supraglottic airway (SGA) differs from a first-generation device chiefly because it:

- A. Incorporates a gastric drainage/access channel to reduce aspiration risk
- B. Requires a stylet for insertion
- C. Cannot be used for positive-pressure ventilation
- D. Has no inflatable cuff

Question 172

Domain II - Airway Equipment

A CRNA obtains a Cormack-Lehane grade 3 view with a Macintosh blade during direct laryngoscopy. Which device is MOST likely to improve glottic visualization by providing an indirect, angulated view around the airway?

- A. A nasopharyngeal airway
- B. A video laryngoscope with a hyperangulated blade
- C. A rigid oral airway
- D. A larger Macintosh blade

Question 173

Domain II - Airway Equipment

During an awake fiberoptic intubation, the CRNA loses the view because of secretions and fogging. Which combination of measures BEST addresses these two problems?

- A. Increasing sedation only
- B. Withdrawing the scope and reinserting a smaller endotracheal tube
- C. Antisialagogue (e.g., glycopyrrolate) beforehand and warming/anti-fog treatment of the scope tip
- D. Applying topical vasoconstrictor to the tongue

Question 174

Domain II - Airway Equipment

A fiberoptic bronchoscope is being used to confirm placement of a left-sided double-lumen tube. When the scope is passed down the TRACHEAL lumen, correct positioning is confirmed by seeing:

- A. Both mainstem bronchi fully occluded
- B. The bronchial cuff herniating over the carina
- C. The blue bronchial cuff just below the carina in the left mainstem bronchus, with a clear view into the right mainstem
- D. The carina not visible at all

Question 175

Domain II - Airway Equipment

During laser airway surgery near the endotracheal tube, which tube feature MOST reduces the risk of an airway fire?

- A. An uncuffed PVC tube with high fresh gas flow
- B. A red rubber tube with nitrous oxide
- C. A laser-resistant tube with a metallic/wrapped shaft and saline-filled cuff(s), used with the lowest safe FiO₂
- D. A standard PVC tube with 100% oxygen

Question 176

Domain II - Airway Equipment

A CRNA selects a left-sided double-lumen tube for a right thoracotomy. Compared with a right-sided DLT, the LEFT-sided tube is generally preferred because:

- A. Right-sided tubes never require bronchoscopic confirmation
- B. The left mainstem bronchus is longer, giving a greater margin before the upper lobe orifice, reducing right upper lobe obstruction risk
- C. The left mainstem bronchus is shorter and more vertical
- D. It is easier to obstruct the left upper lobe

Question 177

Domain II - Airway Equipment

A bronchial blocker is chosen instead of a double-lumen tube for one-lung ventilation in a patient with a difficult airway who is already intubated with a single-lumen tube. Which statement about bronchial blockers is MOST accurate?

- A. They allow easy suctioning and CPAP to the isolated lung
- B. They cannot be used with fiberoptic guidance
- C. They provide faster lung collapse than a DLT
- D. They can be placed through an existing single-lumen ETT but provide slower lung deflation and no independent lung suctioning of the isolated lung

Question 178

Domain II - Airway Equipment

A CRNA is choosing an oral airway size for an adult. The MOST reliable method to estimate the correct length is to measure from the:

- A. Chin to the sternal notch
- B. Nostril to the tragus
- C. Corner of the mouth to the angle of the mandible (or earlobe)
- D. Upper lip to the thyroid cartilage

Question 179

Domain II - Monitoring

A standard two-wavelength pulse oximeter uses light at approximately 660 nm (red) and 940 nm (infrared). On what physical principle does it distinguish oxyhemoglobin from deoxyhemoglobin?

- A. They differ in magnetic resonance
- B. They differ in electrical conductivity
- C. They emit different wavelengths of light
- D. They absorb these two wavelengths differently (Beer-Lambert law), and the pulsatile component isolates arterial blood

Question 180

Domain II - Monitoring

A patient rescued from a house fire has suspected carbon monoxide poisoning. A conventional two-wavelength pulse oximeter reads SpO₂ 98%. Why is this reading unreliable?

- A. Carboxyhemoglobin absorbs similarly to oxyhemoglobin at 660 nm, so the device overestimates saturation
- B. The device cannot detect any pulsatile flow
- C. Carboxyhemoglobin absorbs only infrared light
- D. Carbon monoxide lowers the pulse rate detection

Question 181

Domain II - Monitoring

Methemoglobinemia (e.g., from benzocaine or dapsone) tends to drive a conventional two-wavelength pulse oximeter reading toward which value, regardless of the true arterial saturation?

- A. It reads the true SaO₂ accurately
- B. Approximately 85%
- C. 0%
- D. 100%

Question 182

Domain II - Monitoring

Which of the following is the MOST reliable single indicator that an endotracheal tube is in the trachea (not the esophagus) immediately after intubation?

- A. Sustained (multiple-breath) end-tidal CO₂ waveform on capnography
- B. Chest rise with ventilation
- C. Bilateral breath sounds on auscultation
- D. Fogging (condensation) in the tube

Question 183

Domain II - Monitoring

A capnograph shows a normal waveform whose plateau (phase III) develops a progressive upslope ('shark-fin' appearance) with a prolonged expiratory phase. What does this MOST likely indicate?

- A. Complete airway disconnection
- B. Airflow obstruction such as bronchospasm or COPD
- C. Hyperventilation
- D. Esophageal intubation

Question 184

Domain II - Monitoring

During a stable general anesthetic the EtCO₂ suddenly drops from 38 to near 0 mmHg with loss of the waveform. After confirming the monitor is functioning, which cause requires the MOST immediate attention?

- A. Malignant hyperthermia
- B. Circuit disconnection, esophageal intubation, or complete airway obstruction/apnea
- C. Rebreathing from exhausted absorbent
- D. Gradual hypoventilation

Question 185

Domain II - Monitoring

An abrupt decrease in EtCO₂ to a low-but-nonzero value (e.g., 38 down to 15 mmHg) during a case, with the waveform still present, is MOST consistent with which acute event?

- A. A sudden fall in pulmonary blood flow such as pulmonary/air embolism or acute drop in cardiac output
- B. Bronchospasm
- C. Rebreathing
- D. Hypoventilation

Question 186

Domain II - Monitoring

A mainstream capnometer differs from a sidestream capnometer in that the mainstream device:

- A. Aspirates gas through tubing to a distant sensor
- B. Measures oxygen rather than CO₂
- C. Places the infrared sensor directly in the airway, giving a faster response and no sample-gas aspiration
- D. Cannot be used on intubated patients

Question 187

Domain II - Monitoring

A widened gradient between EtCO₂ and arterial PaCO₂ (EtCO₂ much lower than PaCO₂) MOST directly reflects an increase in which physiologic quantity?

- A. Anatomic shunt
- B. Functional residual capacity
- C. Alveolar dead space
- D. Oxygen consumption

Question 188

Domain II - Monitoring

A capnogram baseline (phase I / inspiratory portion) that fails to return to zero (elevated baseline) MOST strongly suggests:

- A. A leak in the sampling line
- B. Esophageal intubation
- C. Rebreathing of CO₂, as from an incompetent expiratory valve or exhausted absorbent
- D. Hyperventilation

Question 189

Domain II - Monitoring

Using an automated oscillometric noninvasive blood pressure (NIBP) device, which pressure does the monitor measure MOST directly, from which it then derives systolic and diastolic values?

- A. The mean arterial pressure, at the point of maximal cuff-pressure oscillation amplitude
- B. The diastolic pressure, at the last oscillation
- C. The pulse pressure only
- D. The systolic pressure, at the first Korotkoff sound

Question 190

Domain II - Monitoring

A blood pressure cuff that is too SMALL (narrow) for the patient's arm will MOST likely produce which error?

- A. No reading at all
- B. Falsely HIGH blood pressure readings
- C. Falsely LOW blood pressure readings
- D. Accurate readings

Question 191

Domain II - Monitoring

An arterial line transducer must be leveled (zeroed) at the level of the heart (phlebostatic axis). If the transducer is placed 20 cm BELOW the level of the heart, the displayed arterial pressure will be:

- A. Unchanged
- B. Falsely LOW by approximately 15 mmHg
- C. Falsely high by approximately 40 mmHg
- D. Falsely HIGH by approximately 15 mmHg

Question 192

Domain II - Monitoring

An arterial pressure waveform that is OVERDAMPED (e.g., from an air bubble, clot, or kink) will typically show:

- A. A perfectly square wave
- B. A diminished/absent dicrotic notch, underestimated systolic and overestimated diastolic, with preserved mean
- C. An exaggerated systolic overshoot
- D. Elevated systolic with a sharp spike

Question 193

Domain II - Monitoring

During a fast-flush (square-wave) test, the arterial waveform returns to baseline after several oscillations with a slow, undershooting bounce. This indicates the system is:

- A. Underdamped
- B. Optimally (critically) damped
- C. Disconnected
- D. Overdamped

Question 194

Domain II - Monitoring

The central venous pressure (CVP) waveform 'a' wave corresponds to which cardiac event, and its ABSENCE is characteristic of which rhythm?

- A. Tricuspid closure; absent in sinus rhythm
- B. Ventricular contraction; absent in complete heart block
- C. Right atrial contraction; absent in atrial fibrillation
- D. Atrial relaxation; absent in junctional rhythm

Question 195

Domain II - Monitoring

As a pulmonary artery catheter is advanced from the right ventricle into the pulmonary artery, the pressure waveform change that confirms entry into the pulmonary artery is:

- A. A rise in the DIASTOLIC pressure and appearance of a dicrotic notch
- B. Loss of all pulsatility
- C. A change from a wedge tracing to a right atrial tracing
- D. A fall in systolic pressure to near zero

Question 196

Domain II - Monitoring

A pulmonary artery (Swan-Ganz) catheter shows a permanently 'wedged' tracing even with the balloon deflated. What is the MOST appropriate immediate action to prevent pulmonary artery rupture or infarction?

- A. Flush the catheter with heparin under high pressure
- B. Withdraw the catheter slightly until a normal PA waveform returns
- C. Inflate the balloon fully and leave it
- D. Advance the catheter further

Question 197

Domain II - Monitoring

Transesophageal echocardiography (TEE) is used intraoperatively. The mid-esophageal four-chamber view is especially useful for detecting which acute intraoperative event EARLIEST?

- A. Malignant hyperthermia
- B. Laryngospasm
- C. New regional wall-motion abnormalities suggesting myocardial ischemia
- D. Peripheral nerve injury

Question 198

Domain II - Monitoring

A recognized absolute contraindication to placing a transesophageal echocardiography probe is:

- A. Atrial fibrillation
- B. A body mass index over 30
- C. Esophageal stricture, perforation, or recent esophageal/gastric surgery
- D. Moderate aortic stenosis

Question 199

Domain II - Monitoring

A processed EEG depth-of-anesthesia monitor (bispectral index) displays a dimensionless number from 0 to 100. Which range is generally targeted for adequate general anesthesia with a low probability of awareness?

- A. 40-60
- B. 0-20
- C. 90-100
- D. 70-90

Question 200

Domain II - Monitoring

A processed EEG monitor reads 35 during maintenance with a volatile agent at 1.5 MAC. Which statement is MOST accurate regarding this value?

- A. The patient is at high risk of awareness
- B. The value confirms neuromuscular blockade
- C. The patient may be more deeply anesthetized than necessary, and the anesthetic could be reduced
- D. The value indicates the patient is awake

Question 201

Domain II - Monitoring

During neuromuscular monitoring with a train-of-four (TOF) at the ADDUCTOR POLLICIS via ulnar nerve stimulation, which finding corresponds to approximately 90% or greater receptor occupancy (adequate surgical relaxation)?

- A. 1-2 twitches present out of four
- B. Double-burst with two equal strong responses
- C. Sustained tetanus at 100 Hz
- D. Four strong equal twitches with no fade

Question 202

Domain II - Monitoring

Which single quantitative neuromuscular measurement BEST confirms ADEQUATE recovery from nondepolarizing blockade and a low risk of residual weakness before extubation?

- A. A train-of-four ratio (T4/T1) of 0.9 or greater by objective (quantitative) monitoring
- B. Absence of fade on visual double-burst stimulation
- C. Sustained head lift for 3 seconds
- D. A train-of-four count of 4 by visual assessment

Question 203

Domain II - Monitoring

When monitoring onset of neuromuscular blockade for intubation, stimulation of which muscle group reflects the DIAPHRAGM/laryngeal adductors (central, rapidly perfused muscles) more closely than the adductor pollicis?

- A. The corrugator supercilii (facial nerve/orbicularis oculi region)
- B. The flexor hallucis brevis of the foot
- C. The adductor pollicis alone
- D. The abductor digiti minimi

Question 204

Domain II - Monitoring

A patient who received succinylcholine shows train-of-four monitoring with all four twitches equally DIMINISHED (no fade) and no post-tetanic facilitation. This pattern is characteristic of:

- A. A phase II block
- B. A nondepolarizing block
- C. A phase I (depolarizing) block
- D. Complete recovery

Question 205

Domain II - Monitoring

Post-tetanic count (PTC) monitoring is used during which depth of neuromuscular blockade?

- A. Minimal block during recovery
- B. Only after reversal is complete
- C. No block at all
- D. Deep (intense) block when there is no train-of-four or single-twitch response

Question 206

Domain II - Monitoring

Intraoperative core temperature is MOST accurately reflected by which monitoring site?

- A. Distal esophagus, nasopharynx, pulmonary artery, or tympanic membrane
- B. Skin of the forehead
- C. The anesthesia circuit gas temperature
- D. Axilla

Question 207

Domain II - Ventilators

A traditional pneumatically driven bellows anesthesia ventilator uses an ASCENDING (standing) bellows. Compared with a descending (hanging) bellows, the ascending design is safer because during a circuit disconnection it:

- A. Delivers a higher tidal volume
- B. Continues to rise, masking the disconnection
- C. Increases PEEP automatically
- D. Fails to refill/collapses, making the disconnection obvious

Question 208

Domain II - Ventilators

During volume-controlled ventilation on a modern anesthesia machine, the peak inspiratory pressure suddenly rises from 22 to 45 cmH₂O while the PLATEAU pressure remains near 20 cmH₂O. This pattern MOST likely indicates:

- A. A circuit disconnection
- B. An increase in airway resistance (e.g., bronchospasm, secretions, kinked or obstructed tube)
- C. A decrease in lung/chest wall compliance (e.g., pneumothorax, pulmonary edema)
- D. A leak in the endotracheal tube cuff

Question 209

Domain II - Ventilators

In pressure-controlled ventilation compared with volume-controlled ventilation, a key characteristic is that:

- A. It cannot be used in patients with poor compliance
- B. Peak pressure rises uncontrolled as compliance falls
- C. Tidal volume is guaranteed regardless of lung mechanics
- D. Tidal volume varies with changes in compliance and resistance, while peak pressure is limited/constant

Question 210

Domain II - Ventilators

Fresh gas flow decoupling (or a fresh gas compensation feature) on modern anesthesia ventilators is designed to prevent which problem seen on older machines?

- A. Delivered tidal volume being augmented by fresh gas flow entering during inspiration
- B. Rebreathing of CO₂
- C. Vaporizer pumping effect
- D. Loss of PEEP during expiration

Question 211

Domain II - Ventilators

A low-pressure (subatmospheric or low peak-pressure) alarm on an anesthesia ventilator MOST commonly indicates:

- A. A circuit disconnection or major leak
- B. A kinked endotracheal tube
- C. Decreased lung compliance
- D. Bronchospasm

Question 212

Domain II - Ventilators

Applying positive end-expiratory pressure (PEEP) intraoperatively primarily improves oxygenation by:

- A. Decreasing dead space directly
- B. Lowering airway resistance
- C. Increasing minute ventilation
- D. Recruiting and preventing collapse of alveoli, increasing functional residual capacity

Question 213

Domain II - Ventilators

A patient with severe obstructive lung disease develops progressive hyperinflation (auto-PEEP / breath stacking) during mechanical ventilation. Which ventilator adjustment BEST addresses this?

- A. Increase respiratory rate
- B. Increase tidal volume
- C. Reduce respiratory rate and shorten inspiratory time to prolong expiratory time
- D. Increase the inspiratory-to-expiratory ratio toward 2:1

Question 214

Domain II - Ventilators

A piston-driven (electrically driven) anesthesia ventilator has which advantage over a traditional pneumatically driven bellows ventilator?

- A. It requires no electrical power
- B. It eliminates the need for a scavenging system
- C. It cannot deliver small tidal volumes
- D. It does not consume driving gas (oxygen), conserving pipeline/cylinder oxygen

Question 215

Domain II - Safety Systems

Operating rooms use an isolated (ungrounded) power system with a line isolation monitor (LIM). What does an alarming LIM indicate?

- A. The scavenging vacuum has failed
- B. The oxygen supply has failed
- C. A first fault has occurred, so the system is no longer isolated, but shock risk is not yet immediate
- D. A patient is being electrocuted right now

Question 216

Domain II - Safety Systems

Microshock (as small as about 100 microamperes) is dangerous MOST specifically to which patients, and why?

- A. Patients without any invasive lines
- B. All patients equally, because skin resistance is negligible
- C. Only patients who are awake
- D. Patients with a direct conductive pathway to the myocardium (e.g., a pacing wire or fluid-filled central catheter), because tiny currents can induce ventricular fibrillation

Question 217

Domain II - Safety Systems

When using a monopolar electrosurgical unit (ESU), the dispersive (return/grounding) pad's PRIMARY safety purpose is to:

- A. Monitor the patient's ECG
- B. Provide a large surface area for current return, preventing burns by keeping current density low
- C. Ground the anesthesia machine
- D. Deliver the cutting current to the tissue

Question 218

Domain II - Safety Systems

A patient with an implanted cardioverter-defibrillator (ICD) is scheduled for surgery involving monopolar electrocautery. Which is the MOST appropriate perioperative management of the device?

- A. Remove the ICD before surgery
- B. Leave the ICD fully active and use monopolar cautery freely
- C. Disable (suspend) antitachycardia therapy perioperatively and have external defibrillation/pacing immediately available
- D. Place a magnet permanently over the generator postoperatively

Question 219

Domain II - Safety Systems

Using bipolar rather than monopolar electrosurgery is preferred in patients with implanted cardiac devices primarily because bipolar current:

- A. Requires no generator
- B. Cannot cause any tissue coagulation
- C. Is higher in voltage
- D. Flows only between the two tips of the forceps, minimizing interference and stray current

Question 220

Domain II - Safety Systems

During synchronized cardioversion of a hemodynamically unstable patient with atrial fibrillation, the defibrillator is set to SYNCHRONIZE. What does synchronization accomplish?

- A. It doubles the delivered energy
- B. It disables the ECG
- C. It delivers the shock during the T wave for maximum effect
- D. It times the shock to the R wave, avoiding the vulnerable T-wave period that could induce ventricular fibrillation

Question 221

Domain II - Safety Systems

Biphasic defibrillators have largely replaced monophasic units because biphasic waveforms:

- A. Do not require charged capacitors
- B. Cannot be used for synchronized cardioversion
- C. Achieve equal or better defibrillation success at LOWER energy, reducing myocardial injury
- D. Require much higher energy

Question 222

Domain II - Safety Systems

A CRNA sets up a syringe infusion pump for a norepinephrine infusion. Which pump feature MOST directly prevents a dangerous bolus when the line is unclamped after a period of downstream occlusion?

- A. A larger syringe size
- B. Occlusion pressure alarms with anti-bolus (pressure relief) function
- C. Gravity-dependent flow
- D. A faster default rate

Question 223

Domain II - Safety Systems

A 'smart' infusion pump reduces medication errors chiefly through which feature?

- A. Continuous arterial blood gas analysis
- B. A drug library with programmable soft and hard dose limits that warn or block out-of-range settings
- C. Elimination of the need to program a rate
- D. Automatic diagnosis of the patient's condition

Question 224

Domain II - Regional Equipment

A CRNA performs an ultrasound-guided interscalene block using a linear (high-frequency) transducer. Why is a HIGH-frequency (e.g., 10-15 MHz) probe preferred for this superficial block?

- A. It eliminates the need for aspiration
- B. It measures nerve conduction velocity
- C. It penetrates deeper tissues better
- D. It provides higher resolution at shallow depths, though with less penetration

Question 225

Domain II - Regional Equipment

During an ultrasound-guided nerve block using an IN-PLANE approach, the needle is BEST visualized when it is:

- A. Advanced blindly toward the nerve
- B. Perpendicular to the transducer so only a dot is seen
- C. Kept outside the ultrasound beam
- D. Aligned parallel to the long axis of the transducer so the entire shaft and tip are seen

Question 226

Domain II - Regional Equipment

A CRNA is using a nerve stimulator (without ultrasound) for a peripheral nerve block. A motor response that persists at a current of 0.2 mA or less suggests the needle tip is:

- A. Very close to or within the nerve, and injection should not proceed to avoid intraneural injection
- B. Too far from the nerve
- C. In the correct position to inject immediately
- D. In a blood vessel

Question 227

Domain II - Regional Equipment

A pencil-point (e.g., Whitacre/Sprotte) spinal needle is preferred over a cutting-tip (Quincke) needle chiefly because it:

- A. Is stiffer and easier to advance
- B. Is less likely to cause a failed block
- C. Spreads rather than cuts dural fibers, reducing the incidence of post-dural puncture headache
- D. Allows faster CSF flow

Question 228

Domain II - Regional Equipment

An epidural set uses a Tuohy needle with a curved (Huber) tip. What is the primary purpose of this tip design?

- A. To cut a larger dural opening
- B. To prevent catheter shearing only
- C. To measure epidural pressure
- D. To direct the catheter cephalad along the epidural space and reduce accidental dural puncture

Question 229

Domain II - Regional Equipment

The loss-of-resistance technique for identifying the epidural space relies on the fact that:

- A. The ligamentum flavum offers firm resistance that suddenly gives way as the needle enters the epidural space
- B. Bone must be contacted first
- C. The subarachnoid space offers the most resistance
- D. The epidural space is filled with cerebrospinal fluid

Question 230

Domain II - Vascular Access

During ultrasound-guided internal jugular central line placement, how are the internal jugular vein and carotid artery BEST distinguished in the short-axis view?

- A. They cannot be distinguished by ultrasound
- B. The vein is pulsatile and non-compressible
- C. The vein is compressible and thin-walled; the artery is pulsatile, thicker-walled, and non-compressible
- D. The artery is easily compressible

Question 231

Domain II - Vascular Access

After central venous catheter placement, the catheter tip is ideally positioned at which location?

- A. In the subclavian vein
- B. In the right internal jugular vein
- C. Within the right ventricle
- D. The junction of the superior vena cava and right atrium

Question 232

Domain II - Vascular Access

An arterial line is planned in the radial artery. The modified Allen test is performed to assess:

- A. Adequacy of collateral (ulnar) blood flow to the hand before radial cannulation
- B. The size of the radial artery
- C. The presence of an arteriovenous fistula
- D. Peripheral nerve function

Question 233

Domain II - Vascular Access

A CRNA notes that an intravenous catheter's maximum flow rate is governed by the Hagen-Poiseuille relationship. To achieve the FASTEST fluid resuscitation, the ideal catheter is:

- A. Short and large-bore (large diameter)
- B. Long and large-bore
- C. Short and small-bore
- D. Long and small-bore

Question 234

Domain II - Vascular Access

Which measure MOST effectively reduces the risk of catheter-related bloodstream infection during central line insertion?

- A. Routine femoral vein placement
- B. Maximal sterile barrier precautions with chlorhexidine skin antisepsis and preferential use of the subclavian site
- C. Changing the catheter over a guidewire every 48 hours
- D. Using povidone-iodine only, without draping

Question 235

Domain II - Vascular Access

Immediately after left subclavian central line insertion, the patient develops sudden hypotension, absent breath sounds on the left, and rising airway pressures. What is the MOST likely complication?

- A. Catheter-related infection
- B. Tension pneumothorax
- C. Air embolism
- D. Arterial puncture with hematoma

Question 236

Domain II - Vascular Access

To reduce the risk of venous air embolism during central venous catheter INSERTION or removal at the neck, the patient should be positioned:

- A. Sitting upright for insertion
- B. In Trendelenburg (head-down) for insertion, and supine/flat with a sealed dressing during removal
- C. Prone for both insertion and removal
- D. In reverse Trendelenburg (head-up) for insertion

Question 237

Domain II - Vascular Access

A pressurized flush system for an invasive arterial or central line is typically inflated to about 300 mmHg and delivers a slow continuous flush. What is its main purpose?

- A. To measure cardiac output
- B. To warm the infusate
- C. To rapidly infuse resuscitation fluids
- D. To maintain catheter patency with a continuous low-rate flush (about 3 mL/hr) and enable the fast-flush test

Question 238

Domain II - Anesthesia Machine

The 2008 ASA/manufacture anesthesia machine pre-use checkout requires verifying an adequate backup ventilation device is available. Which item BEST satisfies this specific requirement?

- A. A self-inflating manual resuscitation bag
- B. An extra CO₂ absorbent canister
- C. A spare vaporizer
- D. A backup pulse oximeter

Question 239

Domain II - Monitoring

A CRNA is monitoring a patient with a peripheral nerve stimulator and applies a 5-second, 50-Hz TETANIC stimulus. In a partial nondepolarizing block, the expected response is:

- A. Fade (an unsustained, decreasing response) followed by post-tetanic potentiation
- B. No response at all under any block
- C. A sustained, non-fading response
- D. An increasing response during the tetanus

Question 240

Domain II - Safety Systems

A surgical fire requires three elements of the fire triad. In the operating room, the anesthesia provider MOST directly controls which element?

- A. None of the fire triad elements
- B. The ignition source (electrocautery, laser)
- C. The fuel (drapes, prep solutions)
- D. The oxidizer (oxygen and nitrous oxide-enriched atmosphere)

DOMAIN III: GENERAL PRINCIPLES OF ANESTHESIA

Preoperative evaluation, airway management, induction/maintenance/emergence, regional anesthesia, and complications. | Questions 241-415 (175 items)

Question 241

Domain III - Airway

A 52-year-old obese male (BMI 44) undergoes general anesthesia for laparoscopic Roux-en-Y gastric bypass. After uneventful intubation, you note that peak airway pressures are 34 cmH₂O and plateau pressure is 28 cmH₂O. Which intervention is MOST likely to improve compliance and oxygenation?

- A. Increase respiratory rate to 18 breaths/min
- B. Apply PEEP of 8-10 cmH₂O and reverse Trendelenburg 15 degrees
- C. Reduce tidal volume to 4 mL/kg ideal body weight
- D. Switch to volume-controlled ventilation

Question 242

Domain III - Regional

A 28-year-old parturient at 39 weeks gestation receives a spinal anesthetic for elective cesarean delivery. 5 minutes after intrathecal injection, her blood pressure drops from 118/72 to 72/44 mmHg and she becomes nauseated. The fetal heart rate shows late decelerations. What is the FIRST-LINE treatment?

- A. Ephedrine 10 mg IV
- B. Phenylephrine 100 mcg IV bolus; increase IV fluid rate; maintain left uterine displacement
- C. Epinephrine 10 mcg IV
- D. Increase the spinal block height by placing patient in Trendelenburg

Question 243

Domain III - Fluid Management

A 70 kg male undergoes a 4-hour colectomy with estimated blood loss of 800 mL. Using goal-directed fluid management principles, which of the following BEST guides intraoperative fluid administration?

- A. Fixed formula: 4 mL/kg/hr maintenance + 3rd space loss calculation
- B. Dynamic fluid responsiveness (pulse pressure variation >13%, stroke volume variation) with bolus-based resuscitation
- C. CVP measurement targeting 8-12 mmHg throughout the case
- D. Administer 1 L LR per hour regardless of blood pressure

Question 244

Domain III - Airway

A CRNA identifies a Mallampati class IV airway with a 3 cm mouth opening, thick neck (thyroid-to-mental space 5 cm), and history of difficult intubation. The patient is presenting for elective shoulder arthroplasty. Which is the MOST appropriate airway management strategy?

- A. Proceed with RSI using video laryngoscopy - modern video laryngoscopes handle all difficult airways
- B. Perform awake fiberoptic intubation after topicalization and targeted airway blocks
- C. Use a size 4 LMA and avoid intubation
- D. Attempt direct laryngoscopy and have a surgical colleague available for tracheotomy

Question 245

Domain III - Pain

A 55-year-old woman with opioid tolerance (on morphine ER 60 mg twice daily) undergoes open spinal fusion. Which perioperative pain management strategy has the STRONGEST evidence for reducing opioid requirements and improving analgesia?

- A. High-dose IV opioid infusion (morphine PCA)
- B. Multimodal analgesia including ketamine infusion (0.1-0.3 mg/kg/hr), ketorolac, acetaminophen, and regional anesthesia
- C. Increasing oral opioid dose to 100 mg q12h preoperatively
- D. Gabapentin 300 mg once preoperatively only

Question 246

Domain III - Preoperative

A 62-year-old male with a drug-eluting coronary stent placed 5 months ago presents for elective inguinal hernia repair. He is on clopidogrel and aspirin. Which approach is MOST appropriate?

- A. Proceed with surgery; hold both clopidogrel and aspirin 7 days before surgery
- B. Delay surgery until at least 6 months post-stent; continue dual antiplatelet therapy
- C. Proceed with surgery on aspirin alone; hold clopidogrel for 5 days
- D. Continue both antiplatelet agents through surgery

Question 247

Domain III - PACU

A patient develops a persistent bite (masseter spasm) during mask induction with sevoflurane after receiving succinylcholine 1.5 mg/kg. Temperature is 37.8 degrees C. End-tidal CO₂ is 48. Which diagnosis is MOST concerning and what is the appropriate next step?

- A. Laryngospasm - increase sevoflurane and apply jaw thrust
- B. Possible masseter muscle rigidity (MMR) / early MH - stop volatile agent, initiate TIVA, monitor closely and prepare dantrolene
- C. Phase II succinylcholine block - administer neostigmine
- D. Medication error - reverify succinylcholine dose and administer additional dose

Question 248

Domain III - Fluids

A 60-year-old woman with a history of congestive heart failure (EF 30%) undergoes a 3-hour hysterectomy. Intraoperative TEE shows a dilated LV with poor systolic function. The patient develops BP 78/50 mmHg and HR 115. Which medication combination is MOST appropriate?

- A. Phenylephrine infusion + fluid bolus 1 L LR
- B. Dobutamine infusion + vasopressor as needed (norepinephrine or vasopressin) + judicious fluid resuscitation
- C. Metoprolol 5 mg IV to slow HR + fluid bolus
- D. Nitroprusside infusion to reduce afterload

Question 249

Domain III - Positioning

A patient is in the lithotomy position for a 3.5-hour perineal procedure. Post-operatively, she reports bilateral calf pain, weakness in dorsiflexion, and numbness over the dorsum of the foot. Which nerve is MOST likely injured?

- A. Femoral nerve
- B. Sciatic nerve
- C. Common peroneal nerve
- D. Obturator nerve

Question 250

Domain III - Ethics/Legal

A 45-year-old Jehovah's Witness presents for an elective total knee replacement and signs a blood refusal form declining all blood products including PRBCs, FFP, and platelets. During surgery, the patient loses 2500 mL of blood and Hgb falls to 5.8 g/dL with hemodynamic instability. Which is the MOST appropriate action?

- A. Administer blood products immediately - informed consent for transfusion is implied by the emergent situation
- B. Honor the patient's previously documented, competent refusal; maximize non-blood strategies (cell salvage, vasopressors, tranexamic acid, crystalloid)
- C. Contact the hospital ethics committee for emergency authorization to transfuse
- D. Contact the patient's next of kin to obtain surrogate consent for transfusion

Question 251

Domain III - Airway

Which of the following is the MOST appropriate initial treatment for laryngospasm in a spontaneously breathing child who does not have IV access?

- A. Nasopharyngeal airway insertion
- B. Intramuscular succinylcholine 4 mg/kg in the lateral thigh muscle
- C. High-flow O₂ by face mask, jaw thrust, CPAP, call for IV access
- D. Immediate orotracheal intubation without medications

Question 252

Domain III - PACU

A patient is in the PACU following a laparoscopic appendectomy under general anesthesia. She is restless, confused, tachycardic at 118, with a distended abdomen and SpO₂ 95%. She had IV morphine 4 mg in the OR. Which complication must be FIRST ruled out?

- A. Morphine allergy
- B. Urinary retention
- C. Intra-abdominal hemorrhage or bowel perforation
- D. Opioid-induced sedation

Question 253

Domain III - Airway

During a prolonged oral surgery case with LMA in place, the capnography waveform shows a consistent upsloping plateau (shark-fin waveform) with the peak at 52 mmHg. The patient is spontaneously breathing. What does this pattern indicate?

- A. Esophageal intubation with persistent CO₂ from gastric gas
- B. Obstructive pattern consistent with bronchospasm or partial airway obstruction
- C. Normal waveform for a spontaneously breathing patient under anesthesia
- D. Pulmonary embolism causing dead space

Question 254

Domain III - Pharmacology

Which of the following CORRECTLY describes the mechanism and reversal of neostigmine-glycopyrrolate combination for neuromuscular blockade reversal?

- A. Neostigmine directly binds nicotinic receptors to displace NDNMB; glycopyrrolate prevents bradycardia from muscarinic effects
- B. Neostigmine inhibits acetylcholinesterase, increasing ACh at the NMJ to overcome NDNMB; glycopyrrolate (quaternary amine) blocks muscarinic side effects without crossing the BBB
- C. Glycopyrrolate inhibits NDNMB breakdown; neostigmine prevents bradycardia
- D. Neostigmine and glycopyrrolate both act on nicotinic receptors simultaneously

Question 255

Domain III - Monitoring/Safety

A CRNA is asked to administer anesthesia for electroconvulsive therapy (ECT). Which statement regarding ECT anesthesia management is MOST accurate?

- A. Succinylcholine is contraindicated in ECT because of seizure risk
- B. The goal is deep general anesthesia with a high MAC volatile agent to prevent patient awareness
- C. Short-acting agents (methohexital or propofol) + succinylcholine modify the motor response; etomidate is preferred for higher seizure threshold
- D. Ketamine is preferred because it prevents the sympathetic surge during the seizure

Question 256

Domain III - Fluids

Intraoperatively, you draw an ABG on a patient with no pre-existing acid-base disorders who has received 4 liters of normal saline (0.9% NaCl). Results: pH 7.28, PaCO₂ 38, HCO₃ 17, Na 142, Cl 118. What is the MOST likely diagnosis?

- A. Respiratory acidosis from hypoventilation
- B. Metabolic alkalosis from crystalloid administration
- C. Hyperchloremic (non-anion gap) metabolic acidosis from excessive normal saline
- D. Mixed respiratory and metabolic acidosis

Question 257

Domain III - Pain

Which of the following correctly identifies the Apfel Simplified Risk Score for PONV and the threshold at which prophylaxis with 2 agents is recommended?

- A. Risk factors: female sex, non-smoking, history of PONV/motion sickness, postoperative opioids; score 2 = intermediate risk, prophylaxis with 2 agents recommended
- B. Risk factors: age >50, male sex, general anesthesia, nitrous oxide use; score 3 = high risk
- C. Risk factors: obesity, diabetes, opioid allergy, prone positioning; score 2 or more = treat with droperidol
- D. Risk factors: female sex, prior C-section, general anesthesia, GERD; score 3 = high risk

Question 258

Domain III - Safety

A CRNA is setting up for a case in which a laser will be used in the airway (microlaryngoscopy). Which precaution is MOST critical to prevent an airway fire?

- A. Increasing FiO₂ to 100% to prevent hypoxia during the procedure
- B. Using an FiO₂ as low as clinically tolerable (ideally <30%) and a laser-resistant endotracheal tube
- C. Soaking the ETT in saline before use
- D. Flooding the trachea with saline via the ETT

Question 259

Domain III - Neuraxial

A patient receives a combined spinal-epidural (CSE) for labor analgesia. 20 minutes later the nurse reports the patient cannot feel her legs at all and her blood pressure is 70/40 mmHg. On examination, cold sensation is blocked to T2. What occurred and what is the treatment?

- A. Normal high spinal from standard CSE dose - no treatment needed
- B. Total/high spinal from intrathecal migration of the epidural catheter; treat with fluids, vasopressors, prepare for intubation if apneic
- C. Epidural hematoma - immediate MRI
- D. Epidural abscess - empiric antibiotics and neurosurgery consult

Question 260

Domain III - PACU

A patient in the PACU develops acute respiratory distress with pink, frothy secretions from the ETT (still intubated) 30 minutes after reversal of laryngospasm. What is the MOST likely diagnosis and treatment?

- A. Pneumonia - broad-spectrum antibiotics
- B. Negative pressure pulmonary edema (NPPE) - CPAP, diuresis, supportive care
- C. Flash pulmonary edema from fluid overload - reduce IV fluid rate
- D. Pulmonary embolism - heparin anticoagulation

Question 261

Domain III - Preoperative

A 45-year-old patient with known obstructive sleep apnea (OSA) and BMI 38 undergoes an outpatient laparoscopic cholecystectomy. Post-operatively, which is the MOST important discharge consideration?

- A. The patient must remain in PACU for 6 hours regardless of clinical status
- B. If the patient does not have CPAP at home, prescribe a nasal airway for discharge
- C. Ensure the patient meets standard discharge criteria, has adequate pain control without residual opioid sedation, and has a responsible adult escort; prescribe home CPAP if not already using it
- D. Admit all OSA patients for 23-hour observation regardless of surgical complexity

Question 262

Domain III - Pharmacology

A patient receiving a dexmedetomidine infusion at 0.7 mcg/kg/hr for ICU sedation develops a heart rate of 38 bpm and BP 82/50 mmHg. Which is the MOST appropriate intervention?

- A. Increase the dexmedetomidine dose - bradycardia indicates inadequate pain control
- B. Reduce or discontinue the dexmedetomidine infusion; administer atropine if symptomatic; glycopyrrolate if needed
- C. Administer adenosine to differentiate from SVT
- D. Immediately cardiovert at 50J synchronized

Question 263

Domain III - Safety

According to AANA standards, which of the following monitoring parameters represents the MINIMUM standard that must be used during all general anesthetic procedures?

- A. Arterial line, CVP, foley catheter
- B. ECG, noninvasive blood pressure, pulse oximetry, capnography, temperature
- C. ECG, pulse oximetry, capnography only
- D. Pulse oximetry and blood pressure only

Question 264

Domain III - Airway

A CRNA is managing a patient with a known subglottic stenosis for an elective procedure. The trachea is narrowed to approximately 6 mm. Which airway management approach is MOST appropriate?

- A. Select a 6.0 mm ID ETT and proceed with RSI
- B. Perform awake fiberoptic intubation with a small-diameter ETT (5.0-5.5 mm), avoiding excessive sedation
- C. Use a supraglottic airway - subglottic stenosis does not affect LMA placement
- D. Cancel the case and refer to ENT - subglottic stenosis cannot be managed by CRNAs

Question 265

Domain III - Regional

A CRNA performs an ultrasound-guided interscalene block for shoulder arthroscopy. 30 minutes later the patient reports shortness of breath. Oxygen saturation is 94%. A chest X-ray shows hemidiaphragm elevation on the ipsilateral side. Which complication has occurred?

- A. Pneumothorax from needle injury to the apex of the lung
- B. Ipsilateral phrenic nerve palsy (100% incidence with interscalene block)
- C. Contralateral phrenic nerve injury
- D. Cervical epidural spread causing bilateral respiratory depression

Question 266

Domain III - Fluids

A 25-year-old patient in the ICU following a gunshot wound has a TEG (thromboelastography) result showing: prolonged R time, narrow MA, short fibrinolysis time. Which blood product strategy is MOST appropriate?

- A. Platelets and cryoprecipitate only
- B. FFP and antifibrinolytic (TXA) therapy - prolonged R = factor deficiency; fibrinolysis = elevated fibrinolytic activity
- C. Packed red blood cells only - the primary problem is anemia
- D. Heparin infusion - the short R time indicates hypercoagulability

Question 267

Domain III - Preoperative

Which statement BEST describes the anesthetic management of a patient with known or suspected full stomach in an emergency?

- A. Administer ondansetron preoperatively to prevent aspiration
- B. Use rapid sequence induction (RSI): preoxygenate 3-5 min, cricoid pressure, succinylcholine or high-dose rocuronium, intubate immediately without manual ventilation
- C. Use an LMA since it protects against aspiration better than mask ventilation
- D. Delay intubation until patient has been NPO for at least 2 hours

Question 268

Domain III - Pharmacology

A CRNA adds dexamethasone 8 mg IV at the start of a 3-hour abdominal hysterectomy. Which of the following BEST describes the evidence-based rationale for this practice?

- A. Dexamethasone prevents adrenal insufficiency in patients taking chronic steroids
- B. Dexamethasone reduces PONV, has analgesic properties, reduces airway edema, and has anti-inflammatory effects - given as a single multimodal dose
- C. Dexamethasone is given to improve gastric motility and reduce aspiration risk
- D. Dexamethasone prevents wound infection by reducing inflammatory response

Question 269

Domain III - Safety

A CRNA is working with an impaired colleague who smells of alcohol and appears unsteady. What is the MOST appropriate immediate action?

- A. Complete the current case together, then report after the case
- B. Say nothing - it is not the CRNA's professional responsibility to report colleagues
- C. Immediately remove the impaired colleague from patient care, notify administration/supervisor, and follow institutional peer assistance protocols
- D. Ask the impaired colleague privately to excuse themselves from the case

Question 270

Domain III - Preoperative

According to ACC/AHA perioperative cardiovascular guidelines, which patient requires additional cardiac testing before elective major non-cardiac surgery?

- A. A 65-year-old with well-controlled hypertension and no cardiac symptoms undergoing right hemicolectomy
- B. A 58-year-old with known CAD, stable angina, and a Duke Activity Status Index (DASI) ≥ 4 METs
- C. A 70-year-old with known severe symptomatic aortic stenosis undergoing vascular surgery
- D. A 55-year-old with Type 2 diabetes and normal ECG undergoing laparoscopic cholecystectomy

Question 271

Domain III - Airway

After an uncomplicated 4-hour spine surgery in the prone position with estimated blood loss of 1500 mL and 4 liters of crystalloid, the patient is repositioned supine for extubation. The airway examination reveals significant facial edema, swollen lips, and the tongue protrudes over the teeth. What is the MOST appropriate extubation strategy?

- A. Extubate immediately - the case is done and airway edema is cosmetic only
- B. Keep the patient intubated and sedated overnight for airway edema to resolve; extubate in the ICU
- C. Perform a cuff-leak test; if no leak, delay extubation; if leak present, extubate over an airway exchange catheter (AEC) with full airway equipment and personnel available
- D. Perform tracheostomy immediately before extubation

Question 272

Domain III - Pain

Which of the following mechanisms BEST explains how gabapentinoids (gabapentin, pregabalin) provide perioperative analgesia?

- A. Inhibition of cyclooxygenase (COX) enzymes reducing prostaglandin synthesis
- B. Blockade of voltage-gated calcium channels (alpha-2-delta subunit) in the dorsal horn, reducing release of excitatory neurotransmitters
- C. Competitive antagonism at NMDA glutamate receptors
- D. Activation of mu-opioid receptors in the spinal cord

Question 273

Domain III - Monitoring

A CRNA observes a new 2 mm ST segment depression in leads II and V5 30 minutes after femoral-popliteal bypass graft clamping. The patient's HR is 88 and BP is 132/82 mmHg. What is the MOST appropriate immediate response?

- A. Increase volatile agent concentration to ensure depth of anesthesia
- B. Increase HR with atropine to improve coronary perfusion pressure
- C. Notify the surgeon, obtain a 12-lead ECG, check for other signs of ischemia (wall motion on TEE if available), optimize HR and BP toward a rate-pressure product that minimizes demand ischemia
- D. Administer heparin immediately for suspected in-stent thrombosis

Question 274

Domain III - Infection Control

A CRNA prepares a propofol infusion and draws additional medications from multidose vials using the same syringe between patients. Which patient safety concern is MOST directly raised by this practice?

- A. Propofol lipid emulsion instability with repeated injection
- B. Transmission of bloodborne pathogens and bacterial contamination - violation of sterile technique; single-use vials and separate syringes per patient are mandatory
- C. Excessive opioid waste documentation requirements
- D. Increased risk of propofol infusion syndrome from contamination

Question 275

Domain III - PACU

A CRNA administers neostigmine 5 mg + glycopyrrolate 1 mg to reverse rocuronium blockade. The TOF ratio is confirmed at 0.95 before extubation. Post-extubation, the patient's SpO₂ drops to 88% on room air with paradoxical chest wall movement. Which is the MOST likely diagnosis?

- A. Residual neuromuscular blockade despite TOF >0.9
 - B. Opioid-induced respiratory depression
 - C. Complete laryngospasm
 - D. Pulmonary embolism
- DOMAIN IV: Surgical Procedures & Special Populations - Questions 76-100

Question 276

Domain III - Preoperative Evaluation

A 58-year-old man is scheduled for elective inguinal hernia repair. He has well-controlled hypertension, no other systemic disease, and functions independently. Which ASA physical status classification is MOST appropriate?

- A. ASA III
- B. ASA I
- C. ASA II
- D. ASA IV

Question 277

Domain III - Preoperative Evaluation

Per current ASA fasting guidelines for elective procedures, what is the MINIMUM recommended fasting time for a light meal (toast and clear liquids) prior to anesthesia?

- A. 4 hours
- B. 2 hours
- C. 6 hours
- D. 8 hours

Question 278

Domain III - Preoperative Evaluation

A patient reports being able to climb two flights of stairs without stopping and can perform heavy housework. Approximately how many metabolic equivalents (METs) does this represent, and what does it indicate about perioperative cardiac risk?

- A. About 2 METs; poor functional capacity
- B. Greater than 10 METs; excellent but requires stress testing
- C. About 4 METs or greater; adequate functional capacity
- D. Less than 1 MET; high risk

Question 279

Domain III - Preoperative Evaluation

Using the Revised Cardiac Risk Index (RCRI), which of the following is one of the six independent predictors of major perioperative cardiac complications?

- A. Body mass index greater than 35
- B. Age greater than 65 years
- C. Chronic obstructive pulmonary disease
- D. History of ischemic heart disease

Question 280

Domain III - Preoperative Evaluation

A 66-year-old smoker with COPD is scheduled for open upper abdominal surgery. Which intervention is MOST effective at reducing postoperative pulmonary complications?

- A. Lung-protective ventilation and postoperative incentive spirometry
- B. Routine preoperative chest radiograph
- C. Prophylactic postoperative antibiotics
- D. Preoperative pulmonary function testing in all patients

Question 281

Domain III - Preoperative Evaluation

Which set of findings on the STOP-BANG questionnaire indicates a HIGH risk for obstructive sleep apnea?

- A. Score is not predictive of OSA severity
- B. Score of 3 to 4
- C. Score of 5 to 8
- D. Score of 0 to 2

Question 282

Domain III - Preoperative Evaluation

During airway assessment, a thyromental distance of less than which value is associated with increased likelihood of difficult direct laryngoscopy?

- A. Less than 15 cm
- B. Less than 10 cm
- C. Less than 6 cm (about 3 fingerbreadths)
- D. Less than 12 cm

Question 283

Domain III - Preoperative Evaluation

A patient's Mallampati classification is performed. A view in which only the hard palate is visible corresponds to which class?

- A. Class III
- B. Class IV
- C. Class I
- D. Class II

Question 284

Domain III - Preoperative Evaluation

A patient takes an ACE inhibitor for hypertension. According to common perioperative practice, what is the MOST appropriate recommendation regarding this medication on the morning of surgery?

- A. Double the dose to ensure blood pressure control
- B. Continue as usual to avoid rebound hypertension
- C. Consider holding the morning dose to reduce intraoperative refractory hypotension
- D. Switch to intravenous formulation preoperatively

Question 285

Domain III - Preoperative Evaluation

A 70-year-old patient with a bare-metal coronary stent placed 3 months ago on dual antiplatelet therapy needs elective surgery. What is the MOST appropriate recommendation?

- A. Delay elective surgery for at least 12 months regardless
- B. Proceed immediately, stopping both agents
- C. Stop aspirin only and proceed today
- D. Delay elective surgery until at least 1 month after bare-metal stent placement, continuing aspirin if possible

Question 286

Domain III - Preoperative Evaluation

Which preoperative laboratory test is MOST appropriately ordered based on clinical indication rather than routinely for all patients?

- A. Chest radiograph in every patient over 40
- B. Type and screen for a procedure with anticipated significant blood loss
- C. Coagulation studies in a healthy patient with no bleeding history
- D. Electrolyte panel in every healthy outpatient

Question 287

Domain III - Preoperative Evaluation

A patient with a history of severe PONV, non-smoking status, female sex, and planned postoperative opioids has how many Apfel risk factors, and what is the general recommendation?

- A. One factor; no prophylaxis needed
- B. Four factors; multimodal prophylaxis with two or more agents and consideration of TIVA
- C. Two factors; single-agent prophylaxis only
- D. Zero factors; no intervention

Question 288

Domain III - Preoperative Evaluation

Which patient characteristic is MOST predictive of difficult mask ventilation?

- A. Prominent maxillary incisors alone
- B. Young age and low BMI
- C. Small tongue and short thyromental distance only
- D. Presence of a beard, edentulous state, and history of snoring

Question 289

Domain III - Airway Management

A trauma patient with a full stomach requires emergent intubation. During a classic rapid sequence induction, which action is MOST consistent with the technique?

- A. Titration of muscle relaxant to twitch response before intubation
- B. Awake fiberoptic intubation without sedation
- C. Administration of a predetermined induction agent and rapid-onset paralytic with avoidance of routine positive-pressure ventilation
- D. Prolonged mask ventilation before intubation

Question 290

Domain III - Airway Management

During preoxygenation, which end point BEST indicates adequate denitrogenation before induction?

- A. End-tidal CO₂ of 35 mmHg
- B. Three tidal breaths of room air
- C. End-tidal oxygen fraction of at least 0.8 to 0.9
- D. SpO₂ of 95 percent

Question 291

Domain III - Airway Management

A patient cannot be intubated and cannot be adequately mask ventilated, and an LMA fails to establish ventilation. According to the difficult airway algorithm, what is the MOST appropriate next step?

- A. Repeat direct laryngoscopy attempts
- B. Awaken the patient and reschedule
- C. Administer additional neuromuscular blockade
- D. Emergency invasive airway access (cricothyrotomy)

Question 292

Domain III - Airway Management

For an awake fiberoptic intubation, which technique BEST anesthetizes the trachea below the vocal cords to blunt the cough reflex?

- A. Superior laryngeal nerve block alone
- B. Transtracheal injection of local anesthetic through the cricothyroid membrane
- C. Glossopharyngeal nerve block
- D. Topical anesthesia of the soft palate

Question 293

Domain III - Airway Management

The cricothyroid membrane, the site for emergency cricothyrotomy, is located between which two structures?

- A. The cricoid cartilage and first tracheal ring
- B. The thyroid cartilage and cricoid cartilage
- C. The hyoid bone and thyroid cartilage
- D. The epiglottis and thyroid cartilage

Question 294

Domain III - Airway Management

A patient regurgitates gastric contents during induction and develops hypoxemia with wheezing. After securing the airway, what is the MOST appropriate initial management of suspected aspiration?

- A. Prophylactic broad-spectrum antibiotics for all patients
- B. Empiric high-dose corticosteroids
- C. Suctioning of the airway and supportive care with supplemental oxygen and PEEP as needed
- D. Immediate bronchoalveolar lavage with saline

Question 295

Domain III - Airway Management

A CRNA obtains a Cormack-Lehane grade III view (only the epiglottis visible) during direct laryngoscopy. Which adjunct is MOST likely to facilitate successful intubation?

- A. A larger Macintosh blade only
- B. Deeper sedation without paralysis
- C. A bougie (tracheal tube introducer) directed under the epiglottis
- D. Blind digital intubation

Question 296

Domain III - Airway Management

Which of the following is the MOST reliable single method to confirm correct endotracheal tube placement in the trachea?

- A. Chest rise with ventilation
- B. Condensation (fogging) in the tube
- C. Bilateral breath sounds on auscultation
- D. Sustained end-tidal CO₂ waveform over several breaths (capnography)

Question 297

Domain III - Airway Management

Following a failed intubation in a patient who can be mask ventilated, which supraglottic device provides a conduit that also facilitates passage of an endotracheal tube?

- A. Intubating LMA (LMA Fastrach)
- B. Oropharyngeal airway
- C. Nasopharyngeal airway
- D. Classic (first-generation) LMA

Question 298

Domain III - Airway Management

Cricoid pressure (Sellick maneuver) is applied during RSI. Which statement BEST describes current understanding of this technique?

- A. It compresses the esophagus against the vertebral body but may worsen the laryngoscopic view and should be released if it impedes intubation
- B. It reliably prevents all aspiration in every patient
- C. It is applied to the thyroid cartilage
- D. It should be maintained even if active vomiting occurs

Question 299

Domain III - Airway Management

A patient with a suspected cervical spine injury requires intubation. Which technique BEST minimizes cervical spine movement?

- A. Manual in-line stabilization during laryngoscopy
- B. Nasotracheal intubation without stabilization
- C. Maximal head extension for a better view
- D. Removing the entire cervical collar and hyperflexing the neck

Question 300

Domain III - Airway Management

Approximately how long is the safe apnea time (time to significant desaturation) in a well-preoxygenated healthy adult compared with an obese or critically ill patient?

- A. Obese patients tolerate apnea longer due to fat reserves
- B. Both groups have identical apnea times
- C. A healthy preoxygenated adult may tolerate several minutes, while obese or critically ill patients desaturate much faster due to reduced FRC and higher oxygen consumption
- D. Preoxygenation does not affect apnea time

Question 301

Domain III - Regional Anesthesia

During a spinal anesthetic, the CRNA aims for a sensory block adequate for a cesarean delivery. Which dermatome level is the target sensory block height?

- A. T6
- B. T4
- C. T10
- D. L1

Question 302

Domain III - Regional Anesthesia

A patient develops perioral numbness, tinnitus, and metallic taste shortly after a local anesthetic injection, progressing to seizures and cardiovascular collapse. What is the MOST appropriate specific treatment?

- A. Sodium bicarbonate infusion
- B. Immediate 20 percent lipid emulsion (Intralipid) bolus and infusion
- C. High-dose epinephrine boluses of 1 mg
- D. Flumazenil administration

Question 303

Domain III - Regional Anesthesia

Which local anesthetic is associated with the GREATEST cardiotoxicity per equivalent dose, primarily due to avid sodium channel binding?

- A. Mepivacaine
- B. Bupivacaine
- C. Chloroprocaine
- D. Lidocaine

Question 304

Domain III - Regional Anesthesia

A patient develops a positional headache, worse when upright and relieved when supine, two days after spinal anesthesia. Which feature MOST strongly supports post-dural puncture headache?

- A. Headache present only at night
- B. Headache unrelated to position
- C. Fever and neck stiffness
- D. Postural nature that worsens upright and improves when recumbent

Question 305

Domain III - Regional Anesthesia

Per ASRA guidelines, what is the recommended minimum time to wait after the last prophylactic dose of enoxaparin (low-dose LMWH) before performing neuraxial block?

- A. No waiting is required
- B. 4 hours
- C. 12 hours
- D. 24 hours

Question 306

Domain III - Regional Anesthesia

A patient on clopidogrel needs a neuraxial procedure. According to ASRA guidelines, how long should clopidogrel typically be discontinued before neuraxial block?

- A. 3 days
- B. It does not need to be held
- C. 24 hours
- D. 5 to 7 days

Question 307

Domain III - Regional Anesthesia

A CRNA performs an interscalene brachial plexus block and the patient develops ipsilateral shoulder droop, ptosis, and a constricted pupil. What is the MOST likely explanation?

- A. Pneumothorax
- B. Horner syndrome from stellate ganglion spread
- C. Local anesthetic systemic toxicity
- D. Total spinal anesthesia

Question 308

Domain III - Regional Anesthesia

Which nerve is MOST commonly spared or inadequately blocked by an interscalene approach to the brachial plexus?

- A. Musculocutaneous nerve
- B. Suprascapular nerve
- C. Ulnar nerve (inferior trunk, C8-T1)
- D. Axillary nerve

Question 309

Domain III - Regional Anesthesia

When performing ultrasound-guided regional anesthesia, which needle approach BEST allows visualization of the entire needle shaft and tip during advancement?

- A. Landmark-only technique
- B. Out-of-plane approach
- C. Perpendicular blind insertion
- D. In-plane approach with the needle aligned along the long axis of the transducer

Question 310

Domain III - Regional Anesthesia

A patient receiving epidural anesthesia suddenly develops profound hypotension, bradycardia, difficulty breathing, and loss of hand strength. What complication is MOST likely?

- A. High or total spinal from unintended intrathecal spread
- B. Transient neurologic symptoms
- C. Epidural hematoma
- D. Post-dural puncture headache

Question 311

Domain III - Regional Anesthesia

In a combined spinal-epidural (CSE) technique using the needle-through-needle method, which statement is correct?

- A. Both spinal and epidural doses are given intrathecally
- B. The technique cannot be used for labor analgesia
- C. The spinal needle is passed through the epidural (Tuohy) needle to inject intrathecally, then the epidural catheter is threaded
- D. The epidural catheter is placed before the spinal needle

Question 312

Domain III - Regional Anesthesia

Which factor has the GREATEST influence on the spread (block height) of a hyperbaric spinal local anesthetic?

- A. The gauge of the spinal needle
- B. The patient's age only
- C. The speed of injection alone
- D. Patient position and baricity of the solution relative to CSF

Question 313

Domain III - Fluid/Transfusion

A 70 kg patient receives 1 liter of 0.9 percent normal saline. Approximately how much of this crystalloid remains in the intravascular space after equilibration?

- A. None remains intravascular
- B. About 100 percent
- C. About 75 percent
- D. About 25 percent (roughly 250 mL)

Question 314

Domain III - Fluid/Transfusion

Large-volume resuscitation with 0.9 percent normal saline is MOST associated with which acid-base disturbance?

- A. Respiratory acidosis
- B. Respiratory alkalosis
- C. Metabolic alkalosis
- D. Hyperchloremic metabolic acidosis

Question 315

Domain III - Fluid/Transfusion

In a massive transfusion protocol for a hemorrhaging trauma patient, which ratio of components is commonly recommended as a balanced resuscitation strategy?

- A. Packed red cells only
- B. Platelets alone until bleeding stops
- C. Approximately 1:1:1 ratio of packed red cells, fresh frozen plasma, and platelets
- D. 4 units of crystalloid per unit of blood

Question 316

Domain III - Fluid/Transfusion

A patient develops acute hypoxemia and bilateral pulmonary infiltrates within 6 hours of a plasma transfusion, with normal cardiac filling pressures. What is the MOST likely diagnosis?

- A. Acute hemolytic transfusion reaction
- B. Febrile non-hemolytic reaction
- C. Transfusion-related acute lung injury (TRALI)
- D. Transfusion-associated circulatory overload (TACO)

Question 317

Domain III - Fluid/Transfusion

An elderly patient with heart failure receives multiple units of blood and develops dyspnea, hypertension, jugular venous distention, and bilateral crackles. Which management step is MOST appropriate for suspected TACO?

- A. Begin a massive transfusion protocol
- B. Slow or stop the transfusion, sit the patient upright, and administer a diuretic
- C. Administer epinephrine
- D. Rapid additional fluid bolus

Question 318

Domain III - Fluid/Transfusion

On a thromboelastography (TEG) tracing, a prolonged R (reaction) time MOST directly indicates a deficiency in which component, guiding which transfusion?

- A. Fibrinogen; give cryoprecipitate
- B. Fibrinolysis; give tranexamic acid
- C. Clotting factors; give fresh frozen plasma
- D. Platelet number; give platelets

Question 319

Domain III - Fluid/Transfusion

On TEG, a decreased maximum amplitude (MA) MOST directly reflects a problem with which of the following?

- A. Platelet function and number (clot strength)
- B. Clotting factor initiation
- C. Fibrinolysis
- D. Heparin effect

Question 320

Domain III - Fluid/Transfusion

Citrate used as an anticoagulant in stored blood products can cause which electrolyte disturbance during massive transfusion, particularly with impaired hepatic metabolism?

- A. Hypercalcemia
- B. Hypocalcemia from citrate binding of ionized calcium
- C. Hyperphosphatemia
- D. Hypernatremia

Question 321

Domain III - Fluid/Transfusion

A patient develops fever, flank pain, hemoglobinuria, and hypotension minutes after starting a red cell transfusion. What is the MOST appropriate immediate action?

- A. Give an antihistamine and resume
- B. Administer a diuretic and continue the transfusion
- C. Immediately stop the transfusion, maintain IV access with saline, and begin supportive care
- D. Slow the transfusion and continue observing

Question 322

Domain III - Fluid/Transfusion

According to common restrictive transfusion strategy in a stable, non-bleeding patient without active cardiac ischemia, red cells are generally indicated at a hemoglobin threshold of approximately which value?

- A. 7 g/dL
- B. 9 g/dL
- C. 5 g/dL
- D. 10 g/dL

Question 323

Domain III - Fluid/Transfusion

Compared with crystalloids, which statement BEST describes colloids such as albumin for intravascular volume expansion?

- A. They require larger volumes for equivalent expansion
- B. They remain intravascular longer due to oncotic pressure, providing greater volume expansion per unit given
- C. They have no effect on plasma oncotic pressure
- D. They freely cross into the intracellular space

Question 324

Domain III - Complications

During general anesthesia with sevoflurane, a patient develops an unexplained rise in end-tidal CO₂, tachycardia, muscle rigidity, and rising temperature. What is the FIRST pharmacologic treatment?

- A. Dantrolene 2.5 mg/kg IV
- B. Sodium bicarbonate
- C. Active cooling only
- D. Labetalol

Question 325

Domain III - Complications

The recommended initial dantrolene dose for a malignant hyperthermia crisis is 2.5 mg/kg IV. What is the reconstitution consideration for classic dantrolene sodium?

- A. Each vial must be reconstituted with sterile water and requires vigorous mixing, which is labor intensive
- B. It must be diluted in dextrose only
- C. It dissolves instantly in normal saline
- D. It is premixed and ready to infuse

Question 326

Domain III - Complications

Shortly after administration of a neuromuscular blocking agent, a patient develops profound hypotension, tachycardia, bronchospasm, and a diffuse rash. What is the FIRST-line drug?

- A. Diphenhydramine
- B. Epinephrine
- C. Albuterol
- D. Hydrocortisone

Question 327

Domain III - Complications

During emergence, a patient develops complete upper airway obstruction with a high-pitched crowing sound and paradoxical chest movement. What is the MOST appropriate initial management of laryngospasm?

- A. Deep extubation and observation
- B. Immediate surgical airway
- C. Administer a beta blocker
- D. Positive-pressure ventilation with 100 percent oxygen and jaw thrust, escalating to a small dose of succinylcholine if it persists

Question 328

Domain III - Complications

An intubated asthmatic patient develops high peak airway pressures, wheezing, and a prolonged expiratory phase with rising end-tidal CO₂. What is the MOST appropriate initial treatment for intraoperative bronchospasm?

- A. Administer a nondepolarizing muscle relaxant
- B. Deepen anesthesia and administer inhaled beta-2 agonist
- C. Immediately extubate
- D. Decrease the FiO₂

Question 329

Domain III - Complications

A patient reports recall of intraoperative events after general anesthesia. Which factor is MOST associated with an increased risk of intraoperative awareness?

- A. Use of total intravenous anesthesia with neuromuscular blockade and inadequate depth monitoring
- B. Regional anesthesia
- C. High doses of volatile anesthetic
- D. Routine BIS use below 40

Question 330

Domain III - Complications

For an operating room fire to occur, three elements of the fire triad must be present. Which of the following is the oxidizer component MOST relevant in the OR?

- A. Electrocautery
- B. Oxygen and nitrous oxide
- C. Alcohol-based skin prep
- D. Surgical drapes

Question 331

Domain III - Complications

A surgical fire ignites on the patient's drapes during a case using an oxygen-enriched atmosphere. What is the FIRST priority action?

- A. Continue the procedure while calling for help
- B. Use a carbon dioxide extinguisher on the airway
- C. Activate the fire alarm and evacuate the room
- D. Stop the flow of oxidizing gases and remove burning materials from the patient

Question 332

Domain III - Complications

A patient is genetically susceptible to malignant hyperthermia. Which anesthetic plan is SAFEST?

- A. Desflurane with rocuronium
- B. Sevoflurane with succinylcholine
- C. Total intravenous anesthesia with propofol and a nondepolarizing relaxant, using a vapor-free machine
- D. Nitrous oxide with succinylcholine

Question 333

Domain III - Complications

A CRNA suspects a delayed hemolytic reaction is unlikely and instead identifies bronchospasm plus urticaria and hypotension after latex exposure. When does latex anaphylaxis typically present relative to induction?

- A. Never intraoperatively
- B. Only in the PACU
- C. Immediately at induction like an IV drug reaction
- D. Often 20 to 60 minutes after exposure, correlating with mucosal or surgical contact

Question 334

Domain III - Complications

During a case requiring surgery near the airway with electrocautery, which strategy BEST reduces the risk of an airway fire?

- A. Increase FiO₂ to 100 percent for safety margin
- B. Keep delivered oxygen concentration as low as clinically acceptable and avoid nitrous oxide near the cautery
- C. Use only nitrous oxide as the carrier gas
- D. Apply extra alcohol prep to the surgical field

Question 335

Domain III - Induction

A hemodynamically unstable trauma patient with hypovolemia requires induction. Which induction agent BEST maintains cardiovascular stability?

- A. High-dose midazolam
- B. Propofol
- C. Thiopental
- D. Etomidate or ketamine

Question 336

Domain III - Induction

During inhalation induction with sevoflurane in a pediatric patient, which property makes sevoflurane preferred over desflurane and isoflurane for this purpose?

- A. Its low pungency and relatively pleasant odor, causing less airway irritation
- B. Its ability to trigger bronchospasm
- C. Its very high blood-gas solubility
- D. Its high pungency

Question 337

Domain III - Induction

A typical induction dose of propofol in a healthy adult is approximately which range?

- A. 6 to 8 mg/kg
- B. 10 to 12 mg/kg
- C. 1.5 to 2.5 mg/kg
- D. 0.1 to 0.3 mg/kg

Question 338

Domain III - Induction

Which sign BEST indicates that a patient given succinylcholine has developed adequate conditions for intubation?

- A. Cessation of fasciculations and profound flaccid paralysis, typically within about 60 seconds
- B. Increase in blood pressure
- C. Return of spontaneous ventilation
- D. Onset of bradycardia

Question 339

Domain III - Induction

A patient with a documented plasma (pseudo)cholinesterase deficiency receives succinylcholine. What is the expected clinical consequence?

- A. Markedly prolonged neuromuscular blockade requiring continued ventilation
- B. No effect on duration
- C. Immediate reversal of the block
- D. Resistance requiring higher doses

Question 340

Domain III - Induction

During a modified rapid sequence induction in a patient at aspiration risk who also has limited cardiopulmonary reserve, gentle mask ventilation with low pressures may be used. What is the primary rationale for keeping inflation pressures low?

- A. To reduce anesthetic requirement
- B. To minimize gastric insufflation and aspiration risk
- C. To increase tidal volume
- D. To speed onset of paralysis

Question 341

Domain III - Induction

Ketamine is chosen for induction in a patient with active bronchospastic disease. Which property makes it advantageous in this setting?

- A. It reliably causes apnea
- B. It causes bronchoconstriction
- C. It profoundly depresses airway reflexes
- D. It produces bronchodilation and preserves respiratory drive

Question 342

Domain III - Induction

A patient at high risk for aspiration is scheduled for elective surgery. Which premedication is MOST appropriate to reduce gastric volume and acidity before induction?

- A. An anticholinergic such as glycopyrrolate alone
- B. A non-particulate antacid such as sodium citrate, with consideration of an H2 blocker
- C. An opioid
- D. A particulate antacid

Question 343

Domain III - Induction

When priming with a small dose of a nondepolarizing agent before an intubating dose (the priming principle), what is the intended effect?

- A. To eliminate the need for an induction agent
- B. To prolong the total duration of blockade
- C. To prevent histamine release
- D. To speed the onset of adequate intubating conditions

Question 344

Domain III - Induction

A CRNA plans a co-induction with a small dose of midazolam followed by propofol. What is the primary benefit of this combination?

- A. Synergism allows a reduced propofol dose, potentially improving hemodynamic stability
- B. It reverses opioid effects
- C. It increases the required propofol dose
- D. It reliably prevents PONV

Question 345

Domain III - Induction

A patient reports severe pain on injection of propofol through a small hand vein. Which intervention BEST reduces this discomfort?

- A. Dilute the propofol with sterile water
- B. Pretreat with intravenous lidocaine or use a larger, more proximal vein
- C. Warm the propofol to body temperature
- D. Inject the propofol more rapidly

Question 346

Domain III - Maintenance

During maintenance of anesthesia, the concept of MAC (minimum alveolar concentration) is defined as the concentration that prevents movement in what percentage of patients in response to a surgical stimulus?

- A. 25 percent
- B. 50 percent
- C. 75 percent
- D. 95 percent

Question 347

Domain III - Maintenance

Which physiologic factor INCREASES anesthetic requirement (raises MAC)?

- A. Pregnancy
- B. Acute administration of opioids
- C. Chronic alcohol use and hyperthermia
- D. Advanced age

Question 348

Domain III - Maintenance

During maintenance with a volatile agent and controlled ventilation, the depth of anesthesia monitor (processed EEG) reads a value consistent with very deep anesthesia. What is the MOST appropriate response?

- A. Consider reducing the anesthetic depth toward an appropriate target to avoid excessive dosing
- B. Increase the volatile concentration further
- C. Ignore the reading entirely
- D. Administer a paralytic

Question 349

Domain III - Maintenance

The second gas effect during maintenance refers to which phenomenon?

- A. A drug interaction between two intravenous agents
- B. Rebreathing of carbon dioxide
- C. The slowing of induction with two agents
- D. The acceleration of the alveolar rise of a second gas when given with high concentrations of nitrous oxide

Question 350

Domain III - Maintenance

A patient maintained on nitrous oxide undergoes a middle-ear procedure. Why is nitrous oxide often limited or avoided in closed-space surgeries?

- A. It diffuses into closed air-filled spaces faster than nitrogen leaves, increasing volume or pressure
- B. It absorbs gas from closed spaces, collapsing them
- C. It only affects the bloodstream
- D. It has no effect on gas-filled spaces

Question 351

Domain III - Maintenance

During maintenance, a patient's blood pressure and heart rate rise with surgical stimulation despite an adequate volatile concentration. Which intervention is MOST appropriate to address inadequate analgesia?

- A. Administer a diuretic
- B. Administer additional opioid or increase analgesic depth
- C. Decrease minute ventilation
- D. Give a nondepolarizing relaxant to stop movement

Question 352

Domain III - Maintenance

In a low-flow anesthesia technique, what is the PRIMARY safety concern that mandates continuous inspired oxygen monitoring?

- A. Excessive rebreathing of nitrous oxide only
- B. Increased cost of volatile agent
- C. The risk of delivering a hypoxic gas mixture as oxygen is consumed at low fresh gas flows
- D. Excessive anesthetic waste

Question 353

Domain III - Maintenance

A patient receiving a remifentanyl-based total intravenous anesthetic is maintained for a long procedure. Which property distinguishes remifentanyl pharmacokinetics during maintenance?

- A. A very short, constant context-sensitive half-time due to rapid ester hydrolysis
- B. Dependence on renal clearance
- C. A long context-sensitive half-time that lengthens with infusion duration
- D. Accumulation in fat with prolonged infusion

Question 354

Domain III - Maintenance

During maintenance, deliberate mild controlled hypotension may be requested. Which end-organ is MOST vulnerable during controlled hypotension and warrants careful monitoring?

- A. The skin
- B. The spleen only
- C. Peripheral fat
- D. The brain, heart, and kidneys (vital organ perfusion)

Question 355

Domain III - Maintenance

A CRNA notes progressive rise in inspired and expired CO₂ during a circle system case at moderate fresh gas flow. Which cause is MOST likely?

- A. A leak in the breathing circuit
- B. Exhausted or channeled CO₂ absorbent leading to rebreathing
- C. Hyperventilation
- D. Excessive fresh gas flow

Question 356

Domain III - Maintenance

The MAC-BAR of a volatile anesthetic refers to which specific end point?

- A. The concentration at which patients open their eyes on command
- B. The concentration preventing movement in 50 percent of patients
- C. The concentration that blunts the adrenergic (sympathetic) response to surgical incision in 50 percent of patients
- D. The concentration causing burst suppression

Question 357

Domain III - Emergence

Before extubation at the end of a case, which combination of findings BEST indicates readiness for safe extubation?

- A. Deep anesthesia with no reflexes
- B. Adequate reversal of neuromuscular blockade, spontaneous breathing with adequate tidal volume, following commands, and intact airway reflexes
- C. SpO₂ of 90 percent on 100 percent oxygen
- D. Absence of any coughing regardless of consciousness

Question 358

Domain III - Emergence

A patient shows a train-of-four ratio of 0.6 at the end of surgery. What does this indicate about neuromuscular recovery, and what is the appropriate action?

- A. Overdose of reversal agent; no action
- B. No blockade present; observe only
- C. Full recovery; extubate now
- D. Residual neuromuscular blockade; provide reversal and confirm a train-of-four ratio of at least 0.9 before extubation

Question 359

Domain III - Emergence

A patient exhibits residual weakness after reversal with neostigmine, with a fade on train-of-four and weak head lift. Which clinical test at the bedside BEST correlates with adequate recovery of neuromuscular function?

- A. Normal blood pressure
- B. Presence of any spontaneous movement
- C. Ability to open the eyes only
- D. Sustained 5-second head lift

Question 360

Domain III - Emergence

A patient reversed with sugammadex still shows inadequate recovery. Which statement about sugammadex is correct?

- A. It reverses benzodiazepine sedation
- B. It encapsulates aminosteroid relaxants such as rocuronium and vecuronium but not benzyliisoquinolinium agents like cisatracurium
- C. It reverses succinylcholine
- D. It works by inhibiting acetylcholinesterase

Question 361

Domain III - Emergence

A pediatric patient emerging from sevoflurane anesthesia becomes agitated, inconsolable, and thrashing without apparent pain. What is this phenomenon and a reasonable management step?

- A. Anaphylaxis; give epinephrine
- B. Emergence delirium; ensure comfort and safety, treat pain, and consider a small dose of propofol or dexmedetomidine
- C. Malignant hyperthermia; give dantrolene
- D. Residual paralysis; give reversal

Question 362

Domain III - Emergence

A CRNA plans a deep extubation in an appropriate patient. Which patient is the LEAST suitable candidate for deep extubation?

- A. A healthy patient with an easy airway after a minor procedure
- B. A patient undergoing a middle-ear procedure
- C. A patient with a known difficult airway or high aspiration risk
- D. A patient with reactive airways where coughing is undesirable

Question 363

Domain III - Emergence

During emergence, a patient develops negative-pressure pulmonary edema after forceful inspiration against a closed glottis (post-obstructive). What is the underlying mechanism?

- A. Allergic reaction to the anesthetic
- B. Left ventricular failure from fluid overload
- C. Highly negative intrathoracic pressure increasing venous return and transudation of fluid into alveoli
- D. Direct alveolar toxicity from oxygen

Question 364

Domain III - Emergence

An elderly patient is slow to awaken after a general anesthetic. Which is a reasonable FIRST step in evaluating delayed emergence?

- A. Assume a stroke and give thrombolytics
- B. Systematically assess for residual anesthetic and neuromuscular blockade, hypercarbia, hypothermia, hypoglycemia, and electrolyte or metabolic causes
- C. Immediately reintubate
- D. Administer flumazenil empirically to all patients

Question 365

Domain III - Emergence

A patient is being emerged after a procedure with a supraglottic airway in place. Which approach BEST reduces the risk of laryngospasm during LMA removal?

- A. Apply positive pressure and remove abruptly during light anesthesia
- B. Suction deeply around the cords during stage 2
- C. Remove the LMA either deeply anesthetized or fully awake, avoiding the light stage 2 plane
- D. Remove the LMA during a light plane of anesthesia (stage 2)

Question 366

Domain III - Emergence

A patient given neostigmine for reversal develops bradycardia and increased secretions during emergence. Which co-administered agent prevents these muscarinic effects?

- A. Glycopyrrolate (an antimuscarinic)
- B. Propranolol
- C. Naloxone
- D. Additional neostigmine

Question 367

Domain III - Emergence

Which strategy BEST promotes a smooth emergence and reduces coughing and hemodynamic surges in a patient with intracranial pathology?

- A. Techniques such as intravenous lidocaine, adequate analgesia, and controlled blood pressure to blunt the cough and pressor response
- B. Abrupt discontinuation of all agents with vigorous stimulation
- C. Deep suctioning repeatedly during emergence
- D. Rapid reversal with high-dose neostigmine alone

Question 368

Domain III - Pain Management

Which principle BEST describes the rationale for multimodal analgesia in the perioperative period?

- A. Combining analgesics with different mechanisms to improve pain control while reducing opioid consumption and side effects
- B. Using only regional anesthesia for every patient
- C. Avoiding all non-opioid agents
- D. Relying on a single high-dose opioid for all pain

Question 369

Domain III - Pain Management

A patient receives intravenous acetaminophen as part of a multimodal plan. Which is the MOST important safety consideration regarding total daily dosing?

- A. Total daily acetaminophen from all sources should generally not exceed about 4 grams in healthy adults, and less with hepatic impairment
- B. It provides profound anti-inflammatory effects at any dose
- C. It should never be combined with opioids
- D. There is no maximum daily dose

Question 370

Domain III - Pain Management

Which mechanism BEST explains how gabapentinoids such as gabapentin and pregabalin contribute to perioperative analgesia?

- A. They bind the alpha-2-delta subunit of voltage-gated calcium channels, reducing neurotransmitter release
- B. They block sodium channels like local anesthetics
- C. They inhibit cyclooxygenase
- D. They activate mu-opioid receptors

Question 371

Domain III - Pain Management

A patient on chronic buprenorphine for opioid use disorder requires postoperative analgesia. Which statement BEST guides management?

- A. Buprenorphine must always be stopped abruptly before surgery
- B. Naloxone should be given preoperatively
- C. No additional analgesia is ever required
- D. Full agonist opioids may be less effective due to high buprenorphine receptor affinity, so multimodal analgesia and careful opioid titration are needed

Question 372

Domain III - Pain Management

A patient uses intravenous patient-controlled analgesia (PCA) with morphine. What is the PRIMARY safety advantage of the demand-dose-with-lockout design without a continuous background infusion?

- A. It eliminates the need for monitoring
- B. It guarantees complete pain relief
- C. It reduces the risk of overdose because a sedated patient cannot self-administer additional doses
- D. It allows unlimited dosing on demand

Question 373

Domain III - Pain Management

Ketamine is used at subanesthetic doses as an analgesic adjunct. Which receptor action underlies its analgesic and antihyperalgesic effects?

- A. Mu-opioid receptor agonism
- B. NMDA receptor antagonism
- C. Cyclooxygenase inhibition
- D. GABA-A receptor agonism

Question 374

Domain III - Pain Management

Which patient factor is the STRONGEST relative contraindication to perioperative NSAID use?

- A. Mild seasonal allergies
- B. Significant renal impairment or active gastrointestinal bleeding
- C. Well-controlled hypertension
- D. History of PONV

Question 375

Domain III - Pain Management

A transversus abdominis plane (TAP) block is used for postoperative analgesia after abdominal surgery. Which type of pain does it BEST address?

- A. Cardiac ischemic pain
- B. Central neuropathic pain
- C. Somatic pain of the anterior abdominal wall
- D. Visceral pain from the abdominal organs

Question 376

Domain III - Pain Management

A CRNA adds dexmedetomidine as an analgesic and sedative adjunct. Which mechanism explains its opioid-sparing and sedative effects?

- A. NMDA antagonism
- B. Histamine receptor blockade
- C. Beta-adrenergic agonism
- D. Central alpha-2 adrenergic agonism

Question 377

Domain III - Pain Management

Preemptive and preventive analgesia strategies aim to reduce postoperative pain by which mechanism?

- A. Delaying analgesia until pain becomes severe
- B. Increasing central sensitization
- C. Eliminating the need for intraoperative anesthesia
- D. Blunting nociceptive input and reducing the development of central sensitization by treating pain before and throughout the noxious stimulus

Question 378

Domain III - Pain Management

A patient develops opioid-induced respiratory depression in the PACU with a respiratory rate of 6 and pinpoint pupils. What is the MOST appropriate treatment?

- A. Titrated small doses of naloxone (for example 40 to 80 mcg) with airway support
- B. A large single bolus of naloxone 2 mg
- C. Additional opioid to relax the patient
- D. Flumazenil

Question 379

Domain III - Positioning

A patient's arm is abducted greater than 90 degrees and externally rotated on an arm board during surgery. Which nerve injury is MOST likely?

- A. Ulnar nerve at the elbow
- B. Common peroneal nerve
- C. Sciatic nerve
- D. Brachial plexus stretch injury

Question 380

Domain III - Positioning

During prolonged supine positioning, the ulnar nerve is vulnerable to injury. Which positioning practice BEST reduces the risk of ulnar neuropathy?

- A. Fully flexing the elbow beyond 90 degrees
- B. Tucking the arms without any padding
- C. Pronating the forearms with pressure on the medial elbow
- D. Supinating or keeping the forearm neutral and padding the elbow to avoid pressure on the ulnar groove

Question 381

Domain III - Positioning

A patient in steep Trendelenburg for robotic pelvic surgery is at increased risk of which physiologic change?

- A. Reduced central venous pressure
- B. Increased intracranial and intraocular pressure and cephalad shift of abdominal contents impairing ventilation
- C. Decreased intracranial and intraocular pressure
- D. Improved functional residual capacity

Question 382

Domain III - Positioning

A patient positioned in lithotomy for several hours develops lower-extremity compartment syndrome. Which factor MOST increases this risk?

- A. Prolonged lithotomy time with legs elevated, reducing lower-limb perfusion
- B. Low body mass index
- C. Short procedure duration
- D. Supine positioning

Question 383

Domain III - Positioning

A patient undergoing prolonged prone spine surgery develops postoperative vision loss. Which is the MOST common cause in this setting?

- A. Acute glaucoma
- B. Corneal abrasion
- C. Ischemic optic neuropathy
- D. Central retinal artery occlusion from direct globe pressure

Question 384

Domain III - Positioning

In the lateral decubitus position, an axillary roll is placed. What is its PRIMARY purpose?

- A. To improve surgical exposure of the abdomen
- B. To elevate the head
- C. To pad the dependent knee
- D. To relieve pressure on the dependent shoulder and axillary neurovascular structures (brachial plexus and axillary artery)

Question 385

Domain III - Positioning

Which nerve is MOST at risk from compression against the lithotomy stirrup at the lateral fibular head?

- A. Common peroneal (fibular) nerve
- B. Femoral nerve
- C. Tibial nerve
- D. Obturator nerve

Question 386

Domain III - Positioning

When moving an anesthetized patient from supine to the sitting (beach chair) position, which hemodynamic change should the CRNA anticipate and manage?

- A. A rise in blood pressure requiring vasodilators
- B. Venous pooling and hypotension, with a risk of cerebral hypoperfusion
- C. No change in blood pressure
- D. Reflex bradycardia only, without pressure change

Question 387

Domain III - Positioning

A patient in the prone position for spine surgery should have the head positioned to protect the eyes. Which practice BEST prevents direct ocular injury?

- A. Use a headrest that keeps the eyes free of external pressure and check eye position periodically
- B. Turn the head sharply to one side for the entire case
- C. Rest the face directly on a flat foam pad over the eyes
- D. Place tape directly across the open eyes

Question 388

Domain III - Positioning

A patient in steep reverse Trendelenburg for laparoscopic upper abdominal surgery is at increased risk of which event?

- A. Increased functional residual capacity impairing oxygenation
- B. Cerebral edema from venous congestion
- C. Aspiration due to head-down tilt
- D. Hypotension and reduced cerebral perfusion from decreased venous return

Question 389

Domain III - Positioning

Which general principle BEST guides safe patient positioning under anesthesia?

- A. Maintain body alignment within normal physiologic range, pad pressure points, and avoid nerve stretch or compression
- B. Remove all padding to improve surgical access
- C. Position only after the patient is fully paralyzed with no reassessment
- D. Position the patient into any range the surgeon requests regardless of normal limits

Question 390

Domain III - Monitoring Interpretation

During a case, the capnography waveform shows a sudden drop of end-tidal CO₂ to near zero with loss of the waveform. Which cause should be considered MOST urgently?

- A. A slightly exhausted CO₂ absorbent
- B. Circuit disconnection, esophageal intubation, or cardiac arrest
- C. Mild hypoventilation
- D. A small increase in dead space

Question 391

Domain III - Monitoring Interpretation

A capnography tracing shows an upsloping expiratory plateau (a shark-fin shape). Which condition does this MOST suggest?

- A. Expiratory airflow obstruction such as bronchospasm or COPD
- B. Normal ventilation
- C. Esophageal intubation
- D. Hyperventilation

Question 392

Domain III - Monitoring Interpretation

A pulse oximeter reads 85 percent in a patient exposed to carbon monoxide. Why may standard pulse oximetry be misleading in carbon monoxide poisoning?

- A. It cannot read any value in this setting
- B. Standard oximetry cannot distinguish carboxyhemoglobin from oxyhemoglobin, often overestimating true oxygen saturation
- C. Carbon monoxide has no effect on oximetry
- D. It reads falsely low because of carboxyhemoglobin

Question 393

Domain III - Monitoring Interpretation

An arterial line waveform shows a large respiratory variation in systolic pressure during positive-pressure ventilation. What does significant pulse pressure or systolic pressure variation MOST commonly suggest?

- A. Fluid overload
- B. Left ventricular failure
- C. Complete heart block
- D. Hypovolemia and fluid responsiveness

Question 394

Domain III - Monitoring Interpretation

An arterial line displays an overdamped waveform (blunted, slurred upstroke). What is the effect on the displayed pressures and the likely cause?

- A. It only affects the heart rate reading
- B. It has no effect on displayed values
- C. It underestimates systolic and overestimates diastolic pressure; often due to air bubbles, clots, or kinks
- D. It overestimates systolic pressure; caused by tubing that is too stiff

Question 395

Domain III - Monitoring Interpretation

A central venous pressure tracing shows large cannon a waves. This finding is MOST consistent with which condition?

- A. Hypovolemia
- B. Aortic stenosis
- C. Atrioventricular dissociation such as complete heart block or a junctional rhythm (atrium contracting against a closed tricuspid valve)
- D. Normal sinus rhythm

Question 396

Domain III - Monitoring Interpretation

During surgery, the ECG shows new 2 mm ST-segment depression in leads II and V5. What does this MOST likely indicate?

- A. Hypothermia
- B. Electrode disconnection
- C. Benign artifact requiring no action
- D. Myocardial ischemia warranting optimization of oxygen supply and demand

Question 397

Domain III - Monitoring Interpretation

A processed EEG depth-of-anesthesia monitor reads 70 during what should be surgical anesthesia. What does this value MOST likely indicate?

- A. Inadequate anesthetic depth with risk of awareness
- B. Optimal surgical anesthesia
- C. Complete burst suppression
- D. Excessively deep anesthesia

Question 398

Domain III - Monitoring Interpretation

A neuromuscular monitor shows a train-of-four count of 1 twitch. Approximately what level of receptor blockade does this correspond to?

- A. Roughly 90 to 95 percent receptor blockade (deep block)
- B. Around 50 percent receptor occupancy
- C. Full recovery
- D. No blockade

Question 399

Domain III - Monitoring Interpretation

A pulse oximeter shows a poor plethysmographic waveform and unreliable readings in a patient. Which condition MOST commonly degrades the pulse oximetry signal?

- A. Poor perfusion, hypothermia, or motion artifact
- B. Normal blood pressure
- C. A regular heart rhythm
- D. Warm, well-perfused fingers

Question 400

Domain III - Monitoring Interpretation

During emergence, the capnogram shows a small cleft or notch in the plateau (a curare cleft). What does this MOST likely reflect?

- A. Returning spontaneous respiratory effort during mechanical ventilation, often with partial neuromuscular recovery
- B. Complete airway obstruction
- C. Esophageal intubation
- D. Cardiac arrest

Question 401

Domain III - Preoperative Evaluation

A patient with poorly controlled diabetes presents for surgery. Which airway-related concern is specifically increased in long-standing diabetes and may predict difficult intubation?

- A. Decreased neck circumference
- B. A large mouth opening
- C. Limited atlanto-occipital joint mobility (the stiff joint or prayer sign)
- D. Macroglossia only

Question 402

Domain III - Preoperative Evaluation

An outpatient with severe obstructive sleep apnea using home CPAP is scheduled for ambulatory surgery. Which perioperative recommendation is MOST appropriate?

- A. Discontinue CPAP entirely in the perioperative period
- B. Prescribe high-dose long-acting opioids
- C. Avoid all regional anesthesia techniques
- D. Continue CPAP therapy, minimize sedatives and opioids, and use multimodal opioid-sparing analgesia

Question 403

Domain III - Airway Management

A CRNA anticipates a difficult airway in a patient with a large anterior neck mass causing tracheal deviation and stridor. Which airway plan is MOST appropriate?

- A. Immediate deep inhalation induction with apnea
- B. Awake fiberoptic intubation while maintaining spontaneous ventilation
- C. Standard rapid sequence induction with paralysis
- D. Blind nasal intubation without preparation

Question 404

Domain III - Airway Management

During extubation of a patient at risk for reintubation difficulty, which device can be left in place to serve as a conduit for potential reintubation while allowing oxygenation?

- A. An airway exchange catheter (tube exchanger)
- B. An oral airway
- C. A nasogastric tube
- D. A standard stylet

Question 405

Domain III - Regional Anesthesia

A patient develops transient neurologic symptoms (TNS) after spinal anesthesia. Which local anesthetic has been MOST associated with this syndrome?

- A. Chloroprocaine
- B. Ropivacaine
- C. Lidocaine
- D. Bupivacaine

Question 406

Domain III - Regional Anesthesia

The maximum recommended dose of lidocaine with epinephrine for local infiltration in an adult is approximately which value?

- A. 3 mg/kg
- B. 7 mg/kg
- C. 15 mg/kg
- D. 20 mg/kg

Question 407

Domain III - Complications

A patient develops perioperative anaphylaxis. After epinephrine, which class of agents is the MOST common trigger of perioperative anaphylaxis?

- A. Inhaled volatile anesthetics
- B. Neuromuscular blocking agents
- C. Acetaminophen
- D. Crystalloid fluids

Question 408

Domain III - Complications

Which laboratory test, drawn soon after a suspected anaphylactic reaction, BEST supports the diagnosis of mast cell activation?

- A. Creatine kinase
- B. Serum sodium
- C. Lactate dehydrogenase
- D. Serum tryptase

Question 409

Domain III - Pain Management

A patient recovering from major surgery receives a continuous epidural infusion of dilute local anesthetic with an opioid. Which adverse effect requires monitoring specifically related to the epidural opioid component?

- A. Hyperkalemia
- B. Hyponatremia
- C. Hyperglycemia
- D. Delayed respiratory depression, particularly with hydrophilic opioids like morphine

Question 410

Domain III - Emergence

After reversal, a patient shows signs of recurarization (recurrence of weakness). Which scenario BEST explains reversal that wears off before the relaxant?

- A. Administering neostigmine when a long-acting relaxant outlasts the duration of the reversal agent
- B. Adequate spontaneous recovery before reversal
- C. Giving too little relaxant
- D. Using sugammadex for rocuronium at an adequate dose

Question 411

Domain III - Complications

A patient develops perioperative hypothermia (core temperature 34.8 C). Which consequence is MOST directly attributable to intraoperative hypothermia?

- A. Decreased shivering-related oxygen consumption
- B. Improved coagulation
- C. Increased surgical site infection risk, coagulopathy, and prolonged drug metabolism
- D. Accelerated emergence

Question 412

Domain III - Complications

A patient at high risk for PONV is undergoing surgery. Which combination represents an appropriate multimodal antiemetic prophylaxis using agents from different classes?

- A. No prophylaxis, treating only if symptoms occur
- B. Metoclopramide alone at induction
- C. Two doses of the same 5-HT₃ antagonist
- D. A 5-HT₃ antagonist (such as ondansetron) plus dexamethasone, with consideration of a neurokinin-1 antagonist or droperidol

Question 413

Domain III - Maintenance

A CRNA administers dexamethasone at induction partly for PONV prophylaxis. Which additional consideration is relevant to its timing and effect?

- A. It has a delayed onset, so it is typically given early (near induction), and can transiently raise blood glucose
- B. It reverses neuromuscular blockade
- C. It has an immediate onset best given at the end of surgery
- D. It provides immediate bronchodilation

Question 414

Domain III - Fluid/Transfusion

A patient loses an estimated 1.5 liters of blood during surgery. Using the classification of hemorrhagic shock, an adult who has lost roughly 30 to 40 percent of blood volume with tachycardia, hypotension, and altered mental status is in which class?

- A. Class II
- B. Class I
- C. Class III
- D. Class IV

Question 415

Domain III - Monitoring Interpretation

A neuromuscular monitor demonstrates post-tetanic count (PTC) of 2 with no train-of-four response. What does this finding indicate?

- A. No neuromuscular blockade is present
- B. Adequate reversal has occurred
- C. Full recovery of neuromuscular function
- D. Deep (intense) neuromuscular blockade

DOMAIN IV: SURGICAL PROCEDURES & SPECIAL POPULATIONS

Procedure-specific anesthesia and care of special populations across the perioperative continuum. | Questions 416-540 (125 items)

Question 416

Domain IV - Pediatrics

A 3-year-old (15 kg) child presents for tonsillectomy and adenoidectomy. During mask induction with sevoflurane, he develops complete laryngospasm. SpO₂ is 78% and falling. IV access has not yet been established. What is the MOST appropriate immediate action?

- A. Discontinue sevoflurane and observe - laryngospasm resolves spontaneously
- B. Succinylcholine 60 mg IM (4 mg/kg) in the lateral thigh
- C. Atropine 0.3 mg IM to decrease secretions
- D. Nasopharyngeal airway insertion immediately

Question 417

Domain IV - Obstetrics

A parturient at 38 weeks develops severe preeclampsia with BP 172/108, headache, and visual changes. She requires urgent cesarean delivery. Which anesthetic approach is PREFERRED?

- A. General anesthesia with RSI - safer for the fetus in severe preeclampsia
- B. Neuraxial anesthesia (spinal or epidural) if platelet count is adequate and coagulopathy is absent - reduces hypertensive response to intubation
- C. General anesthesia is required because neuraxial is absolutely contraindicated in preeclampsia
- D. Ketamine induction for its sympathomimetic effects to maintain blood pressure

Question 418

Domain IV - Cardiac

A 72-year-old patient undergoes CABG on cardiopulmonary bypass (CPB). After separation from CPB, the TEE shows severe right ventricular dilation with septal flattening and tricuspid regurgitation. BP is 70/40. What is the MOST likely complication and initial treatment?

- A. Left ventricular failure - dobutamine infusion
- B. Right ventricular failure from air embolism or poor myocardial protection - milrinone + vasopressin + inhaled nitric oxide
- C. Systemic air embolism - hyperbaric oxygen
- D. Heparin rebound causing coagulopathy - protamine administration

Question 419

Domain IV - Thoracic

A patient undergoing right lower lobe lobectomy with one-lung ventilation develops SpO₂ falling to 88% despite FiO₂ 1.0 to the dependent left lung. Which intervention should be attempted FIRST?

- A. Apply CPAP 5-10 cmH₂O to the non-dependent (right, collapsed) lung
- B. Recruit the dependent lung with sustained inflation to 40 cmH₂O for 40 seconds
- C. Reduce TV to 4 mL/kg to improve V/Q ratio
- D. Administer almitrine to augment HPV

Question 420

Domain IV - Vascular

During a carotid endarterectomy (CEA) with regional cervical plexus block, the patient becomes agitated, develops contralateral arm weakness, and new dysarthria after cross-clamping of the carotid artery. What is the MOST appropriate response?

- A. Administer midazolam to treat anxiety - agitation is a common response to CEA
- B. Immediately inform the surgeon of neurologic changes consistent with carotid ischemia; prepare for shunt placement or conversion to GA
- C. Increase blood pressure with phenylephrine to improve collateral cerebral perfusion and observe for 5 minutes
- D. Immediately induce general anesthesia and place a shunt without informing the surgeon first

Question 421

Domain IV - Pediatrics

A 6-week-old former 32-week premature infant (corrected age 42 weeks) requires inguinal hernia repair. Which statement regarding postoperative management is MOST accurate?

- A. The infant can be safely discharged home same-day after a 1-hour PACU stay
- B. This infant requires inpatient monitoring for apnea for at least 12 hours post-operatively due to prematurity risk
- C. Spinal anesthesia is absolutely contraindicated in infants this age
- D. Succinylcholine is the preferred induction agent for this patient

Question 422

Domain IV - Obstetrics

A parturient at 36 weeks requires emergency cesarean delivery for placental abruption with category III fetal heart rate tracing. She has an epidural in place from labor analgesia. The epidural infusion is running with 0.0625% bupivacaine + fentanyl. Which is the FASTEST way to achieve surgical anesthesia?

- A. Remove the epidural and perform a spinal
- B. Rapid bolus epidural loading: 3% 2-chloroprocaine 15-20 mL (or 2% lidocaine + epi + bicarb)
- C. Induce general anesthesia with RSI immediately
- D. Continue labor epidural infusion - onset will be within 5 minutes

Question 423

Domain IV - Geriatrics

An 85-year-old woman with moderate dementia and multiple myeloma presents for hip fracture repair. She lives in a memory care facility. Which pharmacokinetic change is MOST clinically relevant to anesthetic dosing in this patient?

- A. Increased hepatic enzyme induction requiring higher drug doses
- B. Increased volume of distribution, decreased albumin, decreased renal and hepatic clearance - requiring dose reduction and longer intervals
- C. Decreased fat stores requiring lower lipid-soluble drug doses only
- D. Increased renal clearance due to compensation for hepatic decline

Question 424

Domain IV - Obesity

Which of the following correctly describes dosing of succinylcholine in a morbidly obese patient (TBW 140 kg, IBW 75 kg)?

- A. Dose based on ideal body weight (75 kg): succinylcholine 112 mg (1.5 mg/kg IBW)
- B. Dose based on total body weight (140 kg): succinylcholine 210 mg (1.5 mg/kg TBW)
- C. Dose based on lean body weight (LBW ~100 kg): succinylcholine 150 mg (1.5 mg/kg LBW)
- D. Use fixed dose of 200 mg regardless of weight

Question 425

Domain IV - Neurosurgery

A patient undergoes endovascular coiling of a ruptured cerebral aneurysm. During the procedure, blood pressure suddenly increases from 110/70 to 180/120 mmHg and the patient's head moves. Which complication is MOST immediately life-threatening?

- A. Pressure-induced retinal hemorrhage
- B. Aneurysm re-rupture during coiling from movement and hypertension
- C. Contrast nephropathy from the angiographic dye
- D. Vasospasm from hypertension

Question 426

Domain IV - Pediatrics

A 2-year-old child with a known history of previous difficult intubation and Pierre Robin sequence (micrognathia, glossoptosis, cleft palate) requires general anesthesia for myringotomy. Which airway management strategy is MOST appropriate?

- A. Standard inhalation induction with Macintosh laryngoscope - Pierre Robin sequence improves with age
- B. Maintain spontaneous ventilation with sevoflurane inhalation; have video laryngoscope, flexible fiberoptic scope, and LMA immediately available; intubate only if necessary
- C. Proceed with RSI - succinylcholine will relax the tongue and facilitate laryngoscopy
- D. Insert LMA first, then exchange for ETT blindly over a tube exchanger

Question 427

Domain IV - Orthopedics

During cementation of the femoral component in a total hip arthroplasty, the patient's BP drops from 120/80 to 72/44 mmHg and SpO₂ falls to 88%. Heart rate is 118. Which complication is MOST likely?

- A. Transfusion reaction from PRBCs administered 20 minutes ago
- B. Bone cement implantation syndrome (BCIS) - venous embolism of fat, marrow, and cement monomer
- C. Anaphylaxis to latex from surgical gloves
- D. Air embolism from the femoral canal

Question 428

Domain IV - Non-OR Anesthesia

A CRNA is called to provide anesthesia for electroconvulsive therapy (ECT) for a severely depressed patient on phenelzine (an MAOI). Which drug combination represents the SAFEST anesthetic for this case?

- A. Meperidine + propofol - meperidine has less MAOI interaction than other opioids
- B. Methohexital (or propofol) alone + succinylcholine; avoid all indirect sympathomimetics; have phentolamine available for hypertensive crisis
- C. Ketamine + midazolam - standard ECT combination
- D. Fentanyl + sevoflurane - provides deep enough anesthesia to prevent awareness during ECT

Question 429

Domain IV - Obstetrics

A patient at 32 weeks gestation with complete placenta previa requires urgent cesarean for antepartum hemorrhage. She has lost approximately 1500 mL of blood and is hemodynamically unstable (BP 84/52, HR 128). Which anesthetic approach is MOST appropriate?

- A. Spinal anesthesia - fastest and avoids fetal drug exposure
- B. General anesthesia with RSI - hemodynamic instability and urgency contraindicate spinal
- C. Epidural anesthesia - slower onset allows hemodynamic stabilization
- D. Local infiltration with IV ketamine sedation

Question 430

Domain IV - Trauma

A trauma patient arrives with suspected tension pneumothorax: absent breath sounds on the right, tracheal deviation to the left, distended neck veins, BP 72/40, HR 148, SpO2 not obtainable. The MOST appropriate IMMEDIATE intervention is:

- A. Chest X-ray to confirm before treatment
- B. CT scan of the chest to localize the pneumothorax
- C. Needle decompression at the 2nd intercostal space, midclavicular line, right side
- D. Immediate intubation and positive pressure ventilation

Question 431

Domain IV - Cardiac

During separation from CPB after aortic valve replacement, the patient remains hypotensive despite adequate volume loading. TEE shows a hyperdynamic LV, small end-diastolic volume, and systolic anterior motion (SAM) of the mitral valve. Which treatment is MOST appropriate?

- A. Dobutamine infusion to increase contractility
- B. Phenylephrine bolus, volume loading, discontinuation of inotropes, possible beta-blockade
- C. Vasodilator (nitroglycerin) to reduce preload
- D. Intraaortic balloon pump placement

Question 432

Domain IV - Special Populations

A 19-year-old patient with a history of sickle cell disease (HbSS) requires laparoscopic cholecystectomy for acute cholecystitis. Which perioperative consideration is MOST important?

- A. Transfuse to hematocrit >40% to prevent perioperative sickling
- B. Maintain adequate oxygenation, hydration, normothermia, and avoid acidosis and hypoxia; consider preoperative exchange transfusion targeting HbS <30%
- C. Administer hydroxyurea 500 mg preoperatively to prevent sickling during surgery
- D. Use N2O as the primary anesthetic to avoid hemoglobin binding by volatile agents

Question 433

Domain IV - Neurosurgery

A 55-year-old patient undergoes awake craniotomy for glioblastoma resection near Broca's area. During the procedure, the patient suddenly becomes agitated, develops generalized tonic-clonic seizure activity. What is the MOST appropriate immediate intervention?

- A. Administer propofol 100 mg IV to terminate the seizure
- B. Irrigate the cortical surface with cold (iced) saline to terminate cortical spreading depression
- C. Administer midazolam 2-4 mg IV; if seizure persists, add propofol in small increments; ensure airway protection
- D. Perform awake fiberoptic intubation immediately

Question 434

Domain IV - NORA

A CRNA is providing deep sedation for a 65-year-old patient undergoing radiofrequency ablation (RFA) of hepatocellular carcinoma in the interventional radiology suite. The patient has a BMI of 38 and STOP-BANG score of 5. 30 minutes into the procedure, SpO2 drops to 88% and ETCO2 rises to 65. The patient is minimally arousable. What is the MOST appropriate initial intervention?

- A. Increase supplemental oxygen to 15 L/min by face mask
- B. Stop the sedation infusion, apply jaw thrust, attempt CPAP by mask, prepare for emergent intubation if not improving
- C. Administer flumazenil to reverse the sedation
- D. Apply nasal CPAP device and increase FiO2

Question 435

Domain IV - Obstetrics

A laboring patient requests an epidural. Informed consent is obtained. After placing the epidural at L3-L4, you inject the test dose (3 mL of 1.5% lidocaine with 1:200,000 epinephrine). Within 60 seconds, the patient's heart rate increases from 78 to 102 bpm and she reports palpitations. What does this indicate?

- A. Normal sympathetic response to epidural analgesia
- B. Positive intravascular test dose - the catheter is likely in an epidural vein; do not inject further; reposition catheter
- C. Subarachnoid placement - the patient is developing a high spinal
- D. Systemic lidocaine toxicity from the test dose

Question 436

Domain IV - Vascular

A patient undergoing endovascular aortic aneurysm repair (EVAR) develops sudden onset of bilateral lower extremity flaccid paralysis immediately after stent graft deployment. Which complication has occurred and what is the treatment?

- A. Anaphylaxis to contrast dye - treat with epinephrine
- B. Spinal cord ischemia from coverage of critical segmental arteries (e.g., Adamkiewicz); treat with CSF drainage, blood pressure augmentation
- C. Peripheral arterial embolism; treat with heparin bolus
- D. Propofol infusion syndrome; treat by stopping propofol

Question 437

Domain IV - Pediatrics

A 5-year-old child (20 kg) requires emergency intubation for epiglottitis. She has stridor, drooling, and high fever. She is positioned sitting upright, leaning forward (tripod position). Which intubation approach is MOST appropriate?

- A. RSI with succinylcholine on the ER stretcher
- B. Take the child to the OR immediately; inhalation induction maintaining spontaneous ventilation, have ENT surgeon scrubbed for emergency tracheotomy, have all sizes of airway equipment available
- C. Attempt awake nasal intubation with a 4.0 ETT
- D. Immediate cricothyrotomy - epiglottitis always requires surgical airway

Question 438

Domain IV - Substance Use

A patient maintained on methadone 80 mg/day for opioid use disorder requires major abdominal surgery. Which perioperative pain management approach is MOST appropriate?

- A. Hold methadone the morning of surgery to reduce opioid load
- B. Continue methadone through surgery; add a regional technique and multimodal analgesia; if IV opioids needed, titrate full-agonist opioids to effect recognizing increased requirements
- C. Switch to buprenorphine-naloxone on admission
- D. Administer naltrexone to clear methadone before surgery

Question 439

Domain IV - Special Populations

A patient with symptomatic severe aortic stenosis (AVA 0.7 cm², gradient 68 mmHg) requires emergency bowel resection for a perforated diverticulitis. Which induction agent best preserves the hemodynamic profile needed in AS?

- A. Propofol 2 mg/kg - rapid and predictable
- B. Etomidate 0.3 mg/kg - hemodynamically stable, minimal vasodilation
- C. Ketamine 2 mg/kg - sympathomimetic effect will prevent hypotension
- D. Thiopental 4 mg/kg - potent induction with brief duration

Question 440

Domain IV - Special Populations

A CRNA is managing a patient with suspected liver failure (INR 3.2, bilirubin 12, encephalopathy grade II) requiring urgent exploratory laparotomy. Which neuromuscular blocking agent is MOST appropriate?

- A. Vecuronium - primarily renal elimination in liver failure
 - B. Rocuronium - rapid onset with sugammadex reversal available
 - C. Cisatracurium - Hofmann elimination ensures predictable duration independent of liver function
 - D. Pancuronium - vagolytic effect is beneficial in shock
- Answer Key and Detailed Rationales Each answer includes the correct letter, a detailed explanation, and rationale for why each incorrect option is wrong. Use these rationales to build deep conceptual understanding - not just to memorize answers. Quick Answer Key Q: Ans Q: Ans Q: Ans Q: Ans Q1: C Q2: B Q3: B Q4: C Q5: B Q6: A Q7: C Q8: B Q9: B Q10: B Q11: A Q12: B Q13: B Q14: B Q15: C Q16: D Q17: A Q18: B Q19: B Q20: B Q21: C Q22: B Q23: B Q24: C Q25: C Q26: B Q27: B Q28: B Q29: B Q30: B Q31: C Q32: B Q33: B Q34: D Q35: B Q36: D Q37: B Q38: C Q39: B Q40: B Q41: B Q42: B Q43: B Q44: B Q45: B Q46: B Q47: B Q48: B Q49: C Q50: B Q51: B Q52: C Q53: B Q54: B Q55: C Q56: C Q57: A Q58: B Q59: B Q60: B Q61: C Q62: B Q63: B Q64: B Q65: B Q66: B Q67: B Q68: B Q69: C Q70: C Q71: C Q72: B Q73: C Q74: B Q75: C Q76: B Q77: B Q78: B Q79: A Q80: B Q81: B Q82: B Q83: B Q84: B Q85: B Q86: B Q87: B Q88: B Q89: B Q90: C Q91: B Q92: B Q93: C Q94: B Q95: B Q96: B Q97: B Q98: B Q99: B Q100: C Detailed Answer Rationales

Question 441

Domain IV - Obstetrics

A 39-week parturient is placed supine for a scheduled cesarean delivery and rapidly becomes hypotensive and lightheaded. What is the MOST appropriate immediate intervention?

- A. Administer 100 mcg phenylephrine and continue supine
- B. Perform left uterine displacement
- C. Place the patient in reverse Trendelenburg
- D. Give a 500 mL rapid crystalloid bolus only

Question 442

Domain IV - Obstetrics

A combined spinal-epidural (CSE) technique is chosen for labor analgesia. What is the PRIMARY advantage of CSE over a standard epidural?

- A. Lower risk of postdural puncture headache
- B. Faster onset of analgesia from the intrathecal dose
- C. Elimination of the need for an epidural catheter
- D. Guaranteed absence of motor block

Question 443

Domain IV - Obstetrics

Compared with the non-pregnant state, the local anesthetic dose required to achieve a given spinal level in the term parturient is:

- A. Increased by about 30 percent
- B. Unchanged
- C. Decreased by about 70 percent
- D. Decreased by about 30 percent

Question 444

Domain IV - Obstetrics

A parturient with severe preeclampsia has a blood pressure of 170/115 mmHg. Which antihypertensive is considered a FIRST-line agent for acute control in this setting?

- A. Labetalol
- B. Nitroprusside
- C. Nicardipine only after magnesium is stopped
- D. Esmolol as sole therapy

Question 445

Domain IV - Obstetrics

A preeclamptic parturient is receiving a magnesium sulfate infusion. She becomes areflexic and her respiratory rate falls. What is the MOST appropriate treatment?

- A. Intravenous furosemide
- B. Additional magnesium bolus
- C. Intravenous calcium gluconate
- D. Sodium bicarbonate

Question 446

Domain IV - Obstetrics

The magnesium level associated with loss of deep tendon reflexes is approximately:

- A. 2 to 4 mg/dL
- B. 5 to 7 mg/dL
- C. 10 mg/dL
- D. 25 mg/dL

Question 447

Domain IV - Obstetrics

Which uterotonic is relatively CONTRAINDICATED in a parturient with reactive airway disease?

- A. Carboprost (15-methyl PGF₂-alpha)
- B. Oxytocin
- C. Methylergonovine
- D. Misoprostol

Question 448

Domain IV - Obstetrics

A parturient develops sudden hypoxemia, hypotension, and coagulopathy immediately after delivery. Which condition is MOST likely?

- A. Venous air embolism
- B. Total spinal
- C. Amniotic fluid embolism
- D. Local anesthetic systemic toxicity

Question 449

Domain IV - Obstetrics

For a nonobstetric surgery in a pregnant patient, which principle is MOST important regarding timing?

- A. Elective surgery should be delayed until after delivery when possible
- B. The first trimester is the safest time for elective surgery
- C. General anesthesia is absolutely contraindicated in pregnancy
- D. Fetal monitoring is never indicated intraoperatively

Question 450

Domain IV - Obstetrics

A pregnant patient at 34 weeks requires emergency appendectomy. To reduce aspiration risk, the anesthetic plan should include:

- A. Awake fiberoptic intubation in all cases
- B. Deep inhalational induction with spontaneous ventilation
- C. Routine use of an LMA
- D. Rapid sequence induction with cricoid pressure

Question 451

Domain IV - Obstetrics

Which physiologic change of pregnancy MOST predisposes the parturient to rapid desaturation during apnea?

- A. Increased functional residual capacity
- B. Decreased oxygen consumption
- C. Decreased functional residual capacity with increased oxygen consumption
- D. Decreased minute ventilation

Question 452

Domain IV - Obstetrics

A woman receiving an epidural infusion for labor suddenly develops a dense motor block, hypotension, and difficulty breathing within minutes of a top-up dose. The MOST likely cause is:

- A. High or total spinal from intrathecal migration
- B. Amniotic fluid embolism
- C. Eclamptic seizure
- D. Normal epidural spread

Question 453

Domain IV - Obstetrics

What is the primary reason ephedrine was historically favored over phenylephrine for maternal hypotension, and why has practice shifted?

- A. Ephedrine causes fetal alkalosis so phenylephrine replaced it
- B. Phenylephrine causes maternal tachycardia
- C. Ephedrine better preserves uterine blood flow; phenylephrine is now preferred because it causes less fetal acidosis
- D. Both drugs are contraindicated in obstetrics

Question 454

Domain IV - Pediatrics

Compared to an adult, the infant larynx is best described as:

- A. More caudad and funnel-shaped with the narrowest point at the cricoid
- B. Identical in position and shape
- C. More cephalad and funnel-shaped, classically narrowest at the cricoid
- D. Located at C6 to C7 with the narrowest point at the glottis

Question 455

Domain IV - Pediatrics

Modern practice increasingly favors cuffed endotracheal tubes in young children primarily because:

- A. They eliminate the need for correct sizing
- B. They cannot cause subglottic injury
- C. They reduce the need for tube exchanges and improve seal at low pressures
- D. They are required for all patients under 1 year

Question 456

Domain IV - Pediatrics

Using the Holliday-Segar (4-2-1) rule, the hourly maintenance fluid rate for a 22 kg child is:

- A. 42 mL/hr
- B. 62 mL/hr
- C. 22 mL/hr
- D. 82 mL/hr

Question 457

Domain IV - Pediatrics

A caudal block is planned for a child undergoing inguinal herniorrhaphy. The needle is inserted through which structure?

- A. Ligamentum flavum at L4 to L5
- B. Sacrococcygeal ligament through the sacral hiatus
- C. Supraspinous ligament at L2
- D. Posterior atlanto-occipital membrane

Question 458

Domain IV - Pediatrics

A 4-year-old awakens from sevoflurane anesthesia agitated, thrashing, and inconsolable, then returns to baseline within 20 minutes. This is MOST consistent with:

- A. Malignant hyperthermia
- B. Laryngospasm
- C. Residual neuromuscular blockade
- D. Emergence delirium

Question 459

Domain IV - Pediatrics

During neonatal resuscitation, if the heart rate remains below 60 bpm despite 30 seconds of effective positive-pressure ventilation, the next step is:

- A. Administer epinephrine immediately
- B. Administer sodium bicarbonate
- C. Withhold further intervention
- D. Begin chest compressions coordinated with ventilation

Question 460

Domain IV - Pediatrics

In a child with an uncorrected large ventricular septal defect, systemic hypotension and increased pulmonary vascular resistance can acutely:

- A. Increase left-to-right shunting
- B. Promote right-to-left shunting and cyanosis
- C. Have no effect on shunt direction
- D. Convert the lesion to an atrial septal defect

Question 461

Domain IV - Pediatrics

A neonate presents with a scaphoid abdomen, respiratory distress, and bowel sounds in the chest. Which anesthetic consideration is MOST important?

- A. Perform a deep inhalational induction with high peak pressures
- B. Avoid positive-pressure mask ventilation to prevent gastric distension
- C. Use nitrous oxide to speed induction
- D. Delay intubation until fully awake

Question 462

Domain IV - Pediatrics

Which feature makes infants more prone to bradycardia-related low cardiac output?

- A. Cardiac output that is largely rate-dependent with limited ability to increase stroke volume
- B. A highly compliant, mature ventricle
- C. High resting heart rate reserve
- D. Insensitivity to vagal stimulation

Question 463

Domain IV - Pediatrics

The most common trigger of perioperative laryngospasm in children is:

- A. Deep anesthesia
- B. Airway stimulation during light planes of anesthesia
- C. Neuromuscular blockade
- D. Hypercarbia alone

Question 464

Domain IV - Pediatrics

For a child with an active upper respiratory infection, the anesthetic concern of GREATEST relevance is:

- A. Malignant hyperthermia
- B. Delayed gastric emptying
- C. Prolonged neuromuscular blockade
- D. Increased risk of perioperative airway events such as laryngospasm and bronchospasm

Question 465

Domain IV - Pediatrics

A child undergoing strabismus surgery develops sudden sinus bradycardia during extraocular muscle traction. The MOST appropriate first response is:

- A. Immediately give epinephrine
- B. Begin chest compressions
- C. Increase the volatile agent
- D. Ask the surgeon to stop the traction

Question 466

Domain IV - Pediatrics

A 3-year-old presents for tonsillectomy with a history of loud snoring and witnessed apneas. What is the MOST important perioperative implication?

- A. Need for arterial line placement
- B. Increased sensitivity to opioids and risk of postoperative airway obstruction
- C. Mandatory awake fiberoptic intubation
- D. Contraindication to acetaminophen

Question 467

Domain IV - Cardiac

Before initiating cardiopulmonary bypass, the target activated clotting time (ACT) after heparinization is typically:

- A. Greater than 120 seconds
- B. Between 150 and 200 seconds
- C. Less than 100 seconds
- D. Greater than 400 to 480 seconds

Question 468

Domain IV - Cardiac

Protamine is administered after separation from bypass. A rapid protamine infusion is MOST associated with which adverse reaction?

- A. Sustained hypertension
- B. Systemic hypotension from histamine and vasodilation
- C. Bradycardia unresponsive to treatment
- D. Hyperkalemia

Question 469

Domain IV - Cardiac

An intra-aortic balloon pump inflates during which phase of the cardiac cycle?

- A. Systole, to increase afterload
- B. Continuously throughout the cycle
- C. Only during isovolumetric contraction
- D. Diastole, to augment coronary perfusion

Question 470

Domain IV - Cardiac

The anesthetic hemodynamic goals for a patient with severe aortic stenosis include:

- A. Promote tachycardia and low afterload
- B. Maintain sinus rhythm, adequate preload, and normal-to-high afterload; avoid tachycardia
- C. Aggressively reduce preload
- D. Encourage bradycardia below 40 bpm

Question 471

Domain IV - Cardiac

The hemodynamic goals for chronic severe aortic regurgitation are best summarized as:

- A. Full, fast, and forward (adequate preload, slightly increased heart rate, reduced afterload)
- B. Slow and tight (bradycardia and high afterload)
- C. Empty and slow
- D. High afterload with bradycardia

Question 472

Domain IV - Cardiac

Off-pump coronary artery bypass (OPCAB) differs from conventional CABG primarily because:

- A. It always requires deep hypothermic circulatory arrest
- B. The heart continues to beat while grafts are placed, avoiding cardiopulmonary bypass
- C. It eliminates the need for anticoagulation
- D. It cannot be converted to on-pump surgery

Question 473

Domain IV - Cardiac

The hemodynamic goals for severe mitral stenosis emphasize:

- A. Promoting tachycardia to improve output
- B. Aggressive afterload reduction
- C. Avoiding tachycardia and maintaining preload and sinus rhythm
- D. Diuresis to a low preload state

Question 474

Domain IV - Cardiac

During weaning from cardiopulmonary bypass, a low mixed venous oxygen saturation with rising lactate MOST likely indicates:

- A. Excellent tissue perfusion
- B. Hyperoxia
- C. Inadequate oxygen delivery or low cardiac output
- D. Hypothermia only

Question 475

Domain IV - Cardiac

Heparin resistance during preparation for CPB (failure to reach target ACT despite adequate dosing) is MOST often due to:

- A. Excess platelet count
- B. Hypercalcemia
- C. Antithrombin III deficiency
- D. Hyperfibrinogenemia unrelated to heparin

Question 476

Domain IV - Neuro

Which intervention MOST rapidly lowers intracranial pressure intraoperatively?

- A. Administration of a volatile anesthetic at high MAC
- B. Hyperventilation to reduce PaCO₂
- C. Trendelenburg positioning
- D. Aggressive intravenous fluid loading

Question 477

Domain IV - Neuro

A patient in the sitting position for posterior fossa surgery develops a sudden drop in end-tidal CO₂, hypotension, and a mill-wheel murmur. The MOST likely cause is:

- A. Malignant hyperthermia
- B. Pulmonary edema
- C. Anaphylaxis
- D. Venous air embolism

Question 478

Domain IV - Neuro

Which anesthetic technique BEST preserves motor evoked potential monitoring during spine surgery?

- A. High-dose volatile anesthetic with neuromuscular blockade
- B. Nitrous oxide at high concentration
- C. Total intravenous anesthesia (propofol plus opioid) avoiding muscle relaxants during monitoring
- D. Deep isoflurane with boluses of rocuronium

Question 479

Domain IV - Neuro

During carotid endarterectomy under general anesthesia, cerebral perfusion during carotid cross-clamping is commonly assessed by:

- A. End-tidal nitrogen
- B. Peripheral nerve stimulation
- C. Bispectral index alone as a perfusion monitor
- D. EEG or processed EEG, stump pressure, or somatosensory evoked potentials

Question 480

Domain IV - Neuro

The relationship between PaCO₂ and cerebral blood flow within the physiologic range is approximately:

- A. Cerebral blood flow changes about 1 to 2 mL/100g/min per 1 mmHg change in PaCO₂
- B. Cerebral blood flow is independent of PaCO₂
- C. Cerebral blood flow falls as PaCO₂ rises
- D. Only extreme PaCO₂ values affect cerebral blood flow

Question 481

Domain IV - Neuro

In managing a patient with elevated intracranial pressure, an appropriate cerebral perfusion pressure goal is generally:

- A. Below 30 mmHg
- B. At least 60 mmHg (CPP = MAP minus ICP)
- C. Exactly equal to ICP
- D. Independent of mean arterial pressure

Question 482

Domain IV - Neuro

Which agent is generally preferred to reduce brain bulk and ICP through an osmotic effect?

- A. Mannitol
- B. Dextrose 5 percent in water
- C. Hypotonic saline
- D. Albumin as an osmotic diuretic

Question 483

Domain IV - Neuro

A patient with an acute traumatic brain injury should generally avoid which ventilation strategy?

- A. Maintaining normocapnia
- B. Routine prophylactic aggressive hypocapnia (PaCO₂ well below 30 mmHg)
- C. Adequate oxygenation
- D. Avoiding hypoxemia

Question 484

Domain IV - Neuro

Volatile anesthetics affect cerebral physiology by:

- A. Reducing cerebral blood flow at all doses
- B. Causing dose-dependent cerebral vasodilation and uncoupling flow from metabolism at higher doses
- C. Having no effect on cerebral blood flow
- D. Increasing cerebral metabolic rate

Question 485

Domain IV - Thoracic

During one-lung ventilation, hypoxic pulmonary vasoconstriction (HPV) serves to:

- A. Divert blood flow away from the nonventilated lung to reduce shunt
- B. Increase blood flow to the collapsed lung
- C. Cause systemic vasodilation
- D. Improve ventilation of the dependent lung

Question 486

Domain IV - Thoracic

A left-sided double-lumen tube is placed for a right thoracotomy. Correct positioning is BEST confirmed by:

- A. Chest radiograph alone
- B. Capnography waveform shape
- C. Fiberoptic bronchoscopy visualizing the bronchial cuff just below the carina in the left mainstem
- D. Absence of a leak at 40 cmH₂O

Question 487

Domain IV - Thoracic

Which factor is MOST likely to inhibit hypoxic pulmonary vasoconstriction during one-lung ventilation?

- A. Mild hypercapnia
- B. Adequate cardiac output
- C. High concentrations of volatile anesthetic and vasodilators like nitroglycerin
- D. Normal mixed venous oxygen tension

Question 488

Domain IV - Thoracic

If severe hypoxemia occurs during one-lung ventilation, an early corrective step is:

- A. Immediately abort surgery
- B. Deepen anesthesia with high-dose volatile agent
- C. Apply CPAP to the nondependent (nonventilated) lung and/or PEEP to the dependent lung
- D. Discontinue all oxygen

Question 489

Domain IV - Thoracic

A bronchial blocker is chosen instead of a double-lumen tube MOST appropriately when:

- A. The patient has a difficult airway or an existing single-lumen tube that should not be exchanged
- B. Rapid deflation and suctioning of the operative lung is the top priority
- C. Selective lobar isolation is impossible
- D. The patient is a small child requiring a 41 Fr tube

Question 490

Domain IV - Thoracic

After lung resection, which postoperative complication is a leading cause of morbidity and warrants vigilant fluid management?

- A. Malignant hyperthermia
- B. Acute lung injury/post-pneumonectomy pulmonary edema
- C. Delayed emergence from opioids only
- D. Corneal abrasion

Question 491

Domain IV - Vascular

During open abdominal aortic aneurysm repair, application of a supraceliac aortic cross-clamp causes:

- A. A fall in systemic vascular resistance
- B. Immediate hypotension distal and proximal
- C. No hemodynamic change
- D. A marked increase in afterload and proximal hypertension with risk of myocardial and organ ischemia

Question 492

Domain IV - Vascular

Release of an aortic cross-clamp (declamping) typically produces:

- A. Sustained hypertension
- B. Hypotension from reactive hyperemia, venous pooling, and washout of vasoactive metabolites
- C. Bradycardia with hypertension
- D. No metabolic consequences

Question 493

Domain IV - Vascular

During thoracoabdominal aortic aneurysm repair, spinal cord ischemia is a feared complication. Which strategy helps reduce this risk?

- A. Lumbar cerebrospinal fluid drainage to improve spinal cord perfusion pressure
- B. Deliberate hypotension throughout
- C. Routine hyperventilation
- D. Avoiding all monitoring of neurologic function

Question 494

Domain IV - Vascular

Carotid endarterectomy performed under regional (cervical plexus) block offers which advantage?

- A. Elimination of shunt use
- B. No need for blood pressure control
- C. Continuous awake neurologic assessment as a monitor of cerebral perfusion during cross-clamping
- D. Guaranteed avoidance of stroke

Question 495

Domain IV - Vascular

Endovascular aneurysm repair (EVAR) compared with open AAA repair is associated with:

- A. Less physiologic stress and shorter recovery, but risk of endoleak requiring surveillance
- B. Higher intraoperative blood loss
- C. Mandatory aortic cross-clamping
- D. No need for imaging follow-up

Question 496

Domain IV - Vascular

A patient develops profound hypotension immediately after supraceliac cross-clamp release. The FIRST priority is:

- A. Deepen anesthesia rapidly
- B. Slow or partial reclamping and volume/vasopressor support while restoring perfusion gradually
- C. Administer a beta-blocker
- D. Induce hyperventilation

Question 497

Domain IV - Trauma

According to ATLS priorities, the FIRST step in the primary survey of a trauma patient is:

- A. Circulation
- B. Disability assessment
- C. Airway with cervical spine protection
- D. Exposure

Question 498

Domain IV - Trauma

Every acute trauma patient requiring emergency surgery should be treated as though they have:

- A. No aspiration risk
- B. A confirmed empty stomach if they last ate 6 hours ago
- C. A full stomach, warranting rapid sequence induction
- D. No need for airway precautions

Question 499

Domain IV - Trauma

During intubation of a trauma patient with a suspected cervical spine injury, the recommended technique includes:

- A. Manual in-line stabilization with minimal neck movement
- B. Maximal neck extension for best view
- C. Removing the collar and hyperflexing the neck
- D. Avoiding intubation entirely

Question 500

Domain IV - Trauma

Damage control resuscitation for severe hemorrhagic shock emphasizes:

- A. Large-volume crystalloid as the primary resuscitation fluid
- B. Delaying blood products until laboratory results return
- C. Balanced transfusion of red cells, plasma, and platelets with permissive hypotension until hemorrhage control
- D. Aggressive normalization of blood pressure before surgical control

Question 501

Domain IV - Trauma

A trauma patient develops the lethal triad. This triad consists of:

- A. Hypothermia, acidosis, and coagulopathy
- B. Hypertension, bradycardia, and irregular respiration
- C. Fever, tachycardia, and hypotension
- D. Hyperkalemia, hypocalcemia, and hyperglycemia

Question 502

Domain IV - Trauma

Rapid transfusion of large volumes of citrated blood products can cause which acute electrolyte disturbance requiring monitoring?

- A. Ionized hypocalcemia from citrate binding
- B. Hypernatremia
- C. Hypophosphatemia as the primary concern
- D. Hyperchloremia only

Question 503

Domain IV - Trauma

A hypotensive trauma patient with distended neck veins, muffled heart sounds, and hypotension MOST likely has:

- A. Cardiac tamponade
- B. Simple pneumothorax
- C. Isolated femur fracture
- D. Neurogenic shock

Question 504

Domain IV - Obesity/Bariatric

The single most effective positioning strategy to optimize airway management and oxygenation in a patient with severe obesity is:

- A. Flat supine position
- B. Trendelenburg position
- C. Ramped (head-elevated) position aligning the ear with the sternal notch
- D. Prone position for induction

Question 505

Domain IV - Obesity/Bariatric

For a patient with severe obesity, which drug is MOST appropriately dosed by LEAN body weight rather than total body weight?

- A. Succinylcholine
- B. Neostigmine at doses ignoring weight
- C. Local anesthetic for infiltration only
- D. Propofol induction dose (and many other agents)

Question 506

Domain IV - Obesity/Bariatric

Patients with obstructive sleep apnea are especially sensitive to which class of perioperative medications?

- A. Opioids and sedatives, due to heightened risk of airway obstruction and respiratory depression
- B. Antibiotics
- C. Antiemetics
- D. Local anesthetics

Question 507

Domain IV - Obesity/Bariatric

Why do patients with severe obesity desaturate quickly during apnea despite adequate preoxygenation?

- A. Increased functional residual capacity
- B. Decreased metabolic rate
- C. Increased chest wall compliance
- D. Reduced functional residual capacity combined with increased oxygen consumption

Question 508

Domain IV - Obesity/Bariatric

Which regional/ventilation strategy helps counteract atelectasis during general anesthesia in patients with obesity?

- A. Zero PEEP with low tidal volumes only
- B. Application of PEEP and recruitment maneuvers
- C. Prolonged apnea to allow lung rest
- D. Permissive hypoxemia

Question 509

Domain IV - Obesity/Bariatric

After bariatric surgery involving gastric restriction, a key postoperative anesthetic-related concern is:

- A. Guaranteed absence of aspiration risk
- B. No need for DVT prophylaxis
- C. Routine deep neuromuscular blockade postoperatively
- D. Respiratory compromise and the need for careful analgesia due to OSA and reduced pulmonary reserve

Question 510

Domain IV - Obesity/Bariatric

When calculating tidal volume for lung-protective ventilation in a patient with obesity, tidal volume should be based on:

- A. Ideal (predicted) body weight
- B. Total body weight
- C. Adjusted body weight plus 50 percent
- D. Lean body weight doubled

Question 511

Domain IV - Geriatrics

With advancing age, the minimum alveolar concentration (MAC) of volatile anesthetics:

- A. Decreases by roughly 6 percent per decade after age 40
- B. Increases with age
- C. Remains constant throughout life
- D. Doubles by age 80

Question 512

Domain IV - Geriatrics

A major reason elderly patients are prone to drug accumulation and prolonged effects is:

- A. Increased total body water
- B. Increased lean muscle mass
- C. Enhanced protein binding of all drugs
- D. Reduced hepatic and renal clearance with altered body composition

Question 513

Domain IV - Geriatrics

Which perioperative complication is notably common in elderly surgical patients and associated with poorer outcomes?

- A. Malignant hyperthermia
- B. Emergence agitation identical to pediatric patients
- C. Postoperative delirium
- D. Pseudocholinesterase deficiency

Question 514

Domain IV - Geriatrics

Which medication is generally best AVOIDED or minimized in elderly patients due to delirium risk?

- A. Acetaminophen
- B. Regional local anesthetics
- C. Supplemental oxygen
- D. Benzodiazepines and anticholinergics such as scopolamine

Question 515

Domain IV - Geriatrics

Age-related cardiovascular changes make the elderly patient MOST sensitive to which intraoperative event?

- A. Mild hypercapnia
- B. Small changes in body temperature only
- C. Hypotension, due to reduced baroreceptor responsiveness and diastolic dysfunction
- D. Transient tachycardia with no consequence

Question 516

Domain IV - Geriatrics

Reduced pulmonary reserve in the elderly is characterized by:

- A. Increased elastic recoil and improved gas exchange
- B. Enhanced ventilatory drive
- C. Decreased residual volume
- D. Increased closing capacity, reduced chest wall compliance, and blunted response to hypoxia and hypercapnia

Question 517

Domain IV - Geriatrics

Polypharmacy in elderly surgical patients is important to review primarily because:

- A. It guarantees drug tolerance
- B. Drug interactions and additive effects can increase perioperative risk
- C. It reduces anesthetic requirements to zero
- D. It has no bearing on anesthesia

Question 518

Domain IV - Orthopedics

A pneumatic tourniquet is used for a lower-extremity procedure. Prolonged inflation beyond about 2 hours increases the risk of:

- A. Fat embolism from the cuff
- B. Immediate hyperkalemia during inflation
- C. Nerve injury and ischemic muscle damage distal to the cuff
- D. Hypothermia in the limb

Question 519

Domain IV - Orthopedics

Immediately after tourniquet deflation, the anesthetist should anticipate:

- A. Sudden hypertension and bradycardia
- B. An immediate rise in core temperature of 2 degrees
- C. No systemic change
- D. A transient rise in end-tidal CO₂ and potassium with possible hypotension

Question 520

Domain IV - Orthopedics

During intramedullary reaming and prosthesis insertion for a hip fracture, a patient suddenly develops hypoxemia, hypotension, and a petechial rash. The MOST likely diagnosis is:

- A. Anaphylaxis to cement
- B. Transfusion reaction
- C. Local anesthetic toxicity
- D. Fat embolism syndrome

Question 521

Domain IV - Orthopedics

Bone cement implantation syndrome during cemented arthroplasty is characterized by:

- A. Isolated hypertension
- B. Bradycardia with hypertension only
- C. Hypotension, hypoxemia, and possible cardiac arrest during cementing and prosthesis insertion
- D. A slow rise in temperature over hours

Question 522

Domain IV - Orthopedics

A patient in the beach chair position for shoulder surgery is at particular risk for cerebral hypoperfusion because:

- A. The head is below the heart
- B. Blood pressure measured at the arm overestimates cerebral perfusion pressure due to the hydrostatic gradient
- C. Venous return is maximized
- D. Cerebral autoregulation is enhanced in this position

Question 523

Domain IV - Orthopedics

Regional anesthesia (neuraxial) for total hip or knee arthroplasty offers which benefit compared with general anesthesia?

- A. Higher rates of aspiration
- B. Reduced blood loss and lower risk of venous thromboembolism
- C. Increased need for opioids
- D. Guaranteed avoidance of hypotension

Question 524

Domain IV - ENT

The defining feature of anesthesia for airway (ENT) surgery such as laryngoscopy is:

- A. No risk of airway fire
- B. Absence of any need for muscle relaxation
- C. Routine use of nasal cannula alone
- D. A shared airway requiring close coordination between surgeon and anesthetist

Question 525

Domain IV - ENT

To reduce the risk of airway fire during laser surgery of the airway, the anesthetist should:

- A. Maximize FiO₂ to 100 percent
- B. Add nitrous oxide to reduce combustion
- C. Use a standard PVC tube with the cuff inflated with air
- D. Use the lowest effective FiO₂, avoid nitrous oxide, and use a laser-resistant endotracheal tube

Question 526

Domain IV - ENT

Jet ventilation for laryngeal surgery relies on which principle to deliver oxygen and remove CO₂?

- A. High-pressure oxygen jets entraining ambient air (Venturi effect) into the airway
- B. Continuous positive pressure through a sealed cuff
- C. Passive diffusion only
- D. Negative pressure generated by the patient

Question 527

Domain IV - ENT

After a difficult tonsillectomy, a child returns to the OR with tachycardia, pallor, and frequent swallowing. This presentation MOST suggests:

- A. Emergence delirium
- B. Malignant hyperthermia
- C. Post-tonsillectomy hemorrhage with a likely full stomach of blood
- D. Simple postoperative nausea

Question 528

Domain IV - ENT

For functional endoscopic sinus surgery, a technique to reduce bleeding and improve the surgical field includes:

- A. Steep Trendelenburg positioning
- B. Deliberate hypertension
- C. Maximizing venous pressure
- D. Head-up positioning and controlled relative hypotension with total intravenous anesthesia

Question 529

Domain IV - ENT

A patient scheduled for microlaryngeal surgery requires an endotracheal tube that is:

- A. Small-diameter (microlaryngeal) to optimize the surgeon's view while maintaining ventilation
- B. The largest possible internal diameter
- C. A double-lumen tube
- D. An uncuffed nasal RAE only

Question 530

Domain IV - Hepatic/Renal disease

Which neuromuscular blocking agent is LEAST affected by renal or hepatic dysfunction, making it useful in these patients?

- A. Pancuronium
- B. Rocuronium at high dose
- C. Cisatracurium, due to Hofmann elimination
- D. Vecuronium in renal failure

Question 531

Domain IV - Hepatic/Renal disease

In a patient with end-stage renal disease, which anesthetic consideration is MOST important?

- A. Routine use of nephrotoxic contrast
- B. Aggressive potassium supplementation
- C. Ignoring timing of dialysis
- D. Avoiding potassium-releasing drugs and monitoring for hyperkalemia and volume status

Question 532

Domain IV - Hepatic/Renal disease

Patients with advanced liver disease commonly have altered pharmacology because of:

- A. Reduced hepatic metabolism, decreased protein synthesis, and increased volume of distribution
- B. Increased plasma albumin
- C. Enhanced clotting factor production
- D. Reduced volume of distribution for all drugs

Question 533

Domain IV - Hepatic/Renal disease

Which volatile anesthetic is generally preferred in patients with hepatic disease because it best preserves hepatic blood flow?

- A. Sevoflurane or isoflurane
- B. Halothane
- C. Methoxyflurane
- D. Diethyl ether

Question 534

Domain IV - Hepatic/Renal disease

Which analgesic requires particular caution in renal failure due to accumulation of an active, neurotoxic metabolite?

- A. Fentanyl
- B. Morphine (accumulation of morphine-6-glucuronide)
- C. Remifentanyl
- D. Acetaminophen at standard dose

Question 535

Domain IV - Hepatic/Renal disease

Hepatorenal syndrome in a patient with cirrhosis is best described as:

- A. Primary glomerulonephritis
- B. Functional renal failure from severe hepatic dysfunction and splanchnic vasodilation, with structurally normal kidneys
- C. Obstructive uropathy
- D. Acute tubular necrosis from contrast only

Question 536

Domain IV - Endocrine surgery

Preoperative preparation for resection of a pheochromocytoma should FIRST include:

- A. Beta-blockade alone
- B. Alpha-adrenergic blockade before adding beta-blockade
- C. No pharmacologic preparation
- D. Immediate beta-blockade without alpha blockade

Question 537

Domain IV - Endocrine surgery

During pheochromocytoma resection, the moment of GREATEST hemodynamic instability toward hypotension is typically:

- A. During skin incision
- B. During preoxygenation
- C. On emergence only
- D. Immediately after ligation of the tumor's venous drainage

Question 538

Domain IV - Endocrine surgery

A patient develops carcinoid crisis intraoperatively. The MOST appropriate specific treatment is:

- A. Octreotide (somatostatin analog)
- B. High-dose epinephrine
- C. Beta-agonist infusion
- D. Calcium channel blocker as first-line

Question 539

Domain IV - Endocrine surgery

Thyroid storm during or after thyroid surgery is treated with which combination?

- A. Beta-blockade, antithyroid drugs, cooling, and supportive care
- B. Thyroid hormone replacement
- C. Warming and atropine
- D. Withholding all medications

Question 540

Domain IV - Endocrine surgery

A recognized complication after total thyroidectomy that can cause acute airway compromise is:

- A. Hyperglycemia
- B. Malignant hyperthermia
- C. Deep vein thrombosis of the arm
- D. Neck hematoma or bilateral recurrent laryngeal nerve injury

ANSWER KEY AND RATIONALES

Detailed Explanations

Quick reference key for all 540 items, followed by full rationales and distractor notes.

Quick Answer Key

1. C	2. B	3. B	4. C	5. B	6. A
7. C	8. B	9. B	10. B	11. A	12. B
13. B	14. B	15. C	16. D	17. A	18. B
19. B	20. B	21. B	22. B	23. D	24. A
25. C	26. C	27. A	28. C	29. A	30. D
31. C	32. A	33. C	34. C	35. C	36. B
37. B	38. D	39. D	40. B	41. B	42. A
43. B	44. D	45. D	46. B	47. D	48. B
49. D	50. B	51. A	52. B	53. C	54. C
55. C	56. B	57. D	58. C	59. D	60. A
61. B	62. A	63. B	64. B	65. A	66. C
67. C	68. C	69. A	70. B	71. D	72. B
73. A	74. C	75. A	76. B	77. C	78. C
79. A	80. C	81. A	82. A	83. A	84. C
85. D	86. A	87. D	88. B	89. D	90. A
91. A	92. D	93. C	94. D	95. C	96. D
97. B	98. C	99. D	100. D	101. C	102. B
103. B	104. D	105. D	106. A	107. C	108. D
109. A	110. C	111. D	112. A	113. A	114. B
115. B	116. B	117. D	118. A	119. A	120. D
121. C	122. B	123. B	124. C	125. C	126. B
127. B	128. B	129. B	130. B	131. C	132. B
133. B	134. D	135. B	136. D	137. B	138. C
139. B	140. B	141. B	142. B	143. D	144. A
145. C	146. C	147. A	148. C	149. A	150. D
151. C	152. A	153. C	154. C	155. C	156. B
157. B	158. D	159. D	160. B	161. B	162. A
163. B	164. D	165. D	166. B	167. D	168. B
169. D	170. B	171. A	172. B	173. C	174. C
175. C	176. B	177. D	178. C	179. D	180. A
181. B	182. A	183. B	184. B	185. A	186. C
187. C	188. C	189. A	190. B	191. D	192. B
193. A	194. C	195. A	196. B	197. C	198. C
199. A	200. C	201. A	202. A	203. A	204. C

205. D	206. A	207. D	208. B	209. D	210. A
211. A	212. D	213. C	214. D	215. C	216. D
217. B	218. C	219. D	220. D	221. C	222. B
223. B	224. D	225. D	226. A	227. C	228. D
229. A	230. C	231. D	232. A	233. A	234. B
235. B	236. B	237. D	238. A	239. A	240. D
241. B	242. B	243. B	244. B	245. B	246. B
247. B	248. B	249. C	250. B	251. B	252. C
253. B	254. B	255. C	256. C	257. A	258. B
259. B	260. B	261. C	262. B	263. B	264. B
265. B	266. B	267. B	268. B	269. C	270. C
271. C	272. B	273. C	274. B	275. C	276. C
277. C	278. C	279. D	280. A	281. C	282. C
283. B	284. C	285. D	286. B	287. B	288. D
289. C	290. C	291. D	292. B	293. B	294. C
295. C	296. D	297. A	298. A	299. A	300. C
301. B	302. B	303. B	304. D	305. C	306. D
307. B	308. C	309. D	310. A	311. C	312. D
313. D	314. D	315. C	316. C	317. B	318. C
319. A	320. B	321. C	322. A	323. B	324. A
325. A	326. B	327. D	328. B	329. A	330. B
331. D	332. C	333. D	334. B	335. D	336. A
337. C	338. A	339. A	340. B	341. D	342. B
343. D	344. A	345. B	346. B	347. C	348. A
349. D	350. A	351. B	352. C	353. A	354. D
355. B	356. C	357. B	358. D	359. D	360. B
361. B	362. C	363. C	364. B	365. C	366. A
367. A	368. A	369. A	370. A	371. D	372. C
373. B	374. B	375. C	376. D	377. D	378. A
379. D	380. D	381. B	382. A	383. C	384. D
385. A	386. B	387. A	388. D	389. A	390. B
391. A	392. B	393. D	394. C	395. C	396. D
397. A	398. A	399. A	400. A	401. C	402. D
403. B	404. A	405. C	406. B	407. B	408. D
409. D	410. A	411. C	412. D	413. A	414. C
415. D	416. B	417. B	418. B	419. A	420. B
421. B	422. B	423. B	424. B	425. B	426. B
427. B	428. B	429. B	430. C	431. B	432. B
433. C	434. B	435. B	436. B	437. B	438. B

439. B	440. C	441. B	442. B	443. D	444. A
445. C	446. C	447. A	448. C	449. A	450. D
451. C	452. A	453. C	454. C	455. C	456. B
457. B	458. D	459. D	460. B	461. B	462. A
463. B	464. D	465. D	466. B	467. D	468. B
469. D	470. B	471. A	472. B	473. C	474. C
475. C	476. B	477. D	478. C	479. D	480. A
481. B	482. A	483. B	484. B	485. A	486. C
487. C	488. C	489. A	490. B	491. D	492. B
493. A	494. C	495. A	496. B	497. C	498. C
499. A	500. C	501. A	502. A	503. A	504. C
505. D	506. A	507. D	508. B	509. D	510. A
511. A	512. D	513. C	514. D	515. C	516. D
517. B	518. C	519. D	520. D	521. C	522. B
523. B	524. D	525. D	526. A	527. C	528. D
529. A	530. C	531. D	532. A	533. A	534. B
535. B	536. B	537. D	538. A	539. A	540. D

Full Rationales

DOMAIN I: BASIC SCIENCES

Question 1 • Correct Answer: C

A 68-year-old patient with end-stage renal disease receives rocuronium 0.6 mg/kg for intubation. The patient remains in the OR for 4 hours. Which...

Rocuronium is primarily excreted by the liver, but in ESRD the drug-sugammadex complex accumulates and may cause rocuronium re-release (recurarization). Despite this, sugammadex is still strongly preferred over neostigmine in ESRD because sugammadex provides complete, quantifiable reversal. Use 4 mg/kg if reversal is needed at shallow block depth, and monitor with TOF for re-curarization. Neostigmine is less reliable and risks incomplete reversal.

Why the other choices are less appropriate:

- A. Neostigmine + glycopyrrolate is reasonable for routine reversal but is inferior to sugammadex in ESRD.
- B. 2 mg/kg is the correct dose for T2 reappearance, but 4 mg/kg provides more complete reversal given prolonged block in ESRD.
- D. Glycopyrrolate does not need to be avoided in renal failure; it is the preferred anticholinergic with neostigmine.

Question 2 • Correct Answer: B

A CRNA administers bupivacaine 0.5% epidurally and the patient develops sudden cardiovascular collapse with a wide-complex dysrhythmia. Which...

This presentation is classic for Local Anesthetic Systemic Toxicity (LAST) from bupivacaine, the most cardiotoxic local anesthetic. Bupivacaine causes 'fast-in, slow-out' sodium channel blockade in the myocardium. The treatment of choice is Intralipid 20% (lipid emulsion therapy): 1.5 mL/kg IV bolus followed by 0.25 mL/kg/min infusion. This creates a lipid sink that sequesters bupivacaine. Concurrent CPR must continue.

Why the other choices are less appropriate:

- A. Defibrillation may be needed but is not the primary treatment - lipid emulsion is the critical intervention.
- C. Sodium bicarb can help alkalinize plasma and reduce drug binding but is not the first-line treatment for LAST.
- D. Amiodarone is NOT recommended in LAST - it inhibits Na⁺ channels and may worsen toxicity.

Question 3 · Correct Answer: B

During one-lung ventilation in the left lateral decubitus position, a patient develops significant hypoxemia. The non-dependent (right, operative)...

Hypoxic pulmonary vasoconstriction (HPV) is the primary physiologic mechanism that compensates for V/Q mismatch during one-lung ventilation. When the non-dependent lung is deflated (alveolar hypoxia), HPV causes vasoconstriction of pulmonary vessels in that lung, diverting blood flow to the dependent, ventilated lung. Volatile anesthetic agents, calcium channel blockers, and nitrates blunt HPV and worsen hypoxemia.

Why the other choices are less appropriate:

- A. Cardiac output changes are not the primary compensatory mechanism.
- C. Increasing TV in the dependent lung can help oxygenation but is a therapeutic intervention, not an automatic physiologic response.
- D. There is no reflex bronchodilation in a deflated lung.

Question 4 · Correct Answer: C

A CRNA is administering sevoflurane 2% with a fresh gas flow of 1 L/min. After 45 minutes, the CO₂ absorbent becomes desiccated. Which MOST...

Desiccated CO₂ absorbents (especially those containing strong bases like NaOH or KOH, such as old soda lime) react with volatile anesthetics to produce carbon monoxide. Desflurane and isoflurane produce the most CO with desiccated soda lime; sevoflurane produces less CO but more Compound A. However, carbon monoxide is the most immediately life-threatening product and the most dangerous in this scenario. Compound A (nephrotoxic) is produced by sevoflurane with non-desiccated soda lime at low flows.

Why the other choices are less appropriate:

- A. CO₂ is produced in normal metabolism and absorbed normally.
- B. Compound A is produced by sevoflurane + soda lime, but at low concentrations and requires very low flow rates.
- D. Hydrogen fluoride can form from sevoflurane degradation but is not the primary danger with desiccated absorbent.

Question 5 · Correct Answer: B

A 72-year-old man with a known PFO (patent foramen ovale) is undergoing posterior fossa craniotomy in the sitting position. During the procedure,...

Venous air embolism (VAE) is occurring. In a patient with a PFO, air that enters the venous system can cross from the right atrium to the left atrium (paradoxical embolism) - particularly when right atrial pressure exceeds left atrial pressure. This can cause arterial air embolism with stroke, myocardial infarction from coronary air embolism, or other end-organ ischemia. This is the unique and most dangerous complication of VAE specifically in patients with intracardiac shunts.

Why the other choices are less appropriate:

- A. Increased ICP is not caused by VAE directly.
- C. Tension pneumothorax presents with decreased breath sounds, tracheal deviation, and no mill-wheel murmur.
- D. Air introduced through an arterial line would be arterial embolism from a different source.

Question 6 · Correct Answer: A

Which of the following correctly describes the mechanism of action of succinylcholine-induced hyperkalemia and which patients are at HIGHEST risk?

Succinylcholine causes depolarization of ALL acetylcholine receptors. In normal patients, this releases a small amount of potassium (~0.5-1 mEq/L increase). However, in patients with upregulation of extrajunctional (immature) nicotinic receptors - which occurs after >72 hours post-burn, denervation, prolonged immobilization, crush injury, or severe infection - massive potassium efflux can cause fatal hyperkalemia (K⁺ up to 10-14 mEq/L). The 72-hour rule for burns is critical: succinylcholine is safe in the acute burn (<72h) but contraindicated after that window.

Why the other choices are less appropriate:

- B. Succinylcholine does not act on the Na/K ATPase.
- C. Succinylcholine is an agonist, not an antagonist, at nicotinic receptors.
- D. Phase II block occurs with repeated dosing or infusions and does not cause hyperkalemia.

Question 7 • Correct Answer: C

A patient with hypertrophic obstructive cardiomyopathy (HOCM) develops sudden severe hypotension during induction with propofol. Which vasopressor...

HOCM obstruction worsens with: (1) decreased preload, (2) decreased afterload, (3) increased HR, and (4) increased contractility. Propofol causes vasodilation (decreased afterload and preload), dramatically worsening LVOT obstruction. Phenylephrine is the ideal vasopressor - it is a pure alpha-1 agonist that increases SVR (afterload) without increasing HR or contractility, which would worsen obstruction. Reflex bradycardia from phenylephrine is actually beneficial in HOCM.

Why the other choices are less appropriate:

- A. Dopamine at 5 mcg/kg/min has both beta and alpha effects - the beta effects increase HR and contractility, worsening obstruction.
- B. Epinephrine increases HR and contractility significantly - contraindicated in HOCM hypotension.
- D. Dobutamine increases contractility and reduces afterload - both worsen HOCM obstruction.

Question 8 • Correct Answer: B

A CRNA is planning to use desflurane for a 2-hour abdominal case. The CRNA notices the vaporizer temperature display is not illuminated and the...

Desflurane has a boiling point of 22.8 degrees C - it would vaporize unpredictably at room temperature in a standard vaporizer. Therefore, desflurane requires a heated, pressurized vaporizer (Tec 6 or equivalent) that maintains the agent at approximately 39 degrees C. The system must complete its warm-up cycle before it allows gas delivery. If the heating element has not reached operating temperature, the vaporizer will display a warning and will not allow delivery - this is a safety feature, not a malfunction.

Why the other choices are less appropriate:

- A. A low desflurane level would trigger a low-agent alarm, not prevent warm-up display.
- C. O₂ pipeline pressure affects flowmeters but does not prevent vaporizer warm-up.
- D. Tilting applies to halogenated vaporizers like isoflurane/sevoflurane - desflurane Tec 6 is not affected by tilting in the same way, and the warm-up issue is more likely.

Question 9 • Correct Answer: B

A patient is receiving a remifentanil infusion at 0.2 mcg/kg/min for a 4-hour spine surgery. What is the PRIMARY concern during emergence from...

Remifentanil undergoes rapid ester hydrolysis with a context-sensitive half-time of 3-5 minutes regardless of infusion duration - it does NOT accumulate. However, the rapid offset of remifentanil after prolonged infusion is associated with significant opioid-induced hyperalgesia (OIH) - a paradoxical increase in pain sensitivity mediated by NMDA receptor activation. CRNAs must plan for this by administering a longer-acting opioid (morphine, hydromorphone) and potentially ketamine 15-30 minutes before emergence.

Why the other choices are less appropriate:

- A. Remifentanil's metabolism is organ-independent; it does not accumulate even after hours of infusion.
- C. Post-operative respiratory depression from remifentanil is minimal due to its 3-5 min half-time.
- D. Re-narcotization does not occur with remifentanil because of its extremely short duration of action.

Question 10 • Correct Answer: B

A 28-year-old pregnant woman at 32 weeks gestation undergoes emergency appendectomy under general anesthesia. During induction, she develops...

Intraoperative anaphylaxis with an IV line already in place requires immediate IV epinephrine - NOT IM epinephrine. The IV route allows faster onset and titratable dosing. Starting dose is 10-100 mcg IV bolus (compared to the 0.3 mg IM used in community settings). Airway management, 100% O₂, and IV fluid resuscitation follow. Diphenhydramine and steroids are helpful but are secondary to epinephrine. In pregnancy, left uterine displacement should also be maintained. Maternal survival takes priority over fetal considerations.

Why the other choices are less appropriate:

- A. IM epinephrine is for community settings without IV access; in the OR, IV is immediately available and faster.
- C. Steroids and antihistamines are adjuncts, not first-line; delaying epinephrine worsens outcomes.
- D. Albuterol does not reverse the cardiovascular collapse of anaphylaxis.

Question 11 · Correct Answer: A

A CRNA is calculating the remaining oxygen supply in an E-cylinder that reads 1000 psig. The patient requires 3 L/min O₂. Approximately how long...

The E-cylinder oxygen calculation: Full E-cylinder = 2000 psig = ~660 liters of O₂. The tank factor for an E-cylinder is 0.3 L/psig. At 1000 psig: $1000 \times 0.3 = 300$ liters remaining. At 3 L/min: $300 / 3 = 100$ minutes. This calculation is critical for transport safety - always account for transport time, induction, and a safety buffer. Replace the cylinder if duration is < 30 minutes more than the estimated procedure length.

Why the other choices are less appropriate:

- B. This would assume only 150 liters remaining - incorrect conversion factor.
- C. 67 minutes would result from an incorrect flow or cylinder factor calculation.
- D. 150 minutes would assume more gas than is present.

Question 12 · Correct Answer: B

Which of the following drug interactions represents the GREATEST concern when using ketamine for procedural sedation in a patient taking an MAOI...

Ketamine is a sympathomimetic agent that inhibits reuptake of catecholamines. When combined with monoamine oxidase inhibitors (MAOIs), which prevent catecholamine breakdown, there is a risk of severe hypertensive crisis and serotonin syndrome (if serotonergic pathways are involved). MAOIs represent one of the most significant drug interaction concerns in anesthesia. Elective procedures should ideally be deferred until MAOIs have been discontinued for 2 weeks. If emergent surgery is required, extreme caution, careful monitoring, and avoidance of sympathomimetics is essential.

Why the other choices are less appropriate:

- A. Ketamine does not trigger MH - volatile agents and succinylcholine are MH triggers.
- C. MAOIs do not prolong neuromuscular blockade.
- D. Ketamine generally maintains respiratory drive; this is not the primary MAOI concern.

Question 13 · Correct Answer: B

A patient with known cirrhosis receives vecuronium. Which statement BEST explains the expected pharmacokinetic change?

Vecuronium is primarily eliminated via hepatic metabolism (deacetylation) and biliary/fecal excretion, with minor renal elimination. In hepatic cirrhosis, both pathways are impaired, resulting in significantly prolonged duration of action. The active metabolite 3-desacetylvecuronium also accumulates. CRNAs should use cisatracurium (Hofmann elimination - organ-independent) as the NDNMB of choice in severe liver failure. Monitor with TOF quantitatively and reverse with sugammadex.

Why the other choices are less appropriate:

- A. Renal compensation does not adequately compensate for hepatic elimination of vecuronium.
- C. Hofmann elimination is the property of cisatracurium and atracurium - NOT vecuronium.
- D. While ascites increases V_d for some drugs, the dominant effect with vecuronium in cirrhosis is prolonged action due to impaired elimination.

Question 14 · Correct Answer: B

An 80 kg patient with no liver or kidney disease requires succinylcholine for rapid sequence intubation. The CRNA calculates the correct dose....

The recommended dose of succinylcholine for RSI is 1.5–2 mg/kg IV. For an 80 kg patient: $1.5 \text{ mg/kg} \times 80 \text{ kg} = 120 \text{ mg}$. This provides the fastest and most complete neuromuscular blockade for RSI conditions. The dose of 1 mg/kg provides adequate intubating conditions in most patients but may result in slightly slower onset or less reliable jaw relaxation. For obese patients, use total body weight (TBW) because succinylcholine is distributed in plasma, and pseudocholinesterase activity is proportional to lean body mass plus fat mass.

Why the other choices are less appropriate:

- A. 1 mg/kg is used for elective intubation but 1.5 mg/kg provides faster, more complete RSI blockade.
- C. 2 mg/kg is acceptable but unnecessarily high for a standard adult without obesity.
- D. 0.5 mg/kg is inadequate for RSI and may result in incomplete blockade.

Question 15 · Correct Answer: C

A 45-year-old woman with COPD and known CO₂ retention (baseline PaCO₂ 55 mmHg) presents for elective knee arthroplasty under spinal anesthesia....

In patients with chronic hypercapnia and COPD, the normal chemoreceptor response to CO₂ is blunted. Their primary ventilatory drive can shift to the hypoxic drive (peripheral chemoreceptors stimulated by low PaO₂). When supplemental oxygen raises the SpO₂ too high, this hypoxic drive is eliminated, ventilatory rate decreases, and CO₂ accumulates further (hypercapnic respiratory failure). The Haldane effect also contributes. Target SpO₂ 88-92% in COPD patients with known CO₂ retention to avoid this complication.

Why the other choices are less appropriate:

- A. Spinal anesthesia was used, not propofol for maintenance.
- B. Nitrous oxide was not used in this case.
- D. No intrathecal opioids were described in this case; neuraxial morphine peak effect is at 6-12h.

Question 16 · Correct Answer: D

Which pharmacokinetic property BEST explains why propofol provides smoother, faster emergence compared to barbiturates after a 3-hour infusion?

Propofol has a very short context-sensitive half-time even after prolonged infusions because of its extremely high hepatic clearance (2 L/min - exceeds hepatic blood flow, suggesting extrahepatic metabolism) combined with redistribution. This means drug concentration drops rapidly when the infusion stops, regardless of duration. Thiopental (barbiturate) has a much longer context-sensitive half-time because it saturates peripheral compartments during a prolonged infusion - hence 'thiopental hangover' after long cases.

Why the other choices are less appropriate:

- A. Propofol actually has a very large volume of distribution (170-350 L).
- B. High protein binding would increase half-life, not decrease it.
- C. Hofmann elimination is a property of cisatracurium and atracurium, not propofol.

Question 17 · Correct Answer: A

A 55-year-old male with a history of MH susceptibility requires emergency surgery. Which anesthetic plan is MOST appropriate?

For MH-susceptible patients, the anesthetic plan must AVOID ALL volatile anesthetic agents (halothane, sevoflurane, desflurane, isoflurane) AND succinylcholine - both are MH triggers. TIVA with propofol + remifentanyl (or fentanyl) is the standard safe anesthetic for MH-susceptible patients. The anesthesia machine must be prepared by flushing with high-flow O₂ for 20-60 minutes (manufacturer-dependent), removing vaporizers, and changing CO₂ absorbent and circuits. Dantrolene must always be immediately available.

Why the other choices are less appropriate:

- B. Sevoflurane is a potent MH trigger - absolutely contraindicated.
- C. Spinal is acceptable but does not address the need for a complete plan if GA is required.
- D. Both volatile agents and succinylcholine are triggers - neither can be used.

Question 18 · Correct Answer: B

A CRNA gives a patient metoclopramide 10 mg IV preoperatively. Which patient would you be MOST concerned about a serious adverse reaction?

Metoclopramide is a dopamine (D₂) receptor antagonist. Its mechanism of promoting gastric motility involves blocking dopaminergic inhibition of GI motility. In patients with Parkinson's disease, dopaminergic pathways are already compromised, and metoclopramide can precipitate severe parkinsonian crisis, rigidity, and extrapyramidal symptoms. Metoclopramide is actually used therapeutically for patients with GERD and peptic ulcer disease - it accelerates gastric emptying.

Why the other choices are less appropriate:

- A. Peptic ulcer disease is not a contraindication - metoclopramide can help reduce gastric acid.
- C. GERD is a common indication for metoclopramide preoperatively.
- D. Prior PONV is a reason to use metoclopramide - not a contraindication.

Question 19 · Correct Answer: B

Which of the following correctly describes the pharmacodynamic interaction between volatile anesthetics and non-depolarizing neuromuscular...

Volatile anesthetic agents (especially isoflurane and desflurane) potentiate NDNMBs - they reduce the required dose by approximately 20-40%. The mechanism includes: (1) enhanced post-junctional sensitivity of the NMJ, (2) depression of muscle spindle activity, and (3) possible pre-junctional effects. This means CRNAs using volatile agents need less NDNMB to achieve the same level of relaxation, and residual block at emergence may be more pronounced.

Why the other choices are less appropriate:

- A. Volatile agents do not competitively block the nicotinic receptor.
- C. Plasma cholinesterase metabolizes succinylcholine and ester local anesthetics, not NDNMBs.
- D. This is incorrect - volatile agents significantly potentiate NDNMB effects clinically.

Question 20 · Correct Answer: B

A patient on buprenorphine (Suboxone 16 mg/day) for opioid use disorder requires emergent laparotomy for a perforated viscus. Which pain...

Current ASRA and AANA guidance recommends CONTINUING buprenorphine perioperatively rather than stopping it abruptly (risk of relapse and inadequate pain control from withdrawal). Buprenorphine has partial mu-agonist activity that can reduce but not eliminate pain management. The plan includes: maintaining buprenorphine, maximizing regional anesthesia and multimodal analgesia (ketamine, NSAIDs, acetaminophen, dexmedetomidine), and using high-dose full agonist opioids if needed (they can partially displace buprenorphine or act at other opioid receptors). Abrupt discontinuation risks relapse and precipitates withdrawal.

Why the other choices are less appropriate:

- A. Abrupt discontinuation risks relapse, withdrawal, and inadequate analgesia.
- C. Naloxone would precipitate acute opioid withdrawal and is not recommended to clear buprenorphine.
- D. Meperidine has no special advantage and carries serotonin syndrome risk in patients on buprenorphine.

Question 21 · Correct Answer: B

A patient's cardiac output falls acutely when PEEP is increased to 15 cmH₂O during mechanical ventilation. Which mechanism MOST directly explains...

High PEEP raises mean intrathoracic pressure, which reduces the pressure gradient for systemic venous return to the right atrium, lowering RV preload and thus cardiac output. This preload-dependent drop is most pronounced in hypovolemic patients.

Why the other choices are less appropriate:

- A. Baroreceptor reflex to reduced CO would cause tachycardia, and it is not the primary mechanism.
- C. PEEP decreases, not increases, LV preload by limiting venous return.
- D. PEEP does not exert a direct negative inotropic effect on cardiac muscle.

Question 22 · Correct Answer: B

During carotid endarterectomy, surgical manipulation of the carotid sinus causes sudden bradycardia and hypotension. Which afferent nerve carries...

The carotid sinus baroreceptors send afferent signals via the carotid sinus branch of the glossopharyngeal nerve (CN IX) to the medulla, triggering a reflex increase in vagal tone. Efferent output is via the vagus, but the afferent limb is CN IX. Local infiltration of the sinus with lidocaine can abolish the reflex.

Why the other choices are less appropriate:

- A. The facial nerve is not involved in carotid baroreceptor signaling.
- C. The hypoglossal nerve is motor to the tongue and has no baroreceptor role.
- D. The vagus (CN X) is the efferent limb of the reflex, not the afferent sensor.

Question 23 · Correct Answer: D

A healthy 70 kg adult has a hemoglobin of 15 g/dL and SaO₂ of 98% with a PaO₂ of 95 mmHg. Which component contributes the LARGEST portion of total...

Oxygen content = (1.34 x Hgb x SaO₂) + (0.003 x PaO₂). Hemoglobin-bound oxygen yields about 1.34 x 15 x 0.98 = 19.7 mL/dL, whereas dissolved O₂ is only 0.003 x 95 = 0.29 mL/dL. Hemoglobin-bound oxygen dominates total content.

Why the other choices are less appropriate:

- A. Dissolved oxygen contributes only ~0.3 mL/dL, a tiny fraction of total content.
- B. Oxygen does not bind plasma proteins to any meaningful extent.
- C. Oxygen is not transported as bicarbonate; that is a CO₂ transport form.

Question 24 · Correct Answer: A

A patient hyperventilates to a PaCO₂ of 20 mmHg during controlled ventilation. What is the MOST likely effect on cerebral blood flow? Cerebral blood flow changes roughly 1-2 mL/100 g/min for each 1 mmHg change in PaCO₂ within the range of about 20-80 mmHg. Hypocapnia produces cerebral vasoconstriction and reduced CBF, which transiently lowers ICP but risks ischemia if excessive.

Why the other choices are less appropriate:

- B. Metabolic rate is not increased by hyperventilation; CBF falls.
- C. CO₂ reactivity overrides pressure autoregulation for this range; CBF does change.
- D. Hypocapnia causes vasoconstriction, not vasodilation.

Question 25 · Correct Answer: C

A patient in the operating room has a measured mixed venous oxygen saturation (SvO₂) of 55%. Assuming stable oxygen consumption and hemoglobin,...

SvO₂ reflects the balance between oxygen delivery and consumption; a normal value is about 65-75%. When cardiac output falls but consumption stays constant, tissues extract more oxygen, lowering SvO₂. Falling SvO₂ therefore suggests reduced delivery, commonly from a low cardiac output.

Why the other choices are less appropriate:

- A. A left shift increases affinity and does not by itself explain a low SvO₂.
- B. Decreased extraction would raise SvO₂, opposite to the finding.
- D. Increased cardiac output would raise SvO₂, not lower it.

Question 26 · Correct Answer: C

A patient develops a tension pneumothorax during laparoscopy. Which finding BEST distinguishes tension pneumothorax from a simple pneumothorax?

A tension pneumothorax progressively increases intrathoracic pressure, causing mediastinal shift and compression of the great veins, producing hypotension and tracheal deviation toward the contralateral side. This hemodynamic collapse distinguishes it from a simple pneumothorax. Immediate needle decompression is indicated.

Why the other choices are less appropriate:

- A. Decreased breath sounds occur in both simple and tension pneumothorax.
- B. Hyperresonance is common to both types and is not specific to tension.
- D. Elevated PIP occurs in both and does not confirm tension physiology.

Question 27 · Correct Answer: A

A patient's functional residual capacity (FRC) decreases markedly after induction of general anesthesia and paralysis in the supine position....

FRC is the oxygen reservoir during apnea; induction, supine positioning, and paralysis reduce FRC by 15-20%, shrinking this reserve. A smaller FRC leads to faster desaturation during apnea, which is why preoxygenation is essential. Reduced FRC also promotes atelectasis and increased shunt.

Why the other choices are less appropriate:

- B. A reduced FRC shortens, not lengthens, the safe apnea time.
- C. Anatomic dead space is not increased by a fall in FRC.
- D. Reduced FRC increases venous admixture from atelectasis, not decreases it.

Question 28 · Correct Answer: C

Which structure must a spinal needle pass through LAST before entering the subarachnoid space during a midline lumbar spinal?

The midline path is skin, subcutaneous tissue, supraspinous ligament, interspinous ligament, ligamentum flavum, epidural space, dura mater, then arachnoid mater into the subarachnoid space (CSF). The arachnoid mater is the last layer traversed before CSF is reached.

Why the other choices are less appropriate:

- A. The ligamentum flavum is crossed before the epidural space, well before the CSF.
- B. The dura is penetrated immediately before the arachnoid, not last.
- D. The posterior longitudinal ligament lies anterior to the cord and is not in the midline needle path.

Question 29 · Correct Answer: A

A patient's urine output falls to 15 mL/hr intraoperatively. Which physiologic response to surgical stress MOST directly contributes to...

Surgical stress and positive-pressure ventilation stimulate ADH and aldosterone release, promoting water and sodium retention and reducing urine output. This neuroendocrine stress response commonly causes transient intraoperative oliguria even without hypovolemia. Reassessment of volume status is still warranted.

Why the other choices are less appropriate:

- B. The renin-angiotensin system is activated, not suppressed, by stress.
- C. ADH secretion rises, not falls, during surgical stress.
- D. ANP promotes diuresis and is not the driver of intraoperative oliguria.

Question 30 · Correct Answer: D

Which portion of the nephron is the PRIMARY site of action for loop diuretics such as furosemide?

Loop diuretics inhibit the Na-K-2Cl cotransporter in the thick ascending limb of the loop of Henle, blocking sodium reabsorption and disrupting the countercurrent concentration gradient. This produces a potent diuresis and can cause hypokalemia and metabolic alkalosis.

Why the other choices are less appropriate:

- A. The collecting duct is where aldosterone antagonists and ADH act.
- B. The distal convoluted tubule is the site for thiazide diuretics.
- C. The proximal tubule is the site for carbonic anhydrase inhibitors like acetazolamide.

Question 31 · Correct Answer: C

A patient with type 1 diabetes presents for emergency surgery with a glucose of 480 mg/dL, pH 7.18, and positive serum ketones. Which is the MOST...

Diabetic ketoacidosis is treated with IV fluids to restore intravascular volume and an insulin infusion to close the anion gap and halt ketogenesis, along with potassium monitoring. Volume resuscitation and insulin together correct the underlying metabolic derangement. Surgery should ideally be delayed until DKA is controlled when feasible.

Why the other choices are less appropriate:

- A. Dextrose is added later once glucose falls to ~200-250 mg/dL, not initially.
- B. Insulin without concurrent fluid and potassium management is unsafe.
- D. Bicarbonate is not routinely used and is reserved for severe acidemia (pH < 6.9).

Question 32 · Correct Answer: A

A patient undergoing adrenalectomy for pheochromocytoma develops severe hypertension during tumor manipulation. Which drug is the MOST appropriate...

Pheochromocytoma releases catecholamines causing alpha-mediated vasoconstriction; phentolamine is a short-acting alpha antagonist ideal for acute intraoperative hypertensive crises. Sodium nitroprusside and nicardipine are also used. Unopposed beta blockade must be avoided before adequate alpha blockade.

Why the other choices are less appropriate:

- B. Phenylephrine is a vasoconstrictor and would worsen the hypertension.
- C. Ephedrine releases catecholamines and would exacerbate the crisis.
- D. Esmolol given first risks unopposed alpha vasoconstriction and worsening hypertension.

Question 33 · Correct Answer: C

A patient with advanced liver cirrhosis is scheduled for surgery. Which physiologic change MOST increases the free (unbound) fraction of highly...

Cirrhosis reduces hepatic synthesis of albumin, the main binding protein for acidic and neutral drugs like diazepam. Lower albumin increases the free, pharmacologically active fraction, enhancing drug effect at a given total dose. Dose reduction and careful titration are prudent.

Why the other choices are less appropriate:

- A. Hepatic blood flow is typically decreased in cirrhosis, not increased.
- B. Biliary excretion changes do not increase the free plasma fraction of a bound drug.
- D. Alpha-1 acid glycoprotein binds basic drugs and does not raise diazepam free fraction.

Question 34 · Correct Answer: C

A patient with untreated primary hyperaldosteronism (Conn syndrome) is likely to present with which electrolyte and acid-base pattern?

Excess aldosterone increases renal sodium reabsorption while promoting potassium and hydrogen ion excretion, producing hypokalemia and metabolic alkalosis along with hypertension. Correcting potassium and controlling blood pressure are important before elective surgery.

Why the other choices are less appropriate:

- A. Aldosterone excess causes potassium loss (hypokalemia), not hyperkalemia, and alkalosis.
- B. The alkalosis is correct, but aldosterone lowers potassium rather than raising it.
- D. Aldosterone excess produces alkalosis, not acidosis.

Question 35 · Correct Answer: C

A patient with chronic kidney disease and a serum potassium of 6.8 mEq/L shows peaked T waves on the ECG. Which intervention MOST rapidly...

Calcium (gluconate or chloride) does not lower serum potassium but rapidly antagonizes the membrane effects of hyperkalemia, restoring the threshold potential and stabilizing the myocardium within minutes. Insulin/dextrose and albuterol then shift potassium intracellularly. Definitive removal requires dialysis or cation exchange.

Why the other choices are less appropriate:

- A. Albuterol shifts potassium intracellularly but is slower and does not protect the membrane.
- B. Insulin/dextrose shifts potassium but acts over 10-20 minutes and does not stabilize the membrane first.
- D. Sodium polystyrene sulfonate removes potassium slowly over hours.

Question 36 · Correct Answer: B

A patient with severe aortic stenosis (valve area 0.7 cm²) becomes hypotensive after spinal anesthesia. Which hemodynamic goal is MOST important...

In severe aortic stenosis the fixed obstruction limits the ability to augment stroke volume, so coronary perfusion depends on maintaining afterload (SVR) and adequate preload. Hypotension can rapidly cause a downward spiral of ischemia. Sinus rhythm and a normal, not fast, heart rate are also desirable.

Why the other choices are less appropriate:

- A. Tachycardia shortens diastolic filling and coronary perfusion, worsening ischemia.
- C. Permissive hypotension risks coronary hypoperfusion and cardiac arrest.
- D. Reducing afterload lowers coronary perfusion pressure and is dangerous in fixed obstruction.

Question 37 • Correct Answer: B

According to the oxyhemoglobin dissociation curve, which condition causes a RIGHTWARD shift, favoring oxygen unloading at the tissues?

A rightward shift decreases hemoglobin oxygen affinity and enhances tissue oxygen unloading. It is produced by acidosis, hypercarbia, hyperthermia, and increased 2,3-DPG (the mnemonic: acid, CO₂, temperature, 2,3-DPG all high). Increased 2,3-DPG is one of these classic rightward-shift factors.

Why the other choices are less appropriate:

- A. Alkalosis increases affinity and shifts the curve left.
- C. Hypothermia increases affinity and shifts the curve left.
- D. Low PaCO₂ shifts the curve left, impairing unloading.

Question 38 • Correct Answer: D

Which volatile anesthetic has the LOWEST blood-gas partition coefficient, producing the FASTEST onset and offset of anesthesia?

The blood-gas partition coefficient determines speed of induction and emergence; lower solubility means faster equilibration. Desflurane has the lowest value (about 0.42), followed by sevoflurane (~0.65), isoflurane (~1.4), and halothane (~2.4). Desflurane therefore offers the fastest onset and offset.

Why the other choices are less appropriate:

- A. Isoflurane is more soluble (~1.4), giving slower kinetics than desflurane.
- B. Sevoflurane (~0.65) is fast but still more soluble than desflurane.
- C. Halothane is the most soluble of these, with the slowest kinetics.

Question 39 • Correct Answer: D

A patient breathes 70% nitrous oxide during induction with sevoflurane. The alveolar concentration of sevoflurane rises faster than expected....

The second gas effect occurs when rapid uptake of a large volume of nitrous oxide concentrates the co-administered volatile agent in the remaining alveolar gas and augments its inflow, accelerating the rise of the second gas. This speeds induction with the accompanying volatile agent.

Why the other choices are less appropriate:

- A. Diffusion hypoxia occurs at emergence when N₂O floods the alveoli, not during induction.
- B. The concentration effect refers to a single high-concentration gas (the N₂O itself), not the co-administered agent.
- C. Low-flow rebreathing slows, rather than speeds, the rise of alveolar concentration.

Question 40 • Correct Answer: B

Which volatile anesthetic is MOST likely to sensitize the myocardium to catecholamines and predispose to dysrhythmias in a patient receiving...

Halothane markedly sensitizes the myocardium to catecholamines, lowering the threshold for ventricular dysrhythmias when epinephrine is administered. The modern ethers (sevoflurane, desflurane, isoflurane) cause much less sensitization. This is one reason halothane has largely been abandoned.

Why the other choices are less appropriate:

- A. Desflurane causes little myocardial sensitization to catecholamines.
- C. Sevoflurane causes minimal catecholamine sensitization.
- D. Isoflurane sensitizes far less than halothane.

Question 41 • Correct Answer: B

A patient receiving nitrous oxide for a middle ear procedure is at risk of which complication due to the physical properties of the gas?

Nitrous oxide is 34 times more soluble than nitrogen, so it diffuses into closed air-filled spaces faster than nitrogen can leave, increasing volume or pressure. This can raise middle ear pressure, expand a pneumothorax, or distend bowel. It is generally avoided in tympanoplasty and when air emboli or pneumothorax are concerns.

Why the other choices are less appropriate:

- A. Nitrous oxide increases, not decreases, pressure/volume in closed spaces.
- C. Nitrous oxide is associated with increased, not decreased, postoperative nausea.
- D. Nitrous oxide can increase pulmonary vascular resistance, especially in susceptible patients.

Question 42 • Correct Answer: A

A patient undergoing TIVA with propofol develops greenish discoloration of the urine. What is the MOST appropriate interpretation of this finding?

Green urine after propofol reflects excretion of phenolic metabolites and is a benign, self-limited phenomenon that does not indicate renal impairment. It resolves once the drug is cleared. No specific treatment is required.

Why the other choices are less appropriate:

- B. Green urine is benign and is not an indication for dialysis.
- C. Propofol infusion syndrome causes metabolic acidosis and rhabdomyolysis, not simply green urine.
- D. The color is from phenolic metabolites, not hemolysis of the emulsion.

Question 43 • Correct Answer: B

Etomidate is often selected for induction in hemodynamically unstable patients but carries which notable endocrine adverse effect?

Etomidate inhibits 11-beta-hydroxylase, suppressing cortisol synthesis even after a single induction dose, with effects lasting several hours. This is a particular concern in septic or critically ill patients. Its hemodynamic stability must be weighed against this transient adrenal suppression.

Why the other choices are less appropriate:

- A. Etomidate is not associated with SIADH.
- C. Etomidate does not cause clinically significant hyperglycemia via insulin suppression.
- D. Etomidate does not precipitate thyroid storm.

Question 44 • Correct Answer: D

A patient with a history of severe egg and soy allergy requires induction. Which concern is MOST relevant when selecting propofol?

Propofol emulsion contains egg lecithin (egg yolk phospholipid) and soybean oil, whereas most egg allergies are to egg white albumin. True allergic reactions to propofol are rare, and current evidence does not support an absolute contraindication in most egg- or soy-allergic patients. Clinical judgment and history of anaphylaxis guide the decision.

Why the other choices are less appropriate:

- A. Soybean oil rarely triggers reactions and is not an absolute contraindication.
- B. Egg allergy is not an absolute contraindication; the allergen differs from egg lecithin.
- C. Egg lecithin is a yolk phospholipid, not egg albumin.

Question 45 • Correct Answer: D

Ketamine produces dissociative anesthesia primarily through which receptor action?

Ketamine is a noncompetitive NMDA (N-methyl-D-aspartate) receptor antagonist, which underlies its dissociative anesthesia, analgesia, and amnesia while preserving airway reflexes and respiratory drive. It also causes sympathetic stimulation, raising heart rate and blood pressure. This makes it useful in hypovolemic or bronchospastic patients.

Why the other choices are less appropriate:

- A. Alpha-2 agonism is the mechanism of dexmedetomidine, not ketamine.
- B. GABA-A agonism is the mechanism of propofol and benzodiazepines, not ketamine.
- C. Ketamine has weak opioid activity that does not account for dissociation.

Question 46 • Correct Answer: B

Dexmedetomidine provides sedation and analgesia without significant respiratory depression through agonism at which receptor?

Dexmedetomidine is a highly selective central alpha-2 adrenergic agonist that reduces sympathetic outflow, producing sedation and analgesia with minimal respiratory depression. Common side effects are bradycardia and hypotension. A rapid bolus can cause transient hypertension from peripheral alpha-2B stimulation.

Why the other choices are less appropriate:

- A. Peripheral alpha-1 stimulation causes vasoconstriction and is not its primary sedative mechanism.
- C. NMDA antagonism is the mechanism of ketamine.
- D. Beta-1 agonism would increase heart rate and contractility, opposite to its effect.

Question 47 · Correct Answer: D

A patient receives morphine for postoperative analgesia and develops prolonged sedation and respiratory depression. The patient has end-stage...

Morphine is metabolized to morphine-6-glucuronide, an active metabolite that is more potent than morphine and is renally excreted. In renal failure it accumulates, causing prolonged sedation and respiratory depression. Hydromorphone and fentanyl are often preferred in significant renal impairment.

Why the other choices are less appropriate:

- A. Morphine has low protein binding, and this is not the mechanism.
- B. Hepatic conjugation is generally preserved; the problem is renal accumulation of the metabolite.
- C. First-pass metabolism is not enhanced and does not explain the accumulation.

Question 48 · Correct Answer: B

Which opioid is MOST associated with serotonin syndrome when combined with a monoamine oxidase inhibitor and should be avoided in these patients?

Meperidine inhibits serotonin reuptake and, combined with an MAOI, can precipitate serotonin syndrome with hyperthermia, rigidity, and autonomic instability. It is therefore contraindicated with MAOIs. Its metabolite normeperidine can also cause seizures, especially in renal impairment.

Why the other choices are less appropriate:

- A. Hydromorphone is not a notable serotonin reuptake inhibitor.
- C. Morphine has minimal serotonergic activity and is not the primary concern.
- D. Fentanyl carries some theoretical risk but far less than meperidine with MAOIs.

Question 49 · Correct Answer: D

A patient develops chest wall rigidity ('wooden chest') after a rapid, high-dose fentanyl bolus during induction. Which intervention MOST directly...

Opioid-induced chest wall rigidity impairs ventilation and is reversed by a neuromuscular blocking agent (for example succinylcholine) or by naloxone, which reverses the opioid effect. Rapid, high-dose administration of potent opioids is the usual trigger. Slower administration reduces the risk.

Why the other choices are less appropriate:

- A. Increasing volatile agent does not reliably relieve opioid-induced rigidity.
- B. Calcium has no role in reversing opioid chest wall rigidity.
- C. CPAP alone cannot overcome severe glottic and chest wall rigidity.

Question 50 · Correct Answer: B

A 30-year-old healthy patient receives cisatracurium for a case with anticipated renal and hepatic dysfunction. Which property makes cisatracurium...

Cisatracurium undergoes Hofmann elimination, a spontaneous, temperature- and pH-dependent breakdown in plasma that does not depend on hepatic or renal function. This makes its duration predictable in organ failure. The metabolite laudanosine is produced but is clinically insignificant at usual doses.

Why the other choices are less appropriate:

- A. It is not dependent on hepatic metabolism for termination of effect.
- C. Cisatracurium is not primarily eliminated by renal excretion of unchanged drug.
- D. Plasma cholinesterase hydrolyzes succinylcholine and mivacurium, not cisatracurium.

Question 51 • Correct Answer: A

During neuromuscular monitoring with a train-of-four (TOF), a patient shows fade with the fourth twitch weaker than the first. This pattern is...

Nondepolarizing blockers produce fade on TOF and tetanic stimulation because they competitively antagonize the receptor and impair presynaptic acetylcholine mobilization. A depolarizing (phase I) block, by contrast, shows equal reduction of all four twitches without fade. Fade is the hallmark of competitive blockade.

Why the other choices are less appropriate:

- B. A normal baseline shows four equal twitches, not fade.
- C. Full recovery would show a TOF ratio near 1.0 with no fade.
- D. Phase I depolarizing block reduces all twitches equally without fade.

Question 52 • Correct Answer: B

A patient received rocuronium and now has a train-of-four count of 2 twitches at the end of surgery. Which reversal strategy is MOST appropriate...

At a TOF count of 2 (moderate block), sugammadex 2 mg/kg reliably and rapidly reverses aminosteroid blockade by encapsulating rocuronium. Neostigmine is less effective and unreliable at deeper levels of block. The 16 mg/kg dose is reserved for immediate reversal of a large intubating dose.

Why the other choices are less appropriate:

- A. 16 mg/kg is reserved for immediate reversal right after a high intubating dose, not moderate block.
- C. Allowing spontaneous recovery risks residual paralysis and is not appropriate here.
- D. Neostigmine is unreliable at TOF count of 2 and has a ceiling effect.

Question 53 • Correct Answer: C

A patient with atypical (pseudo)cholinesterase deficiency who is homozygous receives succinylcholine. What is the MOST likely clinical consequence?

Homozygous atypical plasma cholinesterase deficiency greatly reduces succinylcholine hydrolysis, prolonging paralysis from minutes to hours. Management is continued sedation and mechanical ventilation until spontaneous recovery. A dibucaine number quantifies enzyme quality; a low number indicates abnormal enzyme.

Why the other choices are less appropriate:

- A. Deficiency causes prolonged, not shortened, effect; higher dosing is not the issue.
- B. Enzyme deficiency does not cause malignant hyperthermia.
- D. The duration is markedly prolonged, not unchanged.

Question 54 • Correct Answer: C

A dibucaine number of 20 in a patient given succinylcholine indicates which of the following?

The dibucaine number reflects the percentage the enzyme is inhibited by dibucaine, indicating enzyme quality, not quantity. A normal number is about 80, heterozygotes about 40-60, and homozygous atypical about 20, correlating with markedly prolonged succinylcholine blockade. A number of 20 predicts hours of paralysis.

Why the other choices are less appropriate:

- A. The dibucaine number does not assess malignant hyperthermia risk.
- B. A number near 80, not 20, reflects normal enzyme.
- D. Heterozygotes typically have a number of 40-60, not 20.

Question 55 • Correct Answer: C

Neostigmine is administered with glycopyrrolate rather than atropine for reversal of neuromuscular blockade primarily because glycopyrrolate:

Neostigmine increases acetylcholine at both nicotinic and muscarinic sites, so an antimuscarinic is co-administered to prevent bradycardia. Glycopyrrolate is paired with neostigmine because both have a slower onset and glycopyrrolate does not cross the blood-brain barrier, avoiding central anticholinergic effects. Atropine's faster onset better matches edrophonium.

Why the other choices are less appropriate:

- A. It does not prevent recurarization, which relates to inadequate reversal dosing.
- B. Glycopyrrolate does not act at the neuromuscular junction receptor.
- D. Glycopyrrolate does not prolong neuromuscular reversal; it is an antimuscarinic.

Question 56 • Correct Answer: B

Which property of a local anesthetic MOST determines its potency?

Local anesthetic potency correlates most closely with lipid solubility, which governs penetration of the nerve membrane. Protein binding correlates with duration, and pKa correlates with speed of onset. Highly lipid-soluble agents such as bupivacaine are more potent than lidocaine.

Why the other choices are less appropriate:

- A. Vasoactivity modifies duration and absorption, not intrinsic potency.
- C. Protein binding correlates with duration of action, not potency.
- D. pKa relates to onset speed, not potency.

Question 57 • Correct Answer: D

A local anesthetic with a pKa closer to physiologic pH (7.4) will have which characteristic?

Only the un-ionized (nonionized) form of a local anesthetic crosses the nerve membrane. A pKa nearer 7.4 means a larger un-ionized fraction at body pH, giving a faster onset. This explains why lidocaine (pKa ~7.9) has a faster onset than bupivacaine (pKa ~8.1).

Why the other choices are less appropriate:

- A. Duration relates to protein binding, not pKa proximity to pH.
- B. Potency relates to lipid solubility, not pKa.
- C. A pKa near 7.4 yields more un-ionized drug, so onset is faster, not slower.

Question 58 • Correct Answer: C

Why does injecting a local anesthetic into infected, acidic tissue often result in poor block quality?

In an acidic (low pH) environment, a greater proportion of the local anesthetic exists in the ionized form, which does not cross the nerve membrane. This reduces the amount of un-ionized drug available to block sodium channels, impairing the block. Buffering or using higher concentrations may partially compensate.

Why the other choices are less appropriate:

- A. Infection does not destroy sodium channels; the issue is drug ionization.
- B. Acidosis increases the ionized (not un-ionized) fraction.
- D. Acidosis does not increase lipid solubility of the drug.

Question 59 • Correct Answer: D

Which local anesthetic is an ESTER that is metabolized by plasma cholinesterase and carries a higher risk of allergic reactions due to PABA?

Chloroprocaine is an ester local anesthetic hydrolyzed by plasma cholinesterase, producing para-aminobenzoic acid (PABA), which is associated with allergic reactions. Amide agents (lidocaine, bupivacaine, ropivacaine) rarely cause true allergy and are metabolized in the liver. Its rapid metabolism gives it a short duration.

Why the other choices are less appropriate:

- A. Ropivacaine is an amide, not an ester.
- B. Bupivacaine is an amide and is not associated with PABA allergy.
- C. Lidocaine is an amide, hepatically metabolized, with low allergy risk.

Question 60 • Correct Answer: A

A patient develops perioral numbness, tinnitus, and metallic taste after a large local anesthetic injection. Which is the MOST appropriate...

Perioral numbness, tinnitus, and a metallic taste are early central nervous system signs of local anesthetic systemic toxicity (LAST) that precede seizures and cardiovascular collapse. The injection should be stopped immediately, help called, and lipid emulsion 20% and airway support readied. Early recognition prevents progression.

Why the other choices are less appropriate:

- B. High-dose epinephrine is not the initial step; management focuses on stopping injection and lipid rescue.
- C. A beta blocker is not indicated and can worsen cardiovascular toxicity.
- D. These are warning signs of LAST; continuing is dangerous.

Question 61 • Correct Answer: B

Which local anesthetic is considered the MOST cardiotoxic due to its tight, prolonged binding to cardiac sodium channels?

Bupivacaine binds cardiac sodium channels tightly and dissociates slowly ('fast in, slow out'), making it the most cardiotoxic common local anesthetic, with a low cardiac-to-CNS toxicity ratio. Toxicity can present as refractory ventricular dysrhythmias. Lipid emulsion is the treatment of choice for bupivacaine cardiac toxicity.

Why the other choices are less appropriate:

- A. Chloroprocaine has a short half-life and low systemic cardiotoxicity.
- C. Mepivacaine is less cardiotoxic than bupivacaine.
- D. Lidocaine dissociates rapidly from sodium channels and is far less cardiotoxic.

Question 62 • Correct Answer: A

Epinephrine is added to a lidocaine solution for peripheral nerve block. What is the PRIMARY benefit of this addition?

Epinephrine causes local vasoconstriction, which slows systemic absorption of the local anesthetic. This prolongs the block duration and lowers peak plasma concentration, reducing systemic toxicity risk. It also serves as a marker for intravascular injection.

Why the other choices are less appropriate:

- B. Epinephrine does not block sodium channels directly.
- C. Epinephrine decreases systemic absorption, not increases it.
- D. Epinephrine does not chemically neutralize the anesthetic.

Question 63 • Correct Answer: B

A hypotensive patient with a heart rate of 50 bpm and low cardiac output needs a single agent that increases both heart rate and contractility....

Ephedrine has both direct and indirect actions at alpha and beta receptors, raising heart rate, contractility, and blood pressure, making it appropriate for hypotension with bradycardia. Phenylephrine, a pure alpha agonist, would raise pressure but reflexively slow the heart. Ephedrine is a common first-line vasopressor for this scenario.

Why the other choices are less appropriate:

- A. Phenylephrine is a pure alpha agonist and causes reflex bradycardia, worsening the low rate.
- C. Nitroglycerin lowers blood pressure and is contraindicated here.
- D. Vasopressin raises blood pressure without increasing heart rate or contractility.

Question 64 • Correct Answer: B

Which vasoactive agent primarily works through V1 receptors and is useful for refractory hypotension in vasodilatory shock, including cases...

Vasopressin acts on vascular V1 receptors to cause vasoconstriction independent of adrenergic receptors, which makes it effective in catecholamine-resistant vasodilatory (for example septic or ACE-inhibitor-related) shock. It also spares the pulmonary circulation relative to systemic vasoconstriction. It has little direct inotropic effect.

Why the other choices are less appropriate:

- A. Dobutamine is an inotrope that can lower SVR, worsening vasodilatory hypotension.
- C. Milrinone is an inodilator that reduces SVR and can worsen hypotension.
- D. Norepinephrine acts on adrenergic receptors and can lose efficacy in acidosis and receptor downregulation.

Question 65 • Correct Answer: A

Milrinone improves cardiac output in decompensated heart failure through which mechanism?

Milrinone inhibits phosphodiesterase-3, raising intracellular cyclic AMP in cardiac and vascular smooth muscle. This increases contractility (inotropy) while causing vasodilation, hence the term inodilator, improving forward flow in heart failure. Its action is independent of beta-adrenergic receptors, useful when those are downregulated.

Why the other choices are less appropriate:

- B. Milrinone does not act as a beta-1 agonist; that is dobutamine.
- C. Alpha-1 agonism causes vasoconstriction, opposite to milrinone's vasodilation.
- D. Milrinone does not act by calcium channel blockade.

Question 66 • Correct Answer: C

A full oxygen E-cylinder contains approximately 660 L of oxygen at a pressure of about 1900-2200 psig. Which gas law explains why the cylinder...

Because oxygen in an E-cylinder remains a gas throughout use, pressure falls linearly with the remaining volume at constant temperature, which reflects Gay-Lussac's law relating pressure and amount/temperature. A gauge reading half of full pressure implies roughly half the volume remains. This linear relationship does not hold for nitrous oxide because it exists partly as liquid.

Why the other choices are less appropriate:

- A. Boyle's law relates pressure and volume of a fixed gas quantity, not the cylinder emptying relationship used here.
- B. Dalton's law concerns partial pressures of gas mixtures.
- D. Charles's law relates volume and temperature at constant pressure.

Question 67 • Correct Answer: C

A full nitrous oxide E-cylinder reads 745 psig. As nitrous oxide is used, the gauge pressure remains near 745 psig until most of the contents are...

Nitrous oxide is stored as a liquid in equilibrium with its vapor, so the gauge shows the vapor pressure (about 745 psig at room temperature) and remains constant until nearly all the liquid has evaporated. Therefore the gauge does not indicate remaining volume until the liquid is exhausted. Weighing the cylinder is the reliable way to assess contents.

Why the other choices are less appropriate:

- A. Because liquid is present, it does not behave as a simple gas following a linear pressure-volume relationship.
- B. Although its critical temperature is above room temperature, the specific explanation is the liquid-vapor equilibrium maintaining vapor pressure.
- D. The stable pressure is expected physics, not a faulty gauge.

Question 68 • Correct Answer: C

A variable-bypass vaporizer is moved from sea level to a high-altitude facility. Assuming the dial is set to 2%, how does the delivered PARTIAL...

Variable-bypass vaporizers are relatively altitude-compensated for partial pressure: at high altitude the delivered volume percent rises, but the partial pressure of the agent (which determines anesthetic depth) stays approximately the same. Because clinical effect depends on partial pressure, the effect is largely preserved. Desflurane's electronically controlled vaporizer behaves differently and may require adjustment.

Why the other choices are less appropriate:

- A. The vaporizer continues to function at altitude.
- B. Partial pressure does not fall to zero; it is approximately preserved.
- D. Although volume percent rises, the partial pressure and thus clinical effect are roughly maintained, so overdose is not expected.

Question 69 • Correct Answer: A

Desflurane requires a heated, pressurized vaporizer rather than a conventional variable-bypass design. Which physical property of desflurane MOST...

Desflurane boils at about 22-23 C with a vapor pressure near 1 atmosphere at room temperature, so a conventional variable-bypass vaporizer cannot control its output reliably. The Tec 6 vaporizer heats desflurane to about 39 C and pressurizes it, injecting a controlled amount of pure vapor into the fresh gas flow. This design compensates for its unique volatility.

Why the other choices are less appropriate:

- B. Molecular weight is not the reason for the specialized vaporizer.
- C. MAC relates to potency, not to the vaporizer design requirement.
- D. The blood-gas coefficient affects kinetics, not the need for a heated vaporizer.

Question 70 • Correct Answer: B

A Thorpe tube (variable-orifice) flowmeter is used on an anesthesia machine. At LOW flows, gas flow past the bobbin behaves like flow through a...

At low flows the annular gap around the bobbin is long and narrow, so flow is laminar and governed by Poiseuille's law, where gas viscosity dominates. At high flows the orifice is short and wide, flow becomes turbulent, and density becomes the important property. This is why flowmeters are gas-specific and calibrated for a particular agent.

Why the other choices are less appropriate:

- A. Temperature alone does not define the laminar flow dependence.
- C. Density matters at high (turbulent) flows, not low laminar flows.
- D. Molecular weight is not the primary determinant at low laminar flow.

Question 71 • Correct Answer: D

The oxygen flush valve on an anesthesia machine delivers oxygen at a high flow. Which hazard is MOST associated with using the oxygen flush during...

The oxygen flush delivers about 35-75 L/min of oxygen directly to the common gas outlet, bypassing the vaporizer and flowmeters. If activated during the inspiratory phase of positive-pressure ventilation, this can cause barotrauma and volutrauma from the sudden high flow and pressure. It also dilutes anesthetic, risking awareness rather than overdose.

Why the other choices are less appropriate:

- A. The flush delivers pure oxygen, so a hypoxic mixture is not the hazard.
- B. The flush bypasses the vaporizer and dilutes agent, risking light anesthesia, not overdose.
- C. Cooling of the circuit is not a recognized flush hazard.

Question 72 • Correct Answer: B

According to the Venturi principle used in some oxygen delivery and suction devices, when gas flows through a constriction its velocity increases...

By the Bernoulli/Venturi principle, as fluid velocity increases through a constriction, its lateral (side-wall) pressure falls. This pressure drop entrains a second fluid, as used in Venturi masks to entrain room air and in jet ventilation. The entrainment ratio determines the resulting FiO₂.

Why the other choices are less appropriate:

- A. The pressure does change; it falls at the constriction.
- C. Lateral pressure decreases, not increases, as velocity rises.
- D. The pressure falls below the upstream pressure, not merely to atmospheric.

Question 73 • Correct Answer: A

A pin index safety system (PISS) on an E-cylinder yoke is designed to prevent which error?

The pin index safety system uses a unique arrangement of pins and holes for each medical gas so that a cylinder can only be mounted on the correct gas-specific yoke. This prevents accidental connection of, for example, a nitrous oxide cylinder to the oxygen yoke. It is a mechanical fail-safe against gas misconnection.

Why the other choices are less appropriate:

- B. Fresh gas flow is set by the flowmeters, not the pin index system.
- C. Reverse flow prevention is the job of check valves, not the PISS.
- D. Overfilling is controlled at the filling plant, not by the PISS.

Question 74 • Correct Answer: C

Laminar gas flow through an endotracheal tube follows Poiseuille's law. If the radius of the tube is halved, resistance to laminar flow increases...

Poiseuille's law states resistance is inversely proportional to the fourth power of the radius (R proportional to $1/r^4$). Halving the radius increases resistance by $2^4 = 16$ -fold. This is why small endotracheal tubes dramatically increase work of breathing and airflow resistance.

Why the other choices are less appropriate:

- A. A factor of 4 corresponds to a squared relationship, not the fourth power.
- B. A factor of 2 would apply only to a linear (first-power) relationship.
- D. A factor of 8 corresponds to a cubed relationship, not the fourth power.

Question 75 • Correct Answer: A

When a gas at high pressure is rapidly released from a cylinder through a regulator, it cools. This adiabatic cooling is described by which effect?

The Joule-Thomson effect describes the temperature change of a real gas when it expands through a valve or restriction without heat exchange with the surroundings. For most gases at room temperature, this expansion causes cooling, which is why cylinder regulators and valves can frost during high flows. This principle also underlies cryotherapy devices.

Why the other choices are less appropriate:

- B. The Coanda effect describes fluid adherence to a surface.
- C. The Magnus effect describes force on a spinning object, unrelated to gas cooling.
- D. The Bernoulli effect relates velocity and lateral pressure, not adiabatic cooling.

Question 76 • Correct Answer: B

Which soda lime component is MOST responsible for the generation of Compound A and carbon monoxide when volatile anesthetics contact desiccated...

The strong bases sodium hydroxide and potassium hydroxide in older soda lime formulations catalyze degradation of volatile agents, producing Compound A (notably with sevoflurane) and carbon monoxide (notably with desflurane) when the absorbent is desiccated. Newer absorbents (for example calcium hydroxide lime without strong bases) greatly reduce these products. Keeping absorbent hydrated also minimizes the risk.

Why the other choices are less appropriate:

- A. Silica is added for hardness and is not the reactive catalyst.
- C. Water actually protects against degradation; desiccation increases the risk.
- D. Calcium hydroxide is the bulk absorbent and is not the main catalyst for these degradation products.

Question 77 • Correct Answer: C

Which volatile anesthetic combined with a DESICCATED absorbent poses the GREATEST risk of clinically significant carbon monoxide production?

Carbon monoxide production from degradation by desiccated strong-base absorbents is greatest with desflurane, followed by enflurane and isoflurane, because of their CHF₂ moiety. Sevoflurane produces little CO but instead generates Compound A. Nitrous oxide is not degraded to CO by absorbent.

Why the other choices are less appropriate:

- A. Isoflurane produces CO but less than desflurane.
- B. Nitrous oxide is not degraded by absorbent to CO.
- D. Sevoflurane produces mainly Compound A, not significant CO.

Question 78 • Correct Answer: C

Compound A production during sevoflurane anesthesia is MOST increased under which condition?

Compound A accumulates with low fresh gas flows (which increase rebreathing), higher sevoflurane concentrations, and warm absorbent containing strong bases. Higher fresh gas flows reduce Compound A exposure by flushing it out of the circle. Historically a minimum flow was recommended for prolonged sevoflurane cases.

Why the other choices are less appropriate:

- A. High flows and hydrated absorbent decrease, not increase, Compound A.
- B. Oxygen flush frequency is not the primary driver of Compound A.
- D. A non-rebreathing circuit avoids absorbent contact and does not generate Compound A.

Question 79 • Correct Answer: A

An exhausted soda lime canister often changes color due to a pH indicator. A common indicator turns the granules which color when the absorbent is...

Ethyl violet is a common pH indicator in soda lime that turns from white to purple/violet as the absorbent becomes acidic and exhausted from CO₂ absorption. The color may revert during periods of rest, so exhaustion is best judged by rising inspired CO₂. Color change alone can be misleading.

Why the other choices are less appropriate:

- B. Some formulations use pink-to-white indicators, but the classic ethyl violet change is white to purple.
- C. Green to yellow is not a standard soda lime indicator change.
- D. The typical change is white to purple, not white to blue.

Question 80 • Correct Answer: C

A 40-year-old patient is anesthetized with a mixture delivering 0.5 MAC of sevoflurane and 0.5 MAC of nitrous oxide. What is the approximate total...

MAC values of different inhaled agents are approximately additive, so 0.5 MAC sevoflurane plus 0.5 MAC nitrous oxide equals about 1.0 MAC total. By definition, 1.0 MAC prevents movement to a surgical stimulus in about 50% of patients. This additivity allows agents to be combined to reduce individual agent side effects.

Why the other choices are less appropriate:

- A. The values add, so total is 1.0 MAC, not 0.5.
- B. The sum is 1.0 MAC, not 2.0; the values are fractional.
- D. The sum is 1.0 MAC, not 1.5.

Question 81 • Correct Answer: A

The MAC of isoflurane is about 1.15%. To provide 1.3 MAC for a healthy adult, approximately what end-tidal isoflurane concentration should be...

Multiplying MAC by the desired multiple gives the target concentration: 1.15% x 1.3 = about 1.5%. Targeting roughly 1.3 MAC provides an adequate depth to prevent movement in most patients. End-tidal monitoring confirms the delivered concentration.

Why the other choices are less appropriate:

- B. 2.3% is about 2.0 MAC, which is more than the 1.3 MAC target.
- C. 1.15% is exactly 1.0 MAC, not 1.3 MAC.
- D. 0.9% is below 1 MAC and would be insufficient for 1.3 MAC.

Question 82 • Correct Answer: A

MAC-BAR (blocking adrenergic response) is approximately what multiple of MAC?

MAC-BAR is the concentration that blocks the adrenergic (sympathetic) response to a surgical stimulus in 50% of patients and is roughly 1.7-2.0 MAC, higher than standard MAC. MAC-awake, by contrast, is about 0.3-0.5 MAC. These variants describe different clinical endpoints of anesthetic depth.

Why the other choices are less appropriate:

- B. 1.3 MAC is a common clinical target but is below MAC-BAR.
- C. 0.3-0.4 MAC approximates MAC-awake, not MAC-BAR.
- D. 1.0 MAC prevents movement in 50% but does not block the adrenergic response.

Question 83 • Correct Answer: A

At sea level (barometric pressure 760 mmHg), an anesthetic gas is delivered at 2 volume percent. What is its approximate partial pressure?

Partial pressure equals the fractional concentration times total pressure: $0.02 \times 760 \text{ mmHg} = \text{about } 15.2 \text{ mmHg}$. Partial pressure, not volume percent, determines anesthetic effect at the brain. This is why the same volume percent produces different effects at different atmospheric pressures.

Why the other choices are less appropriate:

- B. 7.6 mmHg corresponds to about 1 volume percent.
- C. 152 mmHg corresponds to about 20 volume percent.
- D. 1.5 mmHg corresponds to about 0.2 volume percent, not 2 percent.

Question 84 • Correct Answer: C

A patient breathes room air (FiO_2 0.21) at sea level. Using the alveolar gas equation with PaCO_2 40 mmHg and a respiratory quotient of 0.8, what...

$\text{PAO}_2 = \text{FiO}_2 \times (\text{PB} - \text{PH}_2\text{O}) - (\text{PaCO}_2 / R) = 0.21 \times (760 - 47) - (40 / 0.8) = 0.21 \times 713 - 50 = \text{about } 150 - 50 = 100 \text{ mmHg}$. This is the expected alveolar oxygen tension breathing room air at sea level. Comparing it to measured PaO_2 gives the A-a gradient.

Why the other choices are less appropriate:

- A. About 50 mmHg is far too low for room air at sea level.
- B. 150 mmHg is the inspired oxygen tension before subtracting the CO_2 term.
- D. 250 mmHg would require a much higher FiO_2 .

Question 85 • Correct Answer: D

A vaporizer output is 1 MAC of desflurane (MAC about 6%). If nitrous oxide 60% is added and reduces the desflurane requirement, the effect on...

The MAC values of coadministered inhaled anesthetics are approximately additive, so adding nitrous oxide allows a proportional reduction in the volatile agent to reach the same total MAC. This additivity is a fundamental principle used to limit the dose and side effects of any single agent. It differs from the synergy sometimes seen between intravenous agents.

Why the other choices are less appropriate:

- A. Inhaled agents are additive, not supra-additive, in their MAC contributions.
- B. They interact additively rather than acting independently with no net summation.
- C. The agents are not antagonistic; the total effect is preserved by summation.

Question 86 • Correct Answer: A

A patient is 1.7 m tall and weighs 98 kg. What is the approximate body mass index (BMI), and which category does it fall into?

$\text{BMI} = \text{weight (kg)} / \text{height (m)}^2 = 98 / (1.7 \times 1.7) = 98 / 2.89 = \text{about } 34 \text{ kg/m}^2$, which is obese class I (30-34.9). Recognizing obesity is important for airway planning, dosing, and positioning. Class categories: 30-34.9 (I), 35-39.9 (II), 40 or more (III).

Why the other choices are less appropriate:

- B. 29 kg/m² would be overweight, but the calculation yields about 34.
- C. 41 kg/m² would be class III, but this patient calculates to about 34.
- D. 24 kg/m² would be normal, but the value is about 34.

Question 87 • Correct Answer: D

A norepinephrine infusion is prepared as 4 mg in 250 mL (16 mcg/mL). For an 80 kg patient, an infusion running at 15 mL/hr delivers approximately...

15 mL/hr x 16 mcg/mL = 240 mcg/hr = 4 mcg/min. Dividing by 80 kg gives $4 / 80 = 0.05$ mcg/kg/min. This is a low-to-moderate norepinephrine dose commonly used to support blood pressure.

Why the other choices are less appropriate:

- A. 1.0 mcg/kg/min is far higher than the calculated rate.
- B. 0.5 mcg/kg/min would require about 150 mL/hr, ten times higher.
- C. 0.1 mcg/kg/min would require about 30 mL/hr, double the given rate.

Question 88 • Correct Answer: B

A patient has a systolic blood pressure of 120 mmHg and a diastolic pressure of 60 mmHg. What is the approximate mean arterial pressure (MAP)?

MAP is approximately diastolic pressure plus one-third of the pulse pressure: $60 + (120 - 60)/3 = 60 + 20 = 80$ mmHg. The formula weights diastole because the heart spends more of the cycle in diastole. A MAP of at least 60-65 mmHg is generally needed for organ perfusion.

Why the other choices are less appropriate:

- A. 90 mmHg overestimates; the correct value is 80.
- C. 60 mmHg is the diastolic pressure, not the MAP.
- D. 100 mmHg would be a simple average, which overestimates MAP.

Question 89 • Correct Answer: D

A patient has a MAP of 90 mmHg, a central venous pressure of 6 mmHg, and a cardiac output of 6 L/min. What is the approximate systemic vascular...

$SVR = [(MAP - CVP) / CO] \times 80 = [(90 - 6) / 6] \times 80 = (84 / 6) \times 80 = 14 \times 80 = 1120$ dynes-sec-cm⁻⁵. This falls within the normal range of about 800-1200. The factor of 80 converts to standard resistance units.

Why the other choices are less appropriate:

- A. About 2400 would indicate marked vasoconstriction, not this scenario.
- B. About 1600 overestimates; the calculation yields 1120.
- C. About 560 would require a much higher cardiac output or lower gradient.

Question 90 • Correct Answer: A

A propofol infusion is set at 150 mcg/kg/min for a 70 kg patient. Using a standard concentration of 10 mg/mL, what is the approximate infusion...

Dose per minute = 150 mcg/kg/min x 70 kg = 10500 mcg/min = 10.5 mg/min. Per hour = 10.5 x 60 = 630 mg/hr. At 10 mg/mL, 630 / 10 = 63 mL/hr. This is a typical maintenance TIVA rate.

Why the other choices are less appropriate:

- B. 32 mL/hr corresponds to about half the required dose.
- C. 95 mL/hr overestimates the calculated rate.
- D. 126 mL/hr is double the correct value.

Question 91 • Correct Answer: A

A pediatric patient weighs 15 kg and requires a maintenance IV fluid rate using the 4-2-1 rule. What is the approximate hourly maintenance rate?

The 4-2-1 rule gives 4 mL/kg/hr for the first 10 kg (40 mL) plus 2 mL/kg/hr for the next 5 kg (10 mL), totaling 50 mL/hr. This estimates hourly maintenance fluid needs in children. Deficits and ongoing losses are added separately.

Why the other choices are less appropriate:

- B. 60 mL/hr would apply to a heavier child (about 20 kg).
- C. 75 mL/hr corresponds to about a 35 kg child.
- D. 25 mL/hr underestimates; the 4-2-1 rule yields 50.

Question 92 · Correct Answer: D

A dopamine infusion order is written to run at a 'renal dose' of 3 mcg/kg/min. For a 60 kg patient using a bag of 400 mg in 250 mL (1600 mcg/mL),...

Dose = 3 mcg/kg/min x 60 kg = 180 mcg/min = 10800 mcg/hr. Divide by concentration: 10800 / 1600 = about 6.75, roughly 7 mL/hr. Low-dose dopamine has fallen out of favor for renal protection, but the calculation illustrates infusion math.

Why the other choices are less appropriate:

- A. About 21 mL/hr corresponds to about 9 mcg/kg/min.
- B. About 28 mL/hr corresponds to about 12 mcg/kg/min.
- C. About 14 mL/hr would correspond to about 6 mcg/kg/min.

Question 93 · Correct Answer: C

A blood loss of 500 mL is estimated in a 70 kg adult whose estimated blood volume is 70 mL/kg. What percentage of the patient's blood volume has...

Estimated blood volume = 70 kg x 70 mL/kg = 4900 mL. Percentage lost = 500 / 4900 = about 10%. This corresponds to a class I hemorrhage, usually well tolerated without significant vital-sign changes.

Why the other choices are less appropriate:

- A. About 5% would be roughly 245 mL lost, not 500.
- B. About 20% would be roughly 980 mL lost.
- D. About 30% would be roughly 1470 mL lost.

Question 94 · Correct Answer: D

A nitroglycerin infusion contains 50 mg in 250 mL (200 mcg/mL) and runs at 15 mL/hr. What is the approximate delivered dose in mcg/min?

15 mL/hr x 200 mcg/mL = 3000 mcg/hr, divided by 60 gives 50 mcg/min. This is a moderate nitroglycerin dose used for blood pressure or myocardial ischemia control. Titration is guided by hemodynamic response.

Why the other choices are less appropriate:

- A. 100 mcg/min would require about 30 mL/hr.
- B. 75 mcg/min would require about 22.5 mL/hr.
- C. 25 mcg/min would require about 7.5 mL/hr.

Question 95 · Correct Answer: C

An obese patient weighs 120 kg with an ideal body weight of 60 kg. Succinylcholine for rapid sequence intubation should be dosed using which...

Succinylcholine is dosed on total body weight because its volume of distribution and the extracellular fluid and plasma cholinesterase activity increase with body mass. At 1.5 mg/kg x 120 kg, the dose is about 180 mg. Dosing on ideal weight risks inadequate intubating conditions.

Why the other choices are less appropriate:

- A. About 45 mg would be a marked underdose for this patient.
- B. Lean body weight is used for many lipophilic induction agents, not succinylcholine.
- D. Dosing on ideal body weight under-doses succinylcholine in obesity.

Question 96 · Correct Answer: D

Which drug is a selective beta-1 antagonist with an ultra-short duration of action ideal for treating intraoperative tachycardia?

Esmolol is a cardioselective beta-1 blocker metabolized rapidly by red blood cell esterases, giving an elimination half-life of about 9 minutes. This makes it ideal for acute, titratable control of intraoperative tachycardia and hypertension. Its brief action allows quick offset if hypotension or bradycardia develops.

Why the other choices are less appropriate:

- A. Metoprolol is beta-1 selective but far longer-acting than esmolol.
- B. Labetalol has combined alpha/beta blockade and a much longer duration.
- C. Propranolol is nonselective and longer-acting.

Question 97 • Correct Answer: B

Atropine is administered to treat symptomatic bradycardia. Which mechanism explains its increase in heart rate?

Atropine is a competitive muscarinic antagonist that blocks vagal (parasympathetic) tone at the sinoatrial node, increasing the heart rate. Low doses can paradoxically cause transient bradycardia via central effects. It is a first-line agent for symptomatic bradycardia.

Why the other choices are less appropriate:

- A. Inhibiting acetylcholinesterase would increase, not decrease, vagal effect.
- C. It does not directly activate calcium channels.
- D. Atropine does not act as a beta-1 agonist.

Question 98 • Correct Answer: C

Adenosine is given to terminate a stable, narrow-complex supraventricular tachycardia. Which describes its mechanism and expected effect?

Adenosine activates A1 receptors, transiently slowing or blocking AV nodal conduction, which interrupts reentrant SVT and can cause a few seconds of asystole before sinus rhythm resumes. Its half-life is only seconds, so it must be given as a rapid bolus followed by a saline flush. Patients should be warned of a brief, uncomfortable flushing or chest sensation.

Why the other choices are less appropriate:

- A. Adenosine is ultra-short-acting, not a beta blocker.
- B. Adenosine acts on the AV node via A1 receptors, not primarily sodium channels.
- D. It slows, rather than increases, AV nodal conduction.

Question 99 • Correct Answer: D

A patient with acute decompensated heart failure and pulmonary edema is given intravenous nitroglycerin. At low-to-moderate doses, its predominant...

At low-to-moderate doses, nitroglycerin predominantly dilates venous capacitance vessels, reducing preload and pulmonary congestion. At higher doses it also dilates arteries and coronary vessels. Preload reduction relieves pulmonary edema symptoms.

Why the other choices are less appropriate:

- A. It has no significant direct inotropic effect.
- B. Any tachycardia is usually reflexive, not a primary beta-1 effect.
- C. Nitroglycerin causes vasodilation, not vasoconstriction.

Question 100 • Correct Answer: D

Which antihypertensive agent used intraoperatively is a direct arterial and venous dilator that can cause cyanide toxicity with prolonged...

Sodium nitroprusside is a potent, rapidly titratable arterial and venous dilator whose metabolism releases cyanide, which can accumulate to toxic levels with high doses or prolonged infusion. Signs include metabolic acidosis and elevated mixed venous oxygen; treatment includes stopping the drug and giving sodium thiosulfate or hydroxocobalamin. Its light sensitivity requires protection of the infusion.

Why the other choices are less appropriate:

- A. Hydralazine is a direct arterial dilator but does not produce cyanide.
- B. Clevidipine is an ultra-short-acting calcium channel blocker without cyanide toxicity.
- C. Nicardipine is a calcium channel blocker without cyanide risk.

Question 101 • Correct Answer: C

A patient taking an ACE inhibitor chronically develops refractory hypotension under general anesthesia that responds poorly to phenylephrine and...

Chronic ACE inhibition blunts the renin-angiotensin response, contributing to refractory vasodilatory hypotension under anesthesia. Vasopressin restores vascular tone through V1 receptors independent of the adrenergic and angiotensin systems and is often effective when catecholamines fail. Recognizing this interaction guides management.

Why the other choices are less appropriate:

- A. Nitroglycerin is a vasodilator and is contraindicated here.
- B. Esmolol lowers blood pressure and would worsen the hypotension.
- D. Additional phenylephrine is often ineffective in this ACE-inhibitor-related refractory hypotension.

Question 102 • Correct Answer: B

Which physiologic change explains the reduced anesthetic requirement (lower MAC) seen in elderly patients?

MAC decreases by roughly 6% per decade after age 40 due to age-related reductions in neuronal density and neurotransmitter activity in the central nervous system. This means elderly patients require lower anesthetic concentrations. Reduced clearance and altered pharmacokinetics further increase sensitivity.

Why the other choices are less appropriate:

- A. Neuron numbers decline, not increase, with age.
- C. MAC reflects central sensitivity, not the volume of distribution.
- D. Clearance typically decreases with age, contributing to prolonged effects.

Question 103 • Correct Answer: B

The Bohr effect describes which physiologic relationship important for oxygen delivery?

The Bohr effect describes how increased carbon dioxide and hydrogen ion concentration (lower pH) reduce hemoglobin's affinity for oxygen, promoting oxygen release in metabolically active tissues. In the lungs, the reverse improves oxygen uptake. This complements the Haldane effect for CO₂ transport.

Why the other choices are less appropriate:

- A. Decreased 2,3-DPG increases oxygen affinity, opposite to what is stated.
- C. Increased temperature decreases, not increases, oxygen affinity.
- D. That describes the Haldane effect, which concerns CO₂ carriage, not the Bohr effect.

Question 104 • Correct Answer: D

During the cardiac cycle, coronary blood flow to the left ventricle occurs PREDOMINANTLY during which phase, and why?

Left ventricular myocardial perfusion occurs mainly during diastole because systolic contraction compresses the intramural coronary vessels and impedes flow. This is why tachycardia, which shortens diastole, and low diastolic pressure both threaten myocardial perfusion. Maintaining diastolic pressure is key in ischemic heart disease.

Why the other choices are less appropriate:

- A. Isovolumic contraction has high wall tension that restricts flow.
- B. Flow is not equal; it is diastole-predominant for the left ventricle.
- C. Systolic compression actually impedes left ventricular coronary flow.

Question 105 • Correct Answer: D

A patient with a large pulmonary shunt fails to improve oxygenation despite increasing FiO₂ to 1.0. Which concept BEST explains this finding?

A true shunt occurs when blood passes from the right to left heart without contacting ventilated alveoli, so raising FiO₂ has little effect because that blood never sees the oxygen. This distinguishes shunt from simple V/Q mismatch, which improves with supplemental oxygen. Treatment targets recruiting collapsed lung with PEEP or addressing the shunt source.

Why the other choices are less appropriate:

- A. Simple V/Q mismatch responds to oxygen, whereas a true shunt does not.
- B. Dead space is ventilation without perfusion and affects CO₂ more than oxygenation.
- C. Diffusion limitation typically improves with high FiO₂, unlike a true shunt.

Question 106 • Correct Answer: A

Which benzodiazepine reversal agent is a competitive antagonist at the GABA-A benzodiazepine site, and what is a key caution with its use?

Flumazenil competitively antagonizes benzodiazepines at the GABA-A receptor to reverse sedation. In patients chronically dependent on benzodiazepines or with mixed overdoses, it can precipitate seizures and acute withdrawal. Its duration is shorter than many benzodiazepines, so resedation may occur.

Why the other choices are less appropriate:

- B. Naloxone reverses opioids, not benzodiazepines.
- C. Physostigmine treats central anticholinergic syndrome, not benzodiazepine sedation.
- D. Sugammadex reverses aminosteroid neuromuscular blockers, not benzodiazepines.

Question 107 • Correct Answer: C

A patient develops severe hypertension and tachycardia after receiving an intravascular epinephrine-containing test dose during epidural...

An epidural test dose typically contains local anesthetic plus epinephrine (for example 15 mcg). A rapid rise in heart rate and blood pressure after injection indicates intravascular placement, prompting catheter repositioning. A rapid, dense motor and sensory block instead suggests intrathecal placement.

Why the other choices are less appropriate:

- A. Intrathecal injection is detected by rapid dense spinal block, not a tachycardic epinephrine response.
- B. An epidural hematoma presents later with neurologic deficits, not an acute test-dose response.
- D. Subdural spread produces a patchy, delayed block, not an acute epinephrine response.

Question 108 • Correct Answer: D

A patient with myasthenia gravis is scheduled for thymectomy. Which statement about neuromuscular blocker sensitivity is correct?

In myasthenia gravis, the reduced number of functional acetylcholine receptors makes patients markedly sensitive to nondepolarizing blockers, so doses are reduced. They tend to be relatively resistant to succinylcholine, needing higher doses. Careful titration with neuromuscular monitoring is essential.

Why the other choices are less appropriate:

- A. The sensitivities are reversed; they are sensitive to nondepolarizers, not resistant.
- B. Reversal can be used cautiously; it is not universally contraindicated.
- C. Their response is abnormal due to receptor loss, not normal.

Question 109 • Correct Answer: A

A patient with carcinoid syndrome undergoing tumor resection develops flushing and severe hypotension during manipulation. Which agent is MOST...

Carcinoid tumors release vasoactive mediators (serotonin, histamine, kinins) that cause flushing and hemodynamic instability. Octreotide, a somatostatin analog, inhibits mediator release and is the treatment of choice for carcinoid crisis. Catecholamines can paradoxically trigger further mediator release and are generally avoided.

Why the other choices are less appropriate:

- B. Ephedrine, like other sympathomimetics, may trigger mediator release.
- C. Histamine is one of the offending mediators, not a treatment.
- D. Epinephrine can provoke mediator release and worsen a carcinoid crisis.

Question 110 • Correct Answer: C

A pulse oximeter uses two wavelengths of light (660 nm red and 940 nm infrared). Which principle allows it to distinguish oxygenated from...

Pulse oximetry relies on the Beer-Lambert law: oxyhemoglobin and deoxyhemoglobin absorb 660 nm (red) and 940 nm (infrared) light in different proportions. The device compares pulsatile absorbance at these wavelengths to compute oxygen saturation. Carboxyhemoglobin and methemoglobin can distort readings because of their absorbance characteristics.

Why the other choices are less appropriate:

- A. It does not rely on magnetic properties of hemoglobin.
- B. Hemoglobin absorbs, rather than emits, the light used.
- D. Pulse oximetry uses light absorbance, not ultrasound reflection.

Question 111 • Correct Answer: D

Capnography measures exhaled carbon dioxide based on which physical principle?

Capnography most commonly uses infrared spectroscopy because carbon dioxide strongly absorbs infrared light at about 4.3 micrometers. The degree of absorption is proportional to CO₂ concentration in the sampled gas. This allows continuous measurement of end-tidal CO₂ and confirmation of ventilation.

Why the other choices are less appropriate:

- A. CO₂ is not measured by electrochemical oxidation in standard capnographs.
- B. Oxygen, not CO₂, is paramagnetic; that principle is used for oxygen analysis.
- C. CO₂ measurement uses infrared absorption, not ultraviolet reflection.

Question 112 • Correct Answer: A

An oxygen analyzer in the anesthesia circuit commonly uses which physical property of oxygen for measurement?

Oxygen is strongly paramagnetic, meaning it is attracted into a magnetic field, and this property is exploited by paramagnetic oxygen analyzers for rapid, accurate measurement. Galvanic (fuel) cells and polarographic sensors are alternative technologies. Oxygen's paramagnetism is unusual among respiratory gases.

Why the other choices are less appropriate:

- B. Oxygen does not absorb infrared strongly the way CO₂ and volatile agents do.
- C. Oxygen is not measured by ultraviolet fluorescence.
- D. Density is not the basis for standard oxygen analyzers.

Question 113 • Correct Answer: A

A patient requires a phenylephrine infusion at 0.5 mcg/kg/min. The patient weighs 70 kg and the bag is mixed at 100 mcg/mL. What is the...

Dose = 0.5 mcg/kg/min x 70 kg = 35 mcg/min = 2100 mcg/hr. Divide by concentration: 2100 / 100 = 21 mL/hr. This provides steady alpha-agonist support for blood pressure.

Why the other choices are less appropriate:

- B. About 32 mL/hr would correspond to about 0.75 mcg/kg/min.
- C. About 42 mL/hr would be double the correct rate.
- D. About 11 mL/hr corresponds to roughly half the ordered dose.

Question 114 • Correct Answer: B

A heparin infusion is ordered at 18 units/kg/hr for an 80 kg patient using a bag of 25,000 units in 250 mL (100 units/mL). What is the approximate...

Dose = 18 units/kg/hr x 80 kg = 1440 units/hr. Divide by concentration: 1440 / 100 = 14.4, about 14 mL/hr. Heparin infusions are titrated to a target aPTT or anti-Xa level.

Why the other choices are less appropriate:

- A. About 7 mL/hr corresponds to roughly half the ordered dose.
- C. About 22 mL/hr overestimates the calculated rate.
- D. About 29 mL/hr is about double the correct value.

Question 115 • Correct Answer: B

A patient has an arterial pH of 7.25, PaCO₂ of 30 mmHg, and HCO₃ of 13 mEq/L. Which primary acid-base disturbance is present?

A low pH with a low bicarbonate indicates a primary metabolic acidosis, and the low PaCO₂ reflects respiratory compensation through hyperventilation (Winter's formula predicts PaCO₂ of about $1.5 \times 13 + 8 = 27.5$, near the measured 30). The pattern is a metabolic acidosis with appropriate respiratory compensation. Identifying the anion gap would further characterize the cause.

Why the other choices are less appropriate:

- A. Metabolic alkalosis would show a high pH and high bicarbonate.
- C. Respiratory acidosis would show a high, not low, PaCO₂.
- D. Respiratory alkalosis would show a high pH from a primary low PaCO₂, not a low pH.

Question 116 • Correct Answer: B

Which inhaled anesthetic has the LOWEST potency, reflected by the HIGHEST minimum alveolar concentration?

MAC is inversely related to potency, so the agent with the highest MAC is the least potent. Nitrous oxide has a MAC of about 104%, meaning it cannot reach 1 MAC at normobaric conditions and is the least potent listed. Isoflurane (~1.15%), sevoflurane (~2%), and desflurane (~6%) are all far more potent.

Why the other choices are less appropriate:

- A. Sevoflurane's MAC (~2%) is far lower than nitrous oxide's.
- C. Desflurane's MAC (~6%) is still far below the 104% of nitrous oxide.
- D. Isoflurane's MAC (~1.15%) reflects high potency.

Question 117 • Correct Answer: D

Which property BEST explains why a single bolus of thiopental produces rapid awakening despite the drug's long elimination half-life?

After a bolus, thiopental's effect terminates primarily by redistribution from the highly perfused brain to muscle and, later, fat, rapidly lowering brain concentration and producing awakening. The long elimination half-life reflects slow metabolism, which matters mainly after repeated dosing or infusion, when the drug can accumulate. This distinction between redistribution and elimination is a core pharmacokinetic concept.

Why the other choices are less appropriate:

- A. Thiopental is not rapidly excreted unchanged by the kidney.
- B. Thiopental is not metabolized at the neuromuscular junction.
- C. Hepatic clearance is slow; awakening after a bolus is due to redistribution, not clearance.

Question 118 • Correct Answer: A

Which structure is responsible for the majority of airway resistance in a normal, spontaneously breathing adult?

Although individual small airways are narrow, their enormous combined cross-sectional area makes their total resistance low. The medium-sized bronchi contribute the greatest portion of airway resistance in the normal adult. In diseases like asthma, however, the small airways become a major site of increased resistance.

Why the other choices are less appropriate:

- B. Alveolar ducts contribute minimal resistance.
- C. Small bronchioles have a large combined cross-sectional area and low total resistance in health.
- D. The trachea alone does not account for the majority of resistance.

Question 119 • Correct Answer: A

A patient with chronic obstructive pulmonary disease has air trapping and dynamic hyperinflation during mechanical ventilation. Which ventilator...

Auto-PEEP results from incomplete exhalation and air trapping, so allowing more time to exhale reduces it. Lowering the respiratory rate and shortening inspiratory time (increasing the I:E ratio toward longer expiration) gives the lungs time to empty. This reduces dynamic hyperinflation and its hemodynamic consequences.

Why the other choices are less appropriate:

- B. Large tidal volumes increase the volume that must be exhaled, worsening trapping.
- C. Increasing the rate shortens expiratory time and worsens air trapping.
- D. Adding high extrinsic PEEP does not reliably reduce auto-PEEP and can worsen hyperinflation.

Question 120 · Correct Answer: D

Sugammadex reverses rocuronium by which mechanism, and which patient counseling point is important for women?

Sugammadex is a modified gamma-cyclodextrin that encapsulates rocuronium (and vecuronium), rapidly removing free drug from the neuromuscular junction. It can bind progesterone, so patients on hormonal contraceptives should use an additional non-hormonal method for about 7 days. This counseling point is important for reversal in women of childbearing potential.

Why the other choices are less appropriate:

- A. It does not work by increasing renal clearance of acetylcholine.
- B. Sugammadex does not inhibit acetylcholinesterase like neostigmine.
- C. It is not a receptor agonist and has no grapefruit interaction.

DOMAIN II: EQUIPMENT, INSTRUMENTATION & TECHNOLOGY

Question 121 · Correct Answer: C

During a machine check, a CRNA fills the isoflurane vaporizer with sevoflurane by mistake using an agent-specific filling device that was...

Modern vaporizers use agent-specific keyed filling devices (e.g., Selectatec, Quik-Fil) designed so that only the matching agent bottle adapter fits the vaporizer. This prevents the wrong agent from being filled. If this system is bypassed (e.g., using the wrong adapter forcibly, or a device that was improperly stored and mislabeled), the safety is defeated. PISS prevents wrong gas cylinders from being connected. DISS is for high-pressure pipeline connections. The proportioning system maintains O₂/N₂O ratios.

Why the other choices are less appropriate:

- A. PISS applies to gas cylinders, not liquid vaporizer filling.
- B. DISS is for pipeline gas connections (O₂, N₂O, air) - not vaporizers.
- D. The proportioning system prevents hypoxic gas mixtures but has no role in vaporizer filling.

Question 122 · Correct Answer: B

A patient's arterial line waveform shows a sharp spike systolic pressure that is 40 mmHg higher than the NIBP reading. The diastolic pressure is...

An underdamped (resonant) arterial line waveform produces a falsely elevated systolic pressure and a falsely low diastolic pressure, with the mean pressure remaining relatively accurate. This occurs when the natural frequency of the catheter-transducer system matches the frequency of the arterial pulse wave, causing resonance. It can be confirmed by performing a fast-flush test: an underdamped system will show several oscillations before returning to baseline. Adding a compliant tubing segment or using an optimally damped system corrects this.

Why the other choices are less appropriate:

- A. Overdamping produces falsely LOW systolic and falsely HIGH diastolic - the opposite pattern.
- C. Arterial vasospasm would reduce the pulse amplitude, not increase it selectively.
- D. Aortic regurgitation causes a widened pulse pressure but is a genuine hemodynamic finding, not a monitoring artifact.

Question 123 · Correct Answer: B

A CRNA attempts direct laryngoscopy with a Macintosh 3 blade and obtains a Cormack-Lehane grade 3 view (epiglottis only visible). Which device...

For a grade 3 Cormack-Lehane view (epiglottis visible but no glottis), the next step is to use a bougie (Eschmann introducer) guided under the epiglottis while applying BURP/external laryngeal manipulation to improve the view. The bougie's tip can often be passed into the trachea even without directly seeing the glottis - tactile confirmation is felt as the bougie 'clicks' across tracheal rings. This is a standard rescue technique before escalating to video laryngoscopy or awake fiberoptic intubation.

Why the other choices are less appropriate:

- A. Switching to a Miller blade may improve the view, but the bougie with BURP is the most efficient next step with existing equipment.
- C. Blind nasal intubation is rarely performed and has a higher complication rate.
- D. Cricothyrotomy is a CICO (cannot intubate, cannot oxygenate) rescue - not indicated when oxygenation is maintained.

Question 124 · Correct Answer: C

A patient's BIS monitor reads 35 during maintenance of anesthesia with sevoflurane 1.5 MAC. The CRNA considers reducing the anesthetic. Which...

The target BIS for general anesthesia is 40-60. A value of 35 suggests deeper anesthesia than necessary. Titrating to a BIS of 40-60 is associated with reduced drug use, faster emergence, and in some studies reduced incidence of postoperative cognitive dysfunction. At 1.5 MAC, the patient is receiving substantially more than the minimum required to prevent awareness. However, the CRNA should confirm the clinical picture (hemodynamics, movement) before reducing, as BIS can be affected by artifacts.

Why the other choices are less appropriate:

- A. 35 is below the target range and represents unnecessarily deep anesthesia.
- B. BIS of 35 is not 'dangerously low' - it simply represents deeper-than-necessary anesthesia.
- D. BIS is validated for use with volatile anesthetics and IV agents alike - it is a useful guide when properly applied.

Question 125 · Correct Answer: C

Which of the following is the MOST reliable indicator that an endotracheal tube is correctly placed in the trachea immediately after intubation?

While visualizing the tube passing through the cords (D) provides confirmation at the time of intubation, a consistent square-wave ETCO₂ waveform sustained over multiple breaths (3-5 consecutive breaths minimum) is the MOST reliable confirmatory test of tracheal intubation. Esophageal intubation can produce 1-2 CO₂ waves from gastric CO₂, but this rapidly disappears. Breath sounds and chest rise can be misleading in obese patients or with left mainstem intubation. Capnography is the ASA standard for ETT confirmation.

Why the other choices are less appropriate:

- A. Breath sounds can be heard over the stomach with esophageal intubation, or may be equal even with right mainstem intubation.
- B. Chest rise is difficult to assess in obese patients and does not confirm tracheal placement.
- D. Viewing the tube through the cords is immediate confirmation but the tube may subsequently migrate; sustained capnography confirms ongoing tracheal placement.

Question 126 · Correct Answer: B

During a case using a circle system at 2 L/min fresh gas flow, the exhaled CO₂ readings begin rising progressively over 45 minutes. The peak flow...

In a circle rebreathing system, CO₂ is absorbed by the CO₂ absorbent (soda lime or Amsorb). As the absorbent becomes exhausted, CO₂ is no longer absorbed - rebreathed CO₂ accumulates, causing progressive rise in inspired CO₂ (FiCO₂) and exhaled CO₂. This manifests as a rising baseline on the capnography waveform and progressive hypercapnia. The solution is to replace the CO₂ absorbent immediately. The color change from white to purple in the canister confirms exhaustion.

Why the other choices are less appropriate:

- A. Endobronchial intubation would cause asymmetric breath sounds and reduced compliance, not rising CO₂.
- C. Bronchospasm increases airway pressure and reduces tidal volume but does not directly cause rising CO₂ rebreathing.
- D. Ventilator disconnection would cause a drop in ETCO₂ to zero, not a progressive rise.

Question 127 · Correct Answer: B

A CRNA is monitoring a patient with a pulmonary artery (Swan-Ganz) catheter. The measured PCWP is 22 mmHg. In the context of a patient with flash...

Pulmonary capillary wedge pressure (PCWP) is a surrogate for left atrial pressure and, in the absence of mitral stenosis, approximates LVEDP. Normal PCWP is 6-12 mmHg. A PCWP of 22 mmHg indicates elevated left ventricular end-diastolic pressure - consistent with LV failure, volume overload, or diastolic dysfunction - explaining the flash pulmonary edema. In mitral stenosis, PCWP overestimates LVEDP. PA catheter use has largely been replaced by TEE for direct ventricular assessment.

Why the other choices are less appropriate:

- A. Normal PCWP is 6-12 mmHg; 22 is significantly elevated.
- C. PCWP reflects left-sided filling, not right ventricular preload (which is reflected by CVP).
- D. Hypoxic pulmonary vasoconstriction causes elevated PA pressures, not elevated wedge pressure.

Question 128 · Correct Answer: B

A 4-year-old child (18 kg) requires intubation for emergency appendectomy. Using the age-based formula, what is the correct uncuffed ETT size, and...

Age-based ETT formula: $(\text{Age}/4) + 4 = (4/4) + 4 = 1 + 4 = 5.0$ mm ID. For cuffed ETTs in children (now preferred even in infants and neonates), the cuff pressure should be maintained at less than 20-30 cmH₂O (commonly cited as <20 cmH₂O to prevent tracheal mucosal ischemia, with some sources citing <30 cmH₂O as the upper limit). The tube insertion depth at the lip: weight (kg) + 10 = 18 + 10 = 28 cm, or age/2 + 12 = 14 cm. Always confirm with bilateral breath sounds and capnography.

Why the other choices are less appropriate:

- A. Correct tube size, but 25 cmH₂O is the cautious limit - <20 cmH₂O is more protective.
- C. 4.5 would be for a 2-year-old $(2/4 + 4 = 4.5)$.
- D. 5.5 would be for a 6-year-old $(6/4 + 4 = 5.5)$.

Question 129 · Correct Answer: B

During a posterior fossa craniotomy in the sitting position, the TEE suddenly shows bubbles in the right atrium. ETCO₂ drops from 38 to 18 mmHg....

Venous air embolism (VAE) management requires stopping the source of air entry. The first step is to notify the surgeon to flood the operative field with saline (water seal prevents more air from entering open venous sinuses) and apply digital pressure or bone wax to the wound edges. Simultaneously: place patient in Durant position (left lateral decubitus + Trendelenburg), 100% O₂, discontinue N₂O, attempt aspiration of air through CVC at RA, and provide hemodynamic support.

Why the other choices are less appropriate:

- A. PEEP can help but increases CVP and may worsen VAE by increasing right heart pressure - not the first priority.
- C. Epinephrine is for cardiac arrest; hemodynamic support is secondary to stopping the air source.
- D. Carotid sinus massage has no role in VAE management.

Question 130 · Correct Answer: B

A CRNA performing spinal anesthesia for a cesarean section uses a 25-gauge Whitacre (pencil-point) needle. Which statement BEST describes why this...

Traditional cutting needles (Quincke/bevel-tip) cut dural collagen fibers, leaving a persistent hole that allows CSF leakage. Pencil-point needles (Whitacre, Sprotte) have a rounded, non-cutting tip with a side-opening port. They separate dural fibers rather than cutting them, allowing the fibers to spring back and self-seal after needle withdrawal, significantly reducing CSF leakage and PDPH. Smaller gauge also helps, but the design is the primary mechanism. Using a 25-27g Whitacre reduces PDPH incidence from ~36% with a 16g Tuohy to <1%.

Why the other choices are less appropriate:

- A. Pencil-point design reduces nerve fiber cutting but the primary benefit is dural fiber separation.
- C. Smaller gauge helps but the design is the primary mechanism of PDPH reduction.
- D. This is incorrect - the pencil-point creates a smaller, self-sealing hole.

Question 131 · Correct Answer: C

A CRNA is using the Mapleson D (Bain) circuit for controlled ventilation in a 70 kg patient. The patient's minute ventilation is 7 L/min....

For the Mapleson D (Bain) circuit, fresh gas flow must be approximately 2x the patient's minute ventilation to prevent rebreathing during controlled (mechanical) ventilation. For spontaneous ventilation, 3x MV is required. At 7 L/min MV: $2 \times 7 = 14$ L/min for controlled ventilation. The Mapleson A (Magill) circuit is the most efficient for spontaneous ventilation (FGF = MV), while the Mapleson D is most efficient for controlled ventilation.

Why the other choices are less appropriate:

- A. Equal to MV is insufficient and will result in CO₂ rebreathing.
- B. Half of MV is far too low and will cause significant hypercarbia.
- D. 3x MV is required for spontaneous ventilation on a Mapleson D, not controlled.

Question 132 · Correct Answer: B

During a laparoscopic cholecystectomy, peak airway pressure suddenly increases from 22 to 45 cmH₂O but plateau pressure remains at 20 cmH₂O. The...

The key distinction here is: high peak pressure + NORMAL plateau pressure = increased airway RESISTANCE (not compliance problem). The difference between peak and plateau pressure reflects the resistance component of the airway and ETT. Causes include: ETT kink, patient biting the tube, mucus plugging, bronchospasm, or laryngospasm. Pneumothorax and pulmonary edema would increase BOTH peak and plateau pressures (reduced lung compliance). Check the ETT for kinking, suction, administer bronchodilators, consider bite block.

Why the other choices are less appropriate:

- A. Pneumothorax reduces compliance, increasing both peak AND plateau pressure.
- C. Pulmonary edema reduces compliance - increases both peak and plateau.
- D. Ventilator malfunction would be a diagnosis of exclusion after ruling out patient/airway causes.

Question 133 · Correct Answer: B

A CRNA is using a standard pulse oximeter on a patient who was found unconscious at a house fire with suspected carbon monoxide (CO) poisoning....

Standard pulse oximeters use two wavelengths of light (660 nm and 940 nm) and cannot distinguish between oxyhemoglobin (HbO₂) and carboxyhemoglobin (COHb). COHb absorbs light similarly to HbO₂ at 660 nm, causing it to be read as oxygenated hemoglobin. A patient with 40% COHb could show SpO₂ of 97% while being severely poisoned. The only way to diagnose CO poisoning is with co-oximetry (arterial blood gas analyzed with a multiple-wavelength co-oximeter). Treat with 100% FiO₂ regardless.

Why the other choices are less appropriate:

- A. This is the dangerous misinterpretation - SpO₂ is falsely elevated in CO poisoning.
- C. CO poisoning does not cause SpO₂ to read <85% on a standard pulse oximeter.
- D. The device is not malfunctioning - it is working as designed but lacks the ability to detect COHb.

Question 134 · Correct Answer: D

A nurse anesthetist checks the oxygen E-cylinder before transporting a patient. The cylinder gauge reads 500 psig. The transport will require 3...

Using the E-cylinder factor of 0.3 L/psig: 500 psig x 0.3 = 150 liters remaining. At 4 L/min: 150 / 4 = 37.5 minutes of supply. A 3-minute transport requires only 12 liters (4 L/min x 3 min), so 150 liters is more than sufficient. Always maintain a safety margin - standard practice is to have at least 30 minutes of reserve above estimated transport time, so this cylinder is safe for the described scenario.

Why the other choices are less appropriate:

- A. 150 liters is correct (500 x 0.3), not 100 liters.
- B. Correct math but incorrectly labeled as 'No' - 150 liters at 4 L/min lasts 37.5 minutes, more than enough.
- C. 500 psig is low for a full case but is adequate for a short transport.

Question 135 · Correct Answer: B

During a craniotomy with neuromonitoring (SSEPs and MEPs), the neurophysiologist reports a 50% drop in MEP amplitude. Which anesthetic agent...

Motor evoked potentials (MEPs) are exquisitely sensitive to volatile anesthetic agents in a dose-dependent manner. Increasing sevoflurane (or any volatile) causes progressive MEP suppression. The standard for neuromonitoring cases is to use TIVA (propofol + opioid infusion) and keep volatile below 0.5 MAC if any is used. A doubling of sevoflurane from 0.5 to 1.0 MAC could easily cause the described 50% amplitude drop. SSEPs are similarly affected but MEPs are more sensitive.

Why the other choices are less appropriate:

- A. Modest increases in propofol have less impact on MEPs than volatile agents - TIVA with propofol is the preferred technique.
- C. Opioids (fentanyl) have minimal effect on MEPs at clinical doses.
- D. Dexmedetomidine has modest, manageable effects on SSEPs and minimal impact on MEPs.

Question 136 · Correct Answer: D

A CRNA needs to perform rapid sequence intubation in the emergency department where the only available agent is rocuronium 1.2 mg/kg. Sugammadex...

Rocuronium 1.2 mg/kg provides intubating conditions equivalent to succinylcholine 1.5 mg/kg for RSI. However, its duration of action is 60-90 minutes, which creates risk if the intubation fails and the patient cannot be oxygenated (CICO). Without sugammadex, there is no reversal option until the block wears off. Therefore, while rocuronium 1.2 mg/kg RSI is acceptable, the provider must have a thorough CICO plan (supraglottic airway, cricothyrotomy). If sugammadex is available in the facility at all, it should be confirmed before proceeding.

Why the other choices are less appropriate:

- A. Correct that sugammadex should be present, but this answer understates the commitment involved.
- B. 0.6 mg/kg does not provide rapid enough onset for RSI.
- C. Rocuronium can be used for RSI, especially in succinylcholine contraindications.

Question 137 · Correct Answer: B

Which mechanism explains why a Bain circuit is described as 'coaxial'?

The Bain circuit is a coaxial modification of the Mapleson D system. 'Coaxial' means one tube runs inside another. In the Bain circuit, the fresh gas supply tubing runs inside the outer corrugated (exhalation) tube. Fresh gas flows from the machine through the inner tube to the patient end, while exhaled gas flows back through the outer corrugated tube toward the reservoir bag and APL valve. A key safety concern: if the inner fresh gas tube disconnects internally, the patient will rebreathe exhaled gas. Check by occluding the inner tube and watching for the flush to distend the bag.

Why the other choices are less appropriate:

- A. A Bain circuit uses a single bag/APL; it is not a dual-bag system.
- C. This is backwards - fresh gas is in the inner tube, exhaled gas in the outer.
- D. The Bain circuit has no CO2 absorber at all.

Question 138 · Correct Answer: C

A patient undergoing a right total hip replacement in lateral decubitus develops SpO2 of 88% 30 minutes after positioning. Breath sounds are...

In the right lateral decubitus position, the left lung is dependent and the right lung is non-dependent (operative side, up). If the ETT migrates into the LEFT mainstem bronchus (the longer, straighter bronchus when positioned left-side down), only the left (dependent) lung is ventilated. This causes reduced breath sounds on the right (non-dependent side), atelectasis of the right lung, and hypoxemia. Repositioning to re-expand the right lung and withdrawing the ETT to above the carina resolves this. Confirm ETT position with FOB.

Why the other choices are less appropriate:

- A. Dependent lung (left) atelectasis in a lateral position would cause hypoxemia but breath sounds would be decreased on the left.
- B. Pneumothorax on the operative (non-dependent) side is possible but less common - would be accompanied by increased peak pressure.
- D. Pleural effusion would be bilateral with massive overload; unilateral drop suggests ETT migration or pneumothorax.

Question 139 · Correct Answer: B

During machine checkout, the CRNA performs a low-pressure leak test and identifies a leak. What is the MOST common cause of this type of leak?

The low-pressure system (from flowmeters to the common gas outlet, including the vaporizer) is the most common site of leaks in the anesthesia machine. The most frequent cause is a faulty, missing, or improperly seated vaporizer O-ring or an incompletely tightened filler cap. These small rubber seals degrade over time and must be inspected regularly. The low-pressure leak test (oxygen flush test with machine master switch off, or negative pressure test) is specifically designed to detect these downstream leaks.

Why the other choices are less appropriate:

- A. Cylinder yoke leaks are high-pressure system problems detected by a different test.
- C. Pressure regulators are in the high/intermediate pressure system, not low pressure.
- D. Pipeline check valves are intermediate pressure components.

Question 140 · Correct Answer: B

A TEE exam is performed on an intubated patient after induction. Which of the following findings would be MOST concerning for acute myocardial...

TEE is an extremely sensitive intraoperative monitor for myocardial ischemia. Regional wall motion abnormalities (RWMAs) - specifically, new hypokinesis, akinesis, or dyskinesis in a coronary artery distribution - are the earliest sign of myocardial ischemia, preceding ECG changes by minutes. Hypokinesis in the LAD distribution (anterior wall, septum, apex) suggests anterior ischemia. This finding requires immediate assessment: check heart rate, blood pressure, correct anemia, consider vasopressors vs. vasodilators based on etiology, and notify the surgical team.

Why the other choices are less appropriate:

- A. Trace MR is a common finding and not acutely concerning in most patients.
- C. Hyperdynamic LV with decreased ESV suggests sympathetic stimulation or hypovolemia, not ischemia.
- D. Mild aortic calcification is a degenerative finding; preserved leaflet excursion indicates no hemodynamically significant stenosis.

Question 141 · Correct Answer: B

During the anesthesia machine checkout, a CRNA closes the oxygen cylinder valve, empties the pipeline, and observes the oxygen flowmeter fall...

The fail-safe device (oxygen pressure failure device such as the Ohmeda pressure sensor shutoff or Dräger oxygen failure protection device) interrupts or proportionally reduces the flow of nitrous oxide and other gases when oxygen supply pressure falls below a threshold (about 20-30 psig). This prevents delivery of a hypoxic mixture during oxygen supply failure.

Why the other choices are less appropriate:

- A. The second-stage regulator provides constant pressure to flow control valves but does not shut off N₂O on O₂ failure.
- C. DISS prevents incorrect pipeline hose connections and is unrelated to shutting off N₂O when O₂ pressure falls.
- D. The hypoxic guard links O₂ and N₂O flow mechanically/pneumatically to maintain a minimum FiO₂, but it responds to flowmeter settings, not to loss of O₂ supply pressure.

Question 142 · Correct Answer: B

On a contemporary anesthesia machine, the oxygen flow control knob is distinguished from other gas knobs by all of the following EXCEPT which feature?

In the United States the oxygen flow control knob is conventionally located on the far RIGHT of the flowmeter bank so that oxygen is the last gas added to the mixture downstream, reducing the chance of a hypoxic mixture from a leak. The oxygen knob is touch-coded: fluted, larger, and projecting farther than the other knobs, so the incorrect statement is that it sits on the far right only as its distinguishing 'knob' feature.

Why the other choices are less appropriate:

- A. The oxygen knob is larger in diameter, another true touch-coding feature.
- C. The oxygen knob projects farther out than adjacent knobs as part of touch coding, so this is true.
- D. The oxygen knob is deliberately fluted for tactile identification, so this is a true feature.

Question 143 · Correct Answer: D

A CRNA performs the machine checkout and needs to verify the low-pressure system for leaks on a machine with a check valve upstream of the common...

Machines with a check valve near the common gas outlet (traditional Ohmeda design) require a NEGATIVE-pressure leak test using a suction bulb, because a positive-pressure test cannot push gas back through the closed check valve to detect a low-pressure leak. The suction bulb evacuates the low-pressure circuit and reveals leaks by re-inflating.

Why the other choices are less appropriate:

- A. A positive-pressure circuit test checks the breathing circuit, not the low-pressure system upstream of a check valve.
- B. There is no standard 'vaporizer overfill test' for leak detection.
- C. The oxygen flush tests high-pressure/pipeline components, not vaporizer/low-pressure leaks.

Question 144 · Correct Answer: A

The oxygen flush valve on a standard anesthesia machine delivers oxygen at what approximate flow rate, and from where in the circuit does this...

The oxygen flush delivers 35-75 L/min of oxygen directly to the common gas outlet from a point UPSTREAM of the flowmeters and vaporizers, so the flush oxygen bypasses any anesthetic vapor. Because it bypasses the vaporizers, prolonged flush can cause awareness (dilution of agent) and its high flow can cause barotrauma if used during inspiration on some ventilators.

Why the other choices are less appropriate:

- B. 100-120 L/min overstates the flush flow and misplaces its origin.
- C. The flush draws from pipeline/machine supply, not exclusively the cylinder, and 10-15 L/min is too low.
- D. 1-5 L/min is far too low; that is typical of fresh gas flow, not the flush.

Question 145 · Correct Answer: C

A hypoxic mixture can still be delivered despite a functioning oxygen ratio (proportioning) system under which circumstance?

Proportioning systems only link oxygen and nitrous oxide; they cannot prevent hypoxia from a leak downstream of the flow valves, from administration of a third inert gas such as helium (which is not linked), from a defective proportioning device, or from wrong gas in the oxygen pipeline. These are recognized limitations of the hypoxic guard.

Why the other choices are less appropriate:

- A. High fresh gas flow does not itself create hypoxia when the proportioning system is intact.
- B. The fail-safe device protects against O₂ supply failure and does not cause hypoxia.
- D. Setting 100% oxygen delivers a safe FiO₂, not a hypoxic mixture.

Question 146 · Correct Answer: C

In the United States, a full oxygen E-cylinder contains approximately 660 L and reads about 2000 psig. A patient is being transported with oxygen...

Because oxygen in an E-cylinder is stored as a gas, pressure is directly proportional to volume. At 1000 psig (half of 2000) the cylinder holds about 330 L; 330 L divided by 4 L/min is roughly 82 minutes, or about 80 minutes. This linear relationship allows quick bedside estimation for transport safety.

Why the other choices are less appropriate:

- A. 40 minutes underestimates the remaining volume; that would apply to a flow near 8 L/min.
- B. 165 minutes corresponds to a full cylinder at this flow, not one at 1000 psig.
- D. 20 minutes grossly underestimates the available volume.

Question 147 · Correct Answer: A

Unlike an oxygen E-cylinder, a nitrous oxide E-cylinder gauge reads a nearly constant pressure of about 745 psig until most of the contents are...

Nitrous oxide is stored predominantly as a LIQUID in equilibrium with its vapor; the gauge reflects the vapor pressure of the liquid (about 745 psig at room temperature), which remains constant as long as liquid remains. Only after essentially all liquid has vaporized does the pressure begin to fall, so the gauge is not a reliable indicator of remaining volume until near the end. Weighing the cylinder is the reliable method.

Why the other choices are less appropriate:

- B. Compressed gas storage (as with oxygen) produces a pressure that falls linearly, which is not what nitrous oxide shows.
- C. The regulator does not mask cylinder pressure on the gauge.
- D. Internal volume differences do not explain the constant-pressure behavior; the liquid-vapor equilibrium does.

Question 148 • Correct Answer: C

In the US color-coding system for medical gas cylinders, which color correctly matches its gas?

In the United States, oxygen cylinders are GREEN, nitrous oxide is blue, carbon dioxide is gray, air is yellow, and helium is brown. Knowing the US convention (which differs from the international ISO standard where oxygen is white) is essential for safe cylinder identification.

Why the other choices are less appropriate:

- A. Nitrous oxide is blue in the US, not green.
- B. Carbon dioxide is gray in the US, not blue.
- D. Air is yellow in the US; brown denotes helium.

Question 149 • Correct Answer: A

The Pin Index Safety System (PISS) and the Diameter Index Safety System (DISS) prevent misconnections at which points, respectively?

The Pin Index Safety System uses a unique pin-and-hole arrangement on small cylinders (E-cylinders) and their hanger yokes to prevent mounting the wrong gas cylinder. The Diameter Index Safety System uses gas-specific diameters on threaded, non-interchangeable pipeline/hose connectors to prevent wrong pipeline hookups. Both are keyed, non-interchangeable safety systems at different locations.

Why the other choices are less appropriate:

- B. PISS is not at the vaporizer filler (that is the keyed/agent-specific filler); DISS is not at the scavenger.
- C. This reverses the two systems.
- D. Neither system operates at the flowmeter.

Question 150 • Correct Answer: D

During machine checkout the pipeline oxygen pressure gauge reads 50 psig and the oxygen cylinder is turned off with its gauge reading 1800 psig....

Because the pipeline is regulated to about 50 psig and the cylinder is regulated to about 45 psig, an OPEN backup cylinder will not normally contribute flow; however, if the pipeline pressure transiently falls the cylinder will silently empty, leaving no reserve when it is truly needed. Therefore cylinders are kept closed except during checkout or a documented pipeline failure.

Why the other choices are less appropriate:

- A. Regulators prevent flowmeter overpressurization regardless of cylinder position.
- B. Keeping cylinders closed is not about preventing fail-safe activation.
- C. An open oxygen cylinder does not dangerously raise FiO₂.

Question 151 • Correct Answer: C

A modern agent-specific variable-bypass vaporizer maintains a constant output concentration despite changes in fresh gas flow. Which design...

Variable-bypass vaporizers use a temperature-sensitive element (a bimetallic strip or expansion valve) that automatically alters the proportion of gas diverted through the vaporizing chamber as temperature changes, keeping output concentration stable. As temperature falls (from the latent heat of vaporization), more flow is directed to the vaporizing chamber to compensate for reduced vapor pressure.

Why the other choices are less appropriate:

- A. A held temperature of 39 C describes the desflurane (Tec 6) heated design, not a conventional variable-bypass vaporizer.
- B. Liquid injection describes measured-flow/injection designs, not a variable-bypass unit.
- D. Wicks increase the surface area for saturation but do not provide temperature compensation.

Question 152 · Correct Answer: A

Desflurane requires a heated, pressurized vaporizer (measured-flow design) rather than a conventional variable-bypass vaporizer. Which physical...

Desflurane boils at about 22-23 degrees C and has a saturated vapor pressure near 669-700 mmHg (close to atmospheric), so at room temperature it would boil unpredictably in a conventional vaporizer. The Tec 6 heats desflurane to about 39 degrees C and pressurizes it (about 2 atm), then blends measured desflurane vapor with fresh gas to deliver an accurate concentration.

Why the other choices are less appropriate:

- B. MAC affects dosing, not the physical need for heating and pressurization.
- C. Molecular weight is not the reason for the heated design; vapor pressure and boiling point are.
- D. Desflurane actually has a LOW blood-gas coefficient (about 0.42), which speeds emergence but is unrelated to the vaporizer design.

Question 153 · Correct Answer: C

A conventional variable-bypass sevoflurane vaporizer is used at high altitude where ambient pressure is significantly reduced. Compared with sea...

In a variable-bypass vaporizer the delivered PARTIAL PRESSURE of agent stays roughly constant across altitudes even though the volume PERCENT reading changes, because anesthetic effect depends on partial pressure. At altitude the volume percent output rises slightly, but the reduced ambient pressure means the partial pressure (and thus clinical effect) is approximately preserved, so dial adjustment is usually unnecessary.

Why the other choices are less appropriate:

- A. Partial pressure does not fall to near zero; that would produce awareness.
- B. Partial pressure does not increase substantially; the effect is largely self-correcting.
- D. The vaporizer continues to deliver agent normally.

Question 154 · Correct Answer: C

The desflurane (measured-flow, heated) vaporizer differs from a variable-bypass vaporizer at high altitude because it delivers a constant...

The heated desflurane vaporizer maintains a set VOLUME percent regardless of ambient pressure, so at high altitude the same volume percent corresponds to a LOWER partial pressure. To maintain equivalent anesthetic effect the clinician must INCREASE the dial setting to compensate for the reduced ambient pressure.

Why the other choices are less appropriate:

- A. Decreasing the dial would worsen underdosing at altitude.
- B. Partial pressure is NOT preserved with this design; that is true only for variable-bypass units.
- D. There is no need to turn it off; simply increase the setting.

Question 155 · Correct Answer: C

A CRNA discovers that a variable-bypass isoflurane vaporizer was tipped during transport and liquid agent may have entered the bypass channel....

Tipping can allow liquid agent into the bypass, causing a dangerously high output when next used. The correct remedy is to flush the vaporizer with a HIGH fresh gas flow (with no patient connected) to clear liquid from the bypass channel and verify stable output before clinical use. Many manufacturers recommend high-flow purging for 20-30 minutes.

Why the other choices are less appropriate:

- A. Filling it further does not remove agent from the bypass.
- B. Immediate use risks a large overdose from agent in the bypass.
- D. Random inversion is not the manufacturer-recommended clearing method and can worsen contamination.

Question 156 · Correct Answer: B

The 'pumping effect' that can cause a variable-bypass vaporizer to deliver a higher-than-set concentration is MOST associated with which condition?

The pumping effect results from intermittent back-pressure (from positive-pressure ventilation or the oxygen flush) that transiently pressurizes and then depressurizes the vaporizing chamber, driving extra saturated vapor into the bypass and raising output. It is most pronounced at LOW fresh gas flows, low dial settings, and low liquid levels; modern vaporizers include check valves and baffles to minimize it.

Why the other choices are less appropriate:

- A. High continuous flows tend to reduce, not cause, the pumping effect.
- C. Altitude affects concentration/partial pressure relationships, not the pumping effect.
- D. An empty chamber cannot produce excess vapor output.

Question 157 · Correct Answer: B

If a modern agent-specific variable-bypass vaporizer designed for a less volatile agent were erroneously filled with a MORE volatile agent (higher...

Because a vaporizer is calibrated for the vapor pressure of its designated agent, filling it with a more volatile agent (higher vapor pressure) causes it to deliver MORE vapor than the dial indicates, risking overdose. Agent-specific keyed fillers (Pin/keyed filling systems) exist precisely to prevent such cross-filling errors.

Why the other choices are less appropriate:

- A. A more volatile agent yields more output, not less.
- C. Vaporizers are agent-SPECIFIC, so cross-filling changes output.
- D. The vaporizer does not shut down; it silently misdoses.

Question 158 · Correct Answer: D

During a case using a circle system, a CRNA notices that turning ON a second vaporizer is impossible while the first is on. Which safety feature...

The vaporizer interlock (exclusion) system mechanically prevents more than one vaporizer from being turned on simultaneously, avoiding delivery of two agents at once and the associated overdose or unpredictable MAC. This is a standard safety feature on manifold-mounted vaporizers.

Why the other choices are less appropriate:

- A. The fail-safe device relates to oxygen supply pressure, not simultaneous vaporizer use.
- B. The oxygen ratio controller (hypoxic guard) links O₂ and N₂O flows only.
- C. The scavenging interface handles waste gas, not vaporizer selection.

Question 159 · Correct Answer: D

According to the classic Mapleson efficiency ranking, which Mapleson circuit is MOST efficient (requires the lowest fresh gas flow to prevent...

For SPONTANEOUS ventilation the efficiency order is A > DFE > CB, so the Mapleson A (Magill) is most efficient, requiring a fresh gas flow approximately equal to minute ventilation to prevent rebreathing. During CONTROLLED ventilation the order reverses to DFE > BC > A, which is why the Bain (a coaxial Mapleson D) is favored for controlled ventilation.

Why the other choices are less appropriate:

- A. Mapleson D is best for controlled, not spontaneous, ventilation.
- B. Mapleson B is relatively inefficient for spontaneous ventilation.
- C. Mapleson E is efficient for controlled ventilation, not the most efficient for spontaneous.

Question 160 • Correct Answer: B

The Bain circuit is a modification of which Mapleson system, and what is its defining structural feature?

The Bain circuit is a coaxial Mapleson D: fresh gas is delivered through a narrow INNER tube that runs inside the corrugated expiratory (outer) limb, so fresh gas emerges near the patient while exhaled gas travels back through the outer tube. A hazard is an unrecognized kink or disconnection of the inner tube, which increases dead space and causes rebreathing/hypercarbia.

Why the other choices are less appropriate:

- A. Mapleson C is a simple valved system, not the Bain.
- C. Mapleson A has a different configuration with the APL valve near the patient.
- D. Mapleson E (Ayre T-piece) has no reservoir bag in its basic form.

Question 161 • Correct Answer: B

A CRNA is using a Bain (coaxial Mapleson D) circuit and suspects a disconnected or kinked INNER fresh-gas tube. Which finding would MOST support...

A kinked or disconnected inner tube of a Bain circuit greatly increases effective dead space, so fresh gas no longer reaches the patient end efficiently and the patient rebreathes exhaled CO₂, producing progressive HYPERCARBIA despite an apparently adequate set flow. The Pethick test (oxygen flush with occluded patient end, watching the bag) is used to confirm inner-tube integrity.

Why the other choices are less appropriate:

- A. A flat-line capnograph suggests total disconnection or no output, not selective inner-tube failure.
- C. High peak pressures with normal EtCO₂ point to obstruction, not inner-tube compromise.
- D. An APL leak causes loss of volume, not the characteristic rebreathing pattern.

Question 162 • Correct Answer: A

Compared with a Mapleson (open/semi-open) system, the primary advantage of a circle breathing system is:

The circle system uses unidirectional valves and a CO₂ absorbent so exhaled gas (minus CO₂) can be rebreathed, conserving heat, humidity, and volatile agent and permitting low fresh gas flows. This economy and conditioning of gases is its principal advantage over Mapleson systems, which waste gas and provide little humidification.

Why the other choices are less appropriate:

- B. The circle system REQUIRES a CO₂ absorbent to allow rebreathing safely.
- C. The circle system has apparatus dead space, particularly at the Y-piece.
- D. Incompetent unidirectional valves are in fact a specific hazard of circle systems.

Question 163 • Correct Answer: B

In a circle system, an incompetent (stuck-open) EXPIRATORY unidirectional valve would MOST likely produce which clinical picture?

If a unidirectional valve (inspiratory or expiratory) is incompetent, exhaled gas can flow back into the inspiratory limb, causing rebreathing of CO₂ and an ELEVATED inspired CO₂ baseline on capnography (the waveform fails to return to zero). This is a classic cause of hypercarbia in a circle system with functioning absorbent.

Why the other choices are less appropriate:

- A. Scavenging is independent of the unidirectional valves.
- C. Valve incompetence does not overdose the vaporizer.
- D. An increased flow requirement alone does not explain the rebreathing pattern.

Question 164 • Correct Answer: D

A CRNA notices the color indicator in the CO₂ absorbent canister has turned violet (from white). What does this MOST likely indicate and what is...

Ethyl violet is the pH indicator in many CO₂ absorbents; it changes from white to VIOLET/purple as the absorbent becomes exhausted and its pH falls, signaling that it should be replaced. Note that color can revert (regenerate) after rest, so rising inspired CO₂ on the capnograph is the more reliable functional sign of exhaustion.

Why the other choices are less appropriate:

- A. Color change is chemical, not a fill-level indicator.
- B. Fresh absorbent is white, not violet.
- C. The color change signals chemical exhaustion, not desiccation.

Question 165 · Correct Answer: D

Which combination of factors MOST increases the risk of dangerous degradation products (such as carbon monoxide with desflurane, or Compound A...

Carbon monoxide formation (worst with desflurane and enflurane) occurs when volatile agents contact DESICCATED absorbent containing strong bases such as potassium and sodium hydroxide; Compound A (from sevoflurane) is favored by strong bases and low flows. Newer absorbents lacking KOH/NaOH (e.g., calcium hydroxide lime) greatly reduce both hazards, and keeping absorbent hydrated is protective.

Why the other choices are less appropriate:

- A. An HME conditions gas and is not the source of these degradation products.
- B. Fresh, hydrated absorbent minimizes degradation products.
- C. Mapleson circuits have no absorbent, so this specific reaction does not apply.

Question 166 · Correct Answer: B

During controlled ventilation with a circle system, the adjustable pressure-limiting (APL) valve is typically:

During MECHANICAL ventilation the ventilator's relief/spill valve controls circuit pressure, and the APL valve is taken out of the circuit (bag/vent selector to 'vent') or fully open so it does not interfere. During MANUAL/spontaneous ventilation the APL is partially closed to set the desired pressure and allow excess gas to spill to the scavenger.

Why the other choices are less appropriate:

- A. A fully closed APL during manual ventilation would cause dangerous pressure buildup/barotrauma.
- C. There is no single fixed 20 cmH₂O setting; it is adjusted to the patient.
- D. The scavenger receives spill gas but does not bypass the APL during controlled ventilation.

Question 167 · Correct Answer: D

A CRNA using manual ventilation cannot ventilate the patient; the reservoir bag is over-distended and airway pressure is climbing dangerously....

A closed APL valve during manual ventilation prevents excess gas from venting, so pressure builds, the bag over-distends, and barotrauma can occur; opening the APL relieves the pressure immediately. This is a classic cause of rising airway pressure that must be corrected before it causes hemodynamic compromise or barotrauma.

Why the other choices are less appropriate:

- A. An empty vaporizer causes light anesthesia, not high pressure.
- B. A disconnected capnograph line does not raise airway pressure.
- C. Depleted absorbent causes hypercarbia, not over-distension of the bag.

Question 168 · Correct Answer: B

A CRNA is setting up an active, closed (balancing valve) scavenging interface. Which hazard is UNIQUE to a scavenging system and could cause...

In an active scavenging interface, if the NEGATIVE-pressure relief valve fails or the reservoir is inadequate while the vacuum is excessive, subatmospheric pressure can be transmitted to the breathing circuit, collapsing the reservoir bag and potentially causing barotrauma/lung collapse or hypoventilation. Proper interfaces have both positive- and negative-pressure relief to protect the patient.

Why the other choices are less appropriate:

- A. Excessive fresh gas flow wastes gas but does not transmit negative pressure.
- C. Positive-pressure buildup from downstream occlusion is a hazard but is not the negative-pressure mechanism described.
- D. Reversed unidirectional valves are a circle-system problem, not a scavenger-specific one.

Question 169 · Correct Answer: D

A CRNA wants to keep endotracheal tube cuff pressure within a safe range to minimize tracheal mucosal ischemia. Which target range is BEST?

Tracheal capillary perfusion pressure is roughly 25-35 mmHg, so cuff pressure should be kept about 20-30 cmH₂O to seal the airway while preserving mucosal blood flow. Pressures above this range risk ischemia, mucosal injury, and later tracheal stenosis, so a manometer is recommended, especially during nitrous oxide use which can diffuse into the cuff and raise pressure.

Why the other choices are less appropriate:

- A. 40-50 cmH₂O exceeds capillary perfusion pressure and risks mucosal ischemia.
- B. 5-10 cmH₂O is usually insufficient to seal the airway and risks aspiration/leak.
- C. 60-70 cmH₂O is clearly excessive and dangerous.

Question 170 · Correct Answer: B

During a case using nitrous oxide, a CRNA notices the endotracheal tube cuff pressure rising steadily. What is the MOST likely mechanism?

Nitrous oxide diffuses from the blood/tissues into the air-filled cuff faster than nitrogen diffuses out, increasing cuff volume and pressure over time during N₂O anesthesia. This can lead to mucosal injury, so cuff pressure should be monitored and adjusted, or the cuff filled with saline or the N₂O mixture.

Why the other choices are less appropriate:

- A. A kinked pilot tube would prevent measurement, not cause a true pressure rise.
- C. A leak would lower, not raise, cuff pressure.
- D. Cooling would decrease pressure slightly, not increase it.

Question 171 · Correct Answer: A

A second-generation supraglottic airway (SGA) differs from a first-generation device chiefly because it:

Second-generation supraglottic airways add a separate gastric drainage channel (and often a higher seal pressure) that allows passage of an orogastric tube and helps separate the respiratory and digestive tracts, reducing aspiration risk. First-generation devices provide only an airway seal without a dedicated gastric channel.

Why the other choices are less appropriate:

- B. SGAs are inserted without a stylet.
- C. Second-generation SGAs actually support higher airway seal pressures for positive-pressure ventilation.
- D. Most SGAs, including second-generation types, still have an inflatable or gel cuff.

Question 172 · Correct Answer: B

A CRNA obtains a Cormack-Lehane grade 3 view with a Macintosh blade during direct laryngoscopy. Which device is MOST likely to improve glottic...

A hyperangulated video laryngoscope provides an indirect camera view that 'sees around the corner' of the airway, improving the laryngeal view in patients where direct line-of-sight laryngoscopy yields a grade 3 (only epiglottis visible) view. It is a first-line rescue for difficult direct laryngoscopy.

Why the other choices are less appropriate:

- A. A nasopharyngeal airway maintains a patent airway but does not visualize the glottis.
- C. An oral airway relieves obstruction but provides no glottic view.
- D. Simply increasing Macintosh blade size does not overcome an anterior larynx as reliably as indirect video.

Question 173 · Correct Answer: C

During an awake fiberoptic intubation, the CRNA loses the view because of secretions and fogging. Which combination of measures BEST addresses...

Secretions obscure the fiberoptic view, so a drying antisialagogue such as glycopyrrolate given in advance markedly improves visualization; fogging is reduced by warming the scope tip, applying antifog solution, or insufflating oxygen/suction through the working channel. Together these optimize the optical field for awake fiberoptic intubation.

Why the other choices are less appropriate:

- A. More sedation risks airway compromise and does not clear secretions or fog.
- B. Changing tube size does not address the optical problems.
- D. Vasoconstrictor to the tongue does not clear secretions or fogging (nasal mucosa vasoconstriction is for bleeding).

Question 174 · Correct Answer: C

A fiberoptic bronchoscope is being used to confirm placement of a left-sided double-lumen tube. When the scope is passed down the TRACHEAL lumen,...

With a correctly placed left DLT, a bronchoscope passed through the TRACHEAL lumen should show the carina, an unobstructed opening into the RIGHT mainstem bronchus, and the top of the blue bronchial cuff just visible in the LEFT mainstem bronchus (not herniating above the carina). This confirms the bronchial lumen is properly seated in the left mainstem.

Why the other choices are less appropriate:

- A. Both bronchi occluded indicates gross malposition.
- B. Cuff herniation over the carina indicates the tube is too shallow and needs advancement.
- D. Inability to see the carina suggests malposition (too deep).

Question 175 · Correct Answer: C

During laser airway surgery near the endotracheal tube, which tube feature MOST reduces the risk of an airway fire?

Laser airway procedures require a laser-resistant (metal or specially wrapped) endotracheal tube, cuffs filled with saline (often tinted with methylene blue to detect rupture), and the LOWEST safe FiO₂ while AVOIDING nitrous oxide, because both oxygen and N₂O support combustion. These measures minimize the chance and severity of an airway fire.

Why the other choices are less appropriate:

- A. An uncuffed flammable tube with high oxygen flow increases fire risk.
- B. Red rubber is combustible and nitrous oxide supports combustion.
- D. A standard PVC tube is flammable and 100% oxygen greatly increases fire risk.

Question 176 · Correct Answer: B

A CRNA selects a left-sided double-lumen tube for a right thoracotomy. Compared with a right-sided DLT, the LEFT-sided tube is generally preferred...

The LEFT mainstem bronchus is longer before its first (upper lobe) branch, giving more room to seat the bronchial cuff without occluding a lobar orifice, whereas the right upper lobe takes off very close to the carina, making right-sided DLTs prone to right-upper-lobe obstruction. For this reason a left-sided DLT is commonly used even for right-sided thoracic surgery when feasible.

Why the other choices are less appropriate:

- A. All DLTs benefit from bronchoscopic confirmation; right-sided ones especially.
- C. It is the RIGHT mainstem that is shorter and more vertical.
- D. Left upper lobe obstruction is less of a concern than right upper lobe obstruction.

Question 177 • Correct Answer: D

A bronchial blocker is chosen instead of a double-lumen tube for one-lung ventilation in a patient with a difficult airway who is already...

A bronchial blocker can be passed through an existing single-lumen endotracheal tube (advantageous in a difficult airway or when the patient is already intubated), but the isolated lung deflates more SLOWLY and cannot be independently suctioned or easily given CPAP through the small central channel. A DLT allows more rapid collapse and independent access to each lung.

Why the other choices are less appropriate:

- A. Independent suctioning/CPAP to the isolated lung is limited with a blocker.
- B. Bronchial blockers are typically positioned UNDER fiberoptic guidance.
- C. Blockers generally give SLOWER, not faster, lung collapse than a DLT.

Question 178 • Correct Answer: C

A CRNA is choosing an oral airway size for an adult. The MOST reliable method to estimate the correct length is to measure from the:

An oral airway is sized by holding it against the face and measuring from the corner of the mouth to the angle of the mandible (approximately the earlobe); this approximates the distance needed to reach just above the epiglottis. An incorrectly sized airway can worsen obstruction: too small pushes the tongue back, too large can obstruct the glottis or traumatize the airway.

Why the other choices are less appropriate:

- A. Chin to sternal notch does not size an oral airway.
- B. Nostril-to-tragus is used to size a NASOpharyngeal airway, not an oral airway.
- D. Upper lip to thyroid cartilage is not a standard oral airway measurement.

Question 179 • Correct Answer: D

A standard two-wavelength pulse oximeter uses light at approximately 660 nm (red) and 940 nm (infrared). On what physical principle does it...

Oxyhemoglobin and deoxyhemoglobin have different absorption coefficients at 660 nm and 940 nm; using the Beer-Lambert relationship and the pulsatile (AC) component of the signal to isolate arterial blood from the constant (DC) tissue background, the device computes the ratio and estimates SpO₂. This is why only two wavelengths yield a two-species estimate.

Why the other choices are less appropriate:

- A. Magnetic resonance is unrelated to pulse oximetry.
- B. Conductivity is not the basis of pulse oximetry.
- C. The device MEASURES transmitted/absorbed light; it does not rely on hemoglobin emitting light.

Question 180 • Correct Answer: A

A patient rescued from a house fire has suspected carbon monoxide poisoning. A conventional two-wavelength pulse oximeter reads SpO₂ 98%. Why is...

Carboxyhemoglobin absorbs red light (660 nm) similarly to oxyhemoglobin, so a standard two-wavelength oximeter falsely reads a high, near-normal SpO₂ despite dangerous oxygen displacement. Accurate assessment requires CO-oximetry (multi-wavelength) or an arterial blood gas measuring carboxyhemoglobin directly.

Why the other choices are less appropriate:

- B. Pulsatile flow is still detected; the problem is spectral overlap.
- C. Carboxyhemoglobin's confounding absorption is in the red band, not only infrared.
- D. CO poisoning does not primarily impair pulse detection.

Question 181 · Correct Answer: B

Methemoglobinemia (e.g., from benzocaine or dapsone) tends to drive a conventional two-wavelength pulse oximeter reading toward which value,...

Methemoglobin absorbs both 660 nm and 940 nm light roughly equally, driving the red-to-infrared ratio toward 1.0, which corresponds to an SpO₂ reading of about 85% regardless of the true SaO₂. This 'pinning' near 85% is a classic clue to methemoglobinemia; co-oximetry is needed for accurate quantification.

Why the other choices are less appropriate:

- A. It does NOT reflect true SaO₂ when methemoglobin is elevated.
- C. It does not read 0%.
- D. It does not read a true 100% in significant methemoglobinemia.

Question 182 · Correct Answer: A

Which of the following is the MOST reliable single indicator that an endotracheal tube is in the trachea (not the esophagus) immediately after...

A sustained capnographic waveform with CO₂ present over several breaths is the most reliable confirmation of tracheal placement, because the esophagus will not produce persistent CO₂ (any initial CO₂ from a stomach with carbonated fluid washes out within a few breaths). Auscultation, chest rise, and tube fogging are supportive but individually unreliable.

Why the other choices are less appropriate:

- B. Chest rise can occur with esophageal intubation or be hard to see.
- C. Breath sounds can be misleading (transmitted sounds, obesity, bronchial intubation).
- D. Tube fogging can also occur with esophageal placement and is unreliable.

Question 183 · Correct Answer: B

A capnograph shows a normal waveform whose plateau (phase III) develops a progressive upslope ('shark-fin' appearance) with a prolonged expiratory...

A prolonged, upsloping expiratory plateau ('shark-fin') reflects uneven alveolar emptying from expiratory airflow obstruction, as seen in bronchospasm, COPD, or a kinked/partially obstructed tube. Recognizing this pattern prompts treatment of bronchospasm or relief of obstruction.

Why the other choices are less appropriate:

- A. A disconnection produces a sudden loss of the waveform to zero.
- C. Hyperventilation lowers EtCO₂ but does not create the sloped plateau.
- D. Esophageal intubation shows little or no sustained CO₂.

Question 184 · Correct Answer: B

During a stable general anesthetic the EtCO₂ suddenly drops from 38 to near 0 mmHg with loss of the waveform. After confirming the monitor is...

A sudden fall of EtCO₂ to zero with loss of the waveform signals an acute failure of ventilation or CO₂ delivery to the sensor, most dangerously a circuit disconnection, unrecognized esophageal intubation, or complete airway obstruction/apnea (or cardiac arrest with no pulmonary blood flow). These demand immediate assessment of the airway, circuit, and circulation.

Why the other choices are less appropriate:

- A. Malignant hyperthermia raises EtCO₂.
- C. Exhausted absorbent raises the inspired CO₂ baseline, not a drop to zero.
- D. Gradual hypoventilation RAISES EtCO₂ slowly rather than dropping it to zero.

Question 185 · Correct Answer: A

An abrupt decrease in EtCO₂ to a low-but-nonzero value (e.g., 38 down to 15 mmHg) during a case, with the waveform still present, is MOST...

A sudden partial drop in EtCO₂ with a preserved (though smaller) waveform reflects a rapid decrease in pulmonary blood flow delivering CO₂ to the lungs, as with pulmonary embolism, venous air embolism, or an abrupt fall in cardiac output/hypotension. The persisting waveform distinguishes it from disconnection (which drops to zero).

Why the other choices are less appropriate:

- B. Bronchospasm produces an upsloping plateau, not primarily an abrupt magnitude drop.
- C. Rebreathing elevates the baseline rather than lowering EtCO₂.
- D. Hypoventilation increases EtCO₂.

Question 186 · Correct Answer: C

A mainstream capnometer differs from a sidestream capnometer in that the mainstream device:

A mainstream capnometer has the infrared sensor located in a cuvette in the breathing circuit at the airway, providing a rapid response time and no need to aspirate gas, though the sensor adds bulk/dead space and needs heating to prevent condensation. Sidestream devices aspirate a gas sample through small-bore tubing to a remote sensor, which introduces a slight delay and can be affected by water/secretions.

Why the other choices are less appropriate:

- A. Aspirating gas to a distant sensor describes the SIDESTREAM design.
- B. Capnometry measures CO₂, not oxygen.
- D. Mainstream capnometry is used specifically on intubated patients.

Question 187 · Correct Answer: C

A widened gradient between EtCO₂ and arterial PaCO₂ (EtCO₂ much lower than PaCO₂) MOST directly reflects an increase in which physiologic quantity?

EtCO₂ normally runs a few mmHg below PaCO₂; a widened gradient indicates increased ALVEOLAR DEAD SPACE, where ventilated alveoli are underperfused (as in pulmonary embolism, hypotension, or low cardiac output) and dilute the exhaled CO₂. The gradient therefore serves as a bedside marker of ventilation-perfusion mismatch from dead space.

Why the other choices are less appropriate:

- A. Shunt (perfusion without ventilation) primarily affects oxygenation, not the EtCO₂-PaCO₂ gradient.
- B. FRC changes do not directly widen the CO₂ gradient.
- D. Oxygen consumption does not directly set this gradient.

Question 188 · Correct Answer: C

A capnogram baseline (phase I / inspiratory portion) that fails to return to zero (elevated baseline) MOST strongly suggests:

When the capnogram baseline does not return to zero during inspiration, the patient is rebreathing CO₂, classically from an incompetent unidirectional valve, exhausted CO₂ absorbent, or inadequate fresh gas flow in a Mapleson system. Correcting the underlying cause restores a zero baseline.

Why the other choices are less appropriate:

- A. A sampling-line leak typically lowers or distorts values, not raises the baseline.
- B. Esophageal intubation gives little sustained CO₂, not an elevated rebreathing baseline.
- D. Hyperventilation lowers EtCO₂ but does not raise the inspiratory baseline.

Question 189 • Correct Answer: A

Using an automated oscillometric noninvasive blood pressure (NIBP) device, which pressure does the monitor measure MOST directly, from which it...

Oscillometric NIBP devices detect cuff-pressure oscillations as the cuff deflates; the MEAN arterial pressure corresponds to the point of MAXIMUM oscillation amplitude and is measured most directly, while systolic and diastolic values are derived algorithmically from the oscillation envelope. This is why MAP is the most accurate oscillometric value.

Why the other choices are less appropriate:

- B. Diastolic is derived, not measured most directly, by oscillometry.
- C. The device provides systolic, diastolic, and mean values, not pulse pressure alone.
- D. Detecting the first Korotkoff sound describes AUSCULTATORY, not oscillometric, measurement.

Question 190 • Correct Answer: B

A blood pressure cuff that is too SMALL (narrow) for the patient's arm will MOST likely produce which error?

A cuff that is too small requires more pressure to occlude the artery, so it over-reads and gives falsely HIGH values; conversely, a cuff that is too large reads falsely low. The bladder width should be about 40% of arm circumference to ensure accuracy.

Why the other choices are less appropriate:

- A. It still produces a (erroneous) reading.
- C. A too-LARGE cuff, not too small, causes falsely low readings.
- D. An improperly sized cuff introduces systematic error.

Question 191 • Correct Answer: D

An arterial line transducer must be leveled (zeroed) at the level of the heart (phlebostatic axis). If the transducer is placed 20 cm BELOW the...

Each 1 cm the transducer sits below the reference point adds about 0.74 mmHg of hydrostatic pressure to the reading; 20 cm below yields roughly 15 mmHg of falsely HIGH pressure. Conversely, placing the transducer above the heart falsely lowers the reading, which is why correct leveling is essential.

Why the other choices are less appropriate:

- A. Transducer height does change the displayed pressure via hydrostatic effect.
- B. Below the heart raises, not lowers, the reading.
- C. 20 cm produces about 15 mmHg error, not 40 mmHg.

Question 192 • Correct Answer: B

An arterial pressure waveform that is OVERDAMPED (e.g., from an air bubble, clot, or kink) will typically show:

Overdamping blunts the waveform: the systolic peak is underestimated, diastolic is overestimated, the dicrotic notch is lost, and the tracing appears sluggish, though the MEAN pressure remains relatively accurate. Common causes include air bubbles, clots, kinks, or compliant tubing; a fast-flush (square-wave) test with slow return to baseline confirms overdamping.

Why the other choices are less appropriate:

- A. A square wave is the flush artifact, not the arterial waveform itself.
- C. Systolic overshoot characterizes UNDERdamping, not overdamping.
- D. A sharp elevated spike suggests underdamping/resonance.

Question 193 · Correct Answer: A

During a fast-flush (square-wave) test, the arterial waveform returns to baseline after several oscillations with a slow, undershooting bounce....

An UNDERdamped system shows multiple oscillations after the flush before settling, which causes systolic overshoot and diastolic undershoot; it is often due to excessive tubing length, stiff catheters, or catheter whip. An optimally damped system returns to baseline after only one to two oscillations, and an overdamped system returns sluggishly with no oscillation.

Why the other choices are less appropriate:

- B. Optimal damping settles in one to two oscillations.
- C. Disconnection would lose the tracing entirely.
- D. Overdamping shows a slow return with NO oscillations.

Question 194 · Correct Answer: C

The central venous pressure (CVP) waveform 'a' wave corresponds to which cardiac event, and its ABSENCE is characteristic of which rhythm?

The 'a' wave of the CVP tracing is produced by right ATRIAL contraction and occurs just after the P wave on the ECG; because it depends on organized atrial contraction, it is ABSENT in atrial fibrillation. Large 'cannon a waves' occur when the atrium contracts against a closed tricuspid valve, as in complete heart block or junctional rhythms.

Why the other choices are less appropriate:

- A. The a wave is present in sinus rhythm.
- B. The a wave is atrial, not ventricular, contraction.
- D. The a wave reflects atrial contraction, not relaxation.

Question 195 · Correct Answer: A

As a pulmonary artery catheter is advanced from the right ventricle into the pulmonary artery, the pressure waveform change that confirms entry...

On entering the pulmonary artery from the right ventricle, the systolic pressure stays similar but the DIASTOLIC pressure RISES (RV diastole is near zero, PA diastole is higher) and a dicrotic notch appears from pulmonic valve closure. Further advancement yields the lower, atrialized pulmonary capillary wedge (occlusion) tracing.

Why the other choices are less appropriate:

- B. Pulsatility persists in the PA.
- C. The progression goes RA -> RV -> PA -> wedge, not backward.
- D. Systolic does not fall to zero on entering the PA.

Question 196 · Correct Answer: B

A pulmonary artery (Swan-Ganz) catheter shows a permanently 'wedged' tracing even with the balloon deflated. What is the MOST appropriate...

A persistent wedge (overwedging) with the balloon deflated means the catheter tip has migrated too far distally and can cause pulmonary artery rupture or infarction; the catheter should be WITHDRAWN slightly until a normal PA waveform reappears. The balloon should never be left inflated in the wedge position.

Why the other choices are less appropriate:

- A. High-pressure flushing of a wedged distal catheter risks vessel rupture.
- C. Leaving the balloon inflated in the wedge risks rupture/infarction.
- D. Advancing further worsens distal migration and rupture risk.

Question 197 · Correct Answer: C

Transesophageal echocardiography (TEE) is used intraoperatively. The mid-esophageal four-chamber view is especially useful for detecting which...

TEE detects new regional wall-motion abnormalities, an early and sensitive sign of myocardial ischemia that often precedes ECG changes, and it also assesses volume status, valvular function, and embolic events. The mid-esophageal views allow rapid assessment of segmental left ventricular function.

Why the other choices are less appropriate:

- A. Malignant hyperthermia is detected by rising EtCO₂, temperature, and metabolic changes, not TEE.
- B. Laryngospasm is an airway event unrelated to TEE.
- D. TEE does not detect peripheral nerve injury.

Question 198 · Correct Answer: C

A recognized absolute contraindication to placing a transesophageal echocardiography probe is:

Absolute contraindications to TEE probe insertion include esophageal pathology such as stricture, diverticulum, tumor, active bleeding, perforation, or recent esophageal/gastric surgery, because probe placement risks perforation or hemorrhage. Cardiac diagnoses like atrial fibrillation or aortic stenosis are actually indications for evaluation, not contraindications.

Why the other choices are less appropriate:

- A. Atrial fibrillation is not a contraindication; TEE is used to assess for atrial thrombus.
- B. Obesity is not a contraindication to TEE.
- D. Aortic stenosis is an indication for echocardiographic assessment.

Question 199 · Correct Answer: A

A processed EEG depth-of-anesthesia monitor (bispectral index) displays a dimensionless number from 0 to 100. Which range is generally targeted...

A bispectral index value of 40-60 is the range generally associated with an appropriate depth of general anesthesia and a low risk of intraoperative awareness. Values near 100 indicate an awake patient, and values below 40 suggest a deep hypnotic state or burst suppression.

Why the other choices are less appropriate:

- B. 0-20 reflects very deep anesthesia or burst suppression.
- C. 90-100 indicates a fully awake state.
- D. 70-90 corresponds to sedation/light hypnosis with higher awareness risk.

Question 200 · Correct Answer: C

A processed EEG monitor reads 35 during maintenance with a volatile agent at 1.5 MAC. Which statement is MOST accurate regarding this value?

A processed EEG value of 35 is below the 40-60 target range, suggesting a deeper-than-necessary hypnotic state; the anesthetic depth could be reduced to avoid excessive drug exposure, hypotension, and prolonged emergence. The monitor reflects hypnosis, not neuromuscular blockade or analgesia.

Why the other choices are less appropriate:

- A. A value of 35 indicates deep anesthesia, not a high awareness risk.
- B. Processed EEG does not measure neuromuscular blockade.
- D. An awake patient reads near 90-100, not 35.

Question 201 · Correct Answer: A

During neuromuscular monitoring with a train-of-four (TOF) at the ADDUCTOR POLLICIS via ulnar nerve stimulation, which finding corresponds to...

With nondepolarizing block, the disappearance of twitches correlates with receptor occupancy: loss of the fourth twitch corresponds to roughly 75-80% block, and a TOF count of 1-2 twitches corresponds to about 90% occupancy, which usually provides adequate surgical relaxation. Deeper block (post-tetanic count only) is needed when no TOF response is required.

Why the other choices are less appropriate:

- B. Two equal strong double-burst responses indicate adequate recovery, not surgical block.
- C. Sustained tetanus indicates recovery, not adequate block.
- D. Four equal twitches without fade indicates minimal or recovered block, not surgical relaxation.

Question 202 · Correct Answer: A

Which single quantitative neuromuscular measurement BEST confirms ADEQUATE recovery from nondepolarizing blockade and a low risk of residual...

An objective (quantitative, e.g., acceleromyography) train-of-four RATIO of 0.9 or greater is the best confirmation of adequate recovery and correlates with restored airway protective reflexes and pharyngeal function. Subjective clinical tests and visual/tactile TOF assessment cannot reliably detect residual block between ratios of 0.4 and 0.9.

Why the other choices are less appropriate:

- B. Visual/tactile double-burst cannot reliably detect fade above a ratio of about 0.4-0.6.
- C. Head lift is insensitive and can be present with a TOF ratio well below 0.9.
- D. A visual TOF count of 4 does not exclude significant fade/residual block.

Question 203 · Correct Answer: A

When monitoring onset of neuromuscular blockade for intubation, stimulation of which muscle group reflects the DIAPHRAGM/laryngeal adductors...

Stimulating the facial nerve and observing the corrugator supercilii reflects the more centrally located, well-perfused laryngeal/diaphragmatic muscles, which have a faster onset and greater resistance to block than the peripheral adductor pollicis. This makes facial nerve monitoring useful for timing intubation, whereas the adductor pollicis better reflects recovery for extubation.

Why the other choices are less appropriate:

- B. The foot muscles are peripheral and do not track the diaphragm well.
- C. The adductor pollicis is peripheral and slower to block than central muscles.
- D. The abductor digiti minimi is a peripheral hand muscle similar to the adductor pollicis.

Question 204 · Correct Answer: C

A patient who received succinylcholine shows train-of-four monitoring with all four twitches equally DIMINISHED (no fade) and no post-tetanic...

A phase I depolarizing block from succinylcholine shows uniform reduction of all TOF twitches WITHOUT fade, no post-tetanic potentiation, and augmentation (not antagonism) by anticholinesterases. Fade and post-tetanic facilitation appearing after repeated or high-dose succinylcholine indicate a phase II block that behaves like a nondepolarizing block.

Why the other choices are less appropriate:

- A. Phase II block shows fade and post-tetanic facilitation.
- B. Nondepolarizing block shows fade and post-tetanic facilitation.
- D. Complete recovery shows four equal FULL-strength twitches.

Question 205 • Correct Answer: D

Post-tetanic count (PTC) monitoring is used during which depth of neuromuscular blockade?

The post-tetanic count is used during PROFOUND block when the train-of-four and single twitch responses are absent; a tetanic stimulus transiently facilitates transmitter release so that post-tetanic single twitches can be counted, and the number correlates with the depth of block and the time until TOF returns. It guides management when deep, immobile relaxation is required.

Why the other choices are less appropriate:

- A. During recovery the TOF ratio is used, not PTC.
- B. After full reversal there is no need for PTC.
- C. PTC is meaningless without block.

Question 206 • Correct Answer: A

Intraoperative core temperature is MOST accurately reflected by which monitoring site?

Core temperature is best measured at sites reflecting the central/vessel-rich compartment: the distal esophagus, nasopharynx, pulmonary artery (via PAC), or tympanic membrane. These track true core temperature closely, which is important for detecting hypothermia and, critically, the rise seen in malignant hyperthermia.

Why the other choices are less appropriate:

- B. Forehead skin temperature underestimates core temperature.
- C. Circuit gas temperature does not reflect patient core temperature.
- D. Axillary temperature is a peripheral, less reliable estimate.

Question 207 • Correct Answer: D

A traditional pneumatically driven bellows anesthesia ventilator uses an ASCENDING (standing) bellows. Compared with a descending (hanging)...

An ascending bellows COLLAPSES and fails to refill when the circuit is disconnected, providing an obvious visual clue and usually triggering low-pressure/volume alarms. A descending (hanging) bellows can continue to fall and rise under gravity/driving gas even when disconnected, potentially masking a disconnection, which is why ascending bellows are considered safer.

Why the other choices are less appropriate:

- A. Tidal volume delivery is not the safety distinction here.
- B. The ascending bellows does NOT keep rising during disconnection; it collapses.
- C. Bellows orientation does not automatically add PEEP.

Question 208 • Correct Answer: B

During volume-controlled ventilation on a modern anesthesia machine, the peak inspiratory pressure suddenly rises from 22 to 45 cmH₂O while the...

Peak pressure reflects both resistive and elastic (compliance) forces, whereas plateau pressure reflects compliance alone; a rise in PEAK with an UNCHANGED plateau isolates the problem to increased airway RESISTANCE, such as bronchospasm, secretions, or a kinked/obstructed tube. If both peak and plateau rose together, decreased compliance would be the cause.

Why the other choices are less appropriate:

- A. A disconnection lowers pressures and triggers low-pressure alarms.
- C. Decreased compliance raises BOTH peak and plateau pressures.
- D. A cuff leak lowers delivered pressure and volume.

Question 209 · Correct Answer: D

In pressure-controlled ventilation compared with volume-controlled ventilation, a key characteristic is that:

In pressure-controlled ventilation the clinician sets a target inspiratory PRESSURE, so peak airway pressure is limited and constant, but the delivered TIDAL VOLUME varies as compliance and resistance change (falling if compliance worsens). This makes it useful for limiting barotrauma but requires vigilant tidal-volume/minute-ventilation monitoring.

Why the other choices are less appropriate:

- A. Pressure control is often chosen precisely for poor-compliance lungs.
- B. Pressure control specifically LIMITS peak pressure.
- C. Guaranteed tidal volume regardless of mechanics describes VOLUME control.

Question 210 · Correct Answer: A

Fresh gas flow decoupling (or a fresh gas compensation feature) on modern anesthesia ventilators is designed to prevent which problem seen on...

On older machines, fresh gas flowing into the circuit during inspiration adds to the ventilator-delivered volume, so higher fresh gas flows increase the actual tidal volume (fresh gas coupling). Fresh gas decoupling isolates the fresh gas inflow from the tidal volume delivery, keeping the set tidal volume accurate regardless of fresh gas flow.

Why the other choices are less appropriate:

- B. Rebreathing is prevented by the CO₂ absorbent and valves, not by decoupling.
- C. The pumping effect is a vaporizer phenomenon, addressed by vaporizer design.
- D. PEEP maintenance is a separate valve function.

Question 211 · Correct Answer: A

A low-pressure (subatmospheric or low peak-pressure) alarm on an anesthesia ventilator MOST commonly indicates:

A low peak inspiratory pressure alarm most commonly signals a circuit disconnection or a significant leak, because the ventilator cannot generate the expected pressure when gas escapes. This alarm is a critical safety monitor and should prompt immediate inspection of all connections, the tube cuff, and the airway.

Why the other choices are less appropriate:

- B. A kinked tube causes HIGH pressure, not low.
- C. Decreased compliance raises pressures, not lowers them.
- D. Bronchospasm raises airway pressure, triggering a HIGH-pressure alarm.

Question 212 · Correct Answer: D

Applying positive end-expiratory pressure (PEEP) intraoperatively primarily improves oxygenation by:

PEEP keeps alveoli open at end-expiration, recruiting collapsed lung units and increasing functional residual capacity, which improves ventilation-perfusion matching and oxygenation. Excessive PEEP, however, can overdistend alveoli, increase dead space, and reduce venous return and cardiac output.

Why the other choices are less appropriate:

- A. Excessive PEEP can actually increase dead space, not decrease it.
- B. PEEP does not primarily lower airway resistance.
- C. PEEP is an expiratory pressure, not primarily a minute-ventilation change.

Question 213 · Correct Answer: C

A patient with severe obstructive lung disease develops progressive hyperinflation (auto-PEEP / breath stacking) during mechanical ventilation....

Auto-PEEP (dynamic hyperinflation) results from insufficient time for complete exhalation; the remedy is to LENGTHEN expiratory time by reducing respiratory rate and shortening inspiratory time (lower I:E ratio), and by treating the underlying obstruction. This allows the lungs to empty and prevents further breath stacking and hemodynamic compromise.

Why the other choices are less appropriate:

- A. Increasing rate shortens expiratory time and worsens air trapping.
- B. Larger tidal volumes add to trapped gas.
- D. A 2:1 I:E ratio shortens expiration and worsens auto-PEEP.

Question 214 · Correct Answer: D

A piston-driven (electrically driven) anesthesia ventilator has which advantage over a traditional pneumatically driven bellows ventilator?

A piston ventilator uses an electric motor rather than pressurized driving gas, so it does not consume the oxygen or air that a bellows ventilator uses as driving gas, conserving supply during long cases or gas supply limitations. Piston designs also deliver accurate small tidal volumes well, but they still require electrical power and a scavenging system.

Why the other choices are less appropriate:

- A. Piston ventilators require electrical power to run the motor.
- B. Scavenging is still required for waste anesthetic gas.
- C. Piston ventilators are actually well suited to small tidal volumes (pediatrics).

Question 215 · Correct Answer: C

Operating rooms use an isolated (ungrounded) power system with a line isolation monitor (LIM). What does an alarming LIM indicate?

The line isolation monitor continuously measures the potential for current flow to ground; an alarm indicates a FIRST fault has degraded the isolation (the system is now effectively grounded), warning that a SECOND fault could allow dangerous current flow. The alarm does not mean someone is being shocked; the last nonessential device plugged in should be unplugged to find the fault.

Why the other choices are less appropriate:

- A. The LIM is unrelated to the scavenging vacuum.
- B. The LIM monitors electrical isolation, not oxygen supply.
- D. An LIM alarm warns of a first fault, not active electrocution.

Question 216 · Correct Answer: D

Microshock (as small as about 100 microamperes) is dangerous MOST specifically to which patients, and why?

Microshock is hazardous when a low-resistance conductive path bypasses the skin and delivers current directly to the heart, as with an external pacing wire or a saline-filled intracardiac catheter; currents around 100 microamperes can trigger ventricular fibrillation. Intact skin normally provides high resistance that protects against such small currents (macroshock requires much larger currents).

Why the other choices are less appropriate:

- A. Patients WITHOUT invasive cardiac conduits are relatively protected from microshock.
- B. Intact skin has substantial resistance; microshock risk requires a direct cardiac conduit.
- C. Consciousness does not determine microshock susceptibility.

Question 217 · Correct Answer: B

When using a monopolar electrosurgical unit (ESU), the dispersive (return/grounding) pad's PRIMARY safety purpose is to:

The dispersive electrode returns the electrosurgical current to the generator over a LARGE surface area, keeping current density (and thus heating) low to prevent a return-site burn. If the pad has poor contact or reduced effective area, the current density rises and can cause a patient burn, which is why proper pad application is essential.

Why the other choices are less appropriate:

- A. The pad does not monitor ECG.
- C. The pad is not for grounding the anesthesia machine.
- D. The active electrode (pencil) delivers cutting/coagulating current to the tissue.

Question 218 · Correct Answer: C

A patient with an implanted cardioverter-defibrillator (ICD) is scheduled for surgery involving monopolar electrocautery. Which is the MOST...

Monopolar electrocautery can be misinterpreted by an ICD as a tachyarrhythmia and trigger inappropriate shocks, so antitachycardia therapy should be suspended (by reprogramming or a magnet per institutional protocol) while external defibrillation/pacing capability is immediately available and the patient is continuously monitored. Therapy is reactivated postoperatively.

Why the other choices are less appropriate:

- A. The ICD is not removed for routine surgery.
- B. Leaving it active risks inappropriate shocks from cautery interference.
- D. A magnet is used intraoperatively per protocol, not left permanently postoperatively.

Question 219 · Correct Answer: D

Using bipolar rather than monopolar electrosurgery is preferred in patients with implanted cardiac devices primarily because bipolar current:

In bipolar electrosurgery the current travels only between the two tips of the instrument, so it does not pass through the body to a dispersive pad and produces far less electromagnetic interference with pacemakers/ICDs and less stray-current risk. This localized current path is why bipolar is favored near implanted devices when feasible.

Why the other choices are less appropriate:

- A. Bipolar still requires an electrosurgical generator.
- B. Bipolar does coagulate tissue between the tips.
- C. Bipolar is not simply higher voltage; the advantage is the confined current path.

Question 220 · Correct Answer: D

During synchronized cardioversion of a hemodynamically unstable patient with atrial fibrillation, the defibrillator is set to SYNCHRONIZE. What...

Synchronized cardioversion delivers the shock in time with the R wave, avoiding the relative refractory (vulnerable) period on the T wave where a shock could provoke ventricular fibrillation. This is essential for organized rhythms such as atrial fibrillation, atrial flutter, and stable VT; defibrillation of VF/pulseless VT is UNSynchronized.

Why the other choices are less appropriate:

- A. Synchronization times, not doubles, the energy.
- B. The ECG remains active to detect the R wave.
- C. Shocking on the T wave is precisely what synchronization AVOIDS.

Question 221 · Correct Answer: C

Biphasic defibrillators have largely replaced monophasic units because biphasic waveforms:

Biphasic defibrillators deliver current in two directions and achieve comparable or superior defibrillation success at LOWER energy levels than monophasic devices, which reduces myocardial damage and improves first-shock efficacy. They are used for both defibrillation and synchronized cardioversion.

Why the other choices are less appropriate:

- A. They still store and discharge energy from capacitors.
- B. Biphasic devices support synchronized cardioversion.
- D. Biphasic units use LOWER energy, not higher.

Question 222 • Correct Answer: B

A CRNA sets up a syringe infusion pump for a norepinephrine infusion. Which pump feature MOST directly prevents a dangerous bolus when the line is...

During a downstream occlusion, pressure builds within the tubing/syringe; a pump with occlusion detection and an anti-bolus feature limits the sudden release of accumulated volume when the obstruction clears, preventing an inadvertent vasopressor bolus. Occlusion alarms also alert the clinician promptly to the problem.

Why the other choices are less appropriate:

- A. A larger syringe does not prevent the stored-pressure bolus.
- C. Infusion pumps are not gravity dependent; the concern is the pressurized syringe.
- D. A faster rate does not address bolus release.

Question 223 • Correct Answer: B

A 'smart' infusion pump reduces medication errors chiefly through which feature?

Smart pumps incorporate a drug library with dose error-reduction software: soft limits generate a warning that can be overridden, and hard limits block programming outside a safe range, catching keypad and unit errors before they reach the patient. This is the principal safety advantage over conventional pumps.

Why the other choices are less appropriate:

- A. Pumps do not perform blood gas analysis.
- C. The clinician still programs drug, concentration, and rate.
- D. Smart pumps do not diagnose the patient.

Question 224 • Correct Answer: D

A CRNA performs an ultrasound-guided interscalene block using a linear (high-frequency) transducer. Why is a HIGH-frequency (e.g., 10-15 MHz)...

High-frequency ultrasound provides superior spatial RESOLUTION for superficial structures but penetrates poorly, so it is ideal for shallow targets like the interscalene brachial plexus. Deeper blocks (e.g., gluteal/sciatic) require a LOWER-frequency curvilinear probe that trades resolution for penetration.

Why the other choices are less appropriate:

- A. Ultrasound does not replace the need to aspirate before injection.
- B. Ultrasound images anatomy; it does not measure nerve conduction.
- C. Higher frequency penetrates LESS, not more.

Question 225 • Correct Answer: D

During an ultrasound-guided nerve block using an IN-PLANE approach, the needle is BEST visualized when it is:

In the in-plane technique the needle is inserted parallel to the long axis of the probe so the ultrasound beam captures the entire needle shaft and tip in real time, maximizing safety by confirming tip location before injection. In the out-of-plane approach the needle crosses the beam and appears only as a bright dot, making tip identification less certain.

Why the other choices are less appropriate:

- A. Ultrasound guidance is used precisely to avoid blind advancement.
- B. A perpendicular (out-of-plane) needle shows only a dot, less reliable for tip tracking.
- C. The needle must stay within the beam to be visualized.

Question 226 • Correct Answer: A

A CRNA is using a nerve stimulator (without ultrasound) for a peripheral nerve block. A motor response that persists at a current of 0.2 mA or...

Eliciting a motor response at a very LOW current (about 0.2 mA or less) indicates the needle tip is intimately close to, or within, the nerve; injecting at such low thresholds risks intraneural injection and nerve injury. The needle should be withdrawn slightly until the response requires a somewhat higher current (typically about 0.3-0.5 mA) before injecting.

Why the other choices are less appropriate:

- B. A response at very low current means the tip is very close, not far.
- C. Injecting at less than 0.2 mA risks intraneural injection.
- D. Nerve stimulation reflects proximity to nerve tissue, not intravascular position.

Question 227 · Correct Answer: C

A pencil-point (e.g., Whitacre/Sprotte) spinal needle is preferred over a cutting-tip (Quincke) needle chiefly because it:

A pencil-point needle has a rounded, non-cutting tip with a side port that SPREADS the dural fibers rather than cutting them, so the dura reseals more effectively and the incidence of post-dural puncture headache is LOWER. This is why small-gauge pencil-point needles are favored, especially in young patients and obstetrics.

Why the other choices are less appropriate:

- A. Pencil-point needles are actually more flexible and can be harder to direct.
- B. The main advantage is reduced headache, not block success.
- D. CSF flow is often slower through a pencil-point side port, not faster.

Question 228 · Correct Answer: D

An epidural set uses a Tuohy needle with a curved (Huber) tip. What is the primary purpose of this tip design?

The Tuohy needle's curved Huber tip guides the advancing epidural catheter in the desired (usually cephalad) direction along the epidural space and its blunt, curved design helps reduce the chance of inadvertent dural puncture compared with a sharp straight tip. Careful technique still avoids withdrawing the catheter through the needle to prevent shearing.

Why the other choices are less appropriate:

- A. The design is intended to AVOID dural puncture, not cut the dura.
- B. Preventing shearing is a technique caution, not the tip's primary purpose.
- C. The tip does not measure pressure.

Question 229 · Correct Answer: A

The loss-of-resistance technique for identifying the epidural space relies on the fact that:

As the needle passes through the dense ligamentum flavum, the plunger meets firm resistance to injected air or saline; upon entering the epidural (potential) space, resistance suddenly disappears (loss of resistance), signaling correct placement. This tactile change is the classic endpoint for epidural needle placement.

Why the other choices are less appropriate:

- B. Contacting bone is not a required step of loss of resistance.
- C. Entering the subarachnoid space yields CSF, a different endpoint.
- D. The epidural space contains fat and vessels, not CSF (CSF is subarachnoid).

Question 230 · Correct Answer: C

During ultrasound-guided internal jugular central line placement, how are the internal jugular vein and carotid artery BEST distinguished in the...

On ultrasound the internal jugular vein is typically larger, thin-walled, and readily COMPRESSIBLE with gentle probe pressure, whereas the carotid artery is round, thick-walled, pulsatile, and NON-compressible. Confirming compressibility (and the absence of arterial pulsatility) reduces the risk of inadvertent carotid puncture.

Why the other choices are less appropriate:

- A. Ultrasound reliably distinguishes them by compressibility and pulsatility.
- B. The vein is non-pulsatile and compressible, not pulsatile/non-compressible.
- D. The artery is non-compressible under gentle pressure.

Question 231 · Correct Answer: D

After central venous catheter placement, the catheter tip is ideally positioned at which location?

The optimal central venous catheter tip location is at the SVC-right atrial junction (in the lower SVC), which provides reliable central pressure measurement and reduces the risk of arrhythmias and cardiac perforation that occur if the tip is in the atrium or ventricle. A post-procedure chest radiograph confirms tip position and excludes pneumothorax.

Why the other choices are less appropriate:

- A. A subclavian position is too proximal for accurate central measurement.
- B. An IJ position is too proximal (not central).
- C. A tip in the right ventricle risks arrhythmias and perforation.

Question 232 • Correct Answer: A

An arterial line is planned in the radial artery. The modified Allen test is performed to assess:

The modified Allen test evaluates collateral circulation: after occluding both radial and ulnar arteries and exsanguinating the hand, releasing the ULNAR artery should restore color within a few seconds, indicating adequate collateral flow should the radial artery become compromised. Although its predictive value is debated, it is the traditional pre-cannulation screen.

Why the other choices are less appropriate:

- B. The test assesses collateral flow, not vessel diameter.
- C. It does not detect arteriovenous fistulae.
- D. It does not test nerve function.

Question 233 • Correct Answer: A

A CRNA notes that an intravenous catheter's maximum flow rate is governed by the Hagen-Poiseuille relationship. To achieve the FASTEST fluid...

By the Hagen-Poiseuille relationship, flow is proportional to the fourth power of the radius and inversely proportional to length, so a SHORT, LARGE-diameter catheter maximizes flow; radius has by far the greatest effect. A large-bore peripheral catheter often delivers faster flow than a long multi-lumen central line for rapid resuscitation.

Why the other choices are less appropriate:

- B. Length adds resistance; a long catheter is slower even if large-bore.
- C. Small bore and short still limits flow because diameter dominates.
- D. Long and small-bore minimizes flow.

Question 234 • Correct Answer: B

Which measure MOST effectively reduces the risk of catheter-related bloodstream infection during central line insertion?

Central line bundle elements shown to reduce bloodstream infection include maximal sterile barrier precautions (cap, mask, sterile gown, gloves, and full drape), chlorhexidine-based skin antisepsis, and choosing a lower-risk insertion site (the subclavian generally has lower infection risk than the femoral). Hand hygiene and prompt removal of unnecessary lines are also key.

Why the other choices are less appropriate:

- A. The femoral site carries a HIGHER infection risk.
- C. Routine guidewire exchanges do not reduce infection and may introduce it.
- D. Chlorhexidine with full barrier precautions is superior to povidone-iodine without draping.

Question 235 • Correct Answer: B

Immediately after left subclavian central line insertion, the patient develops sudden hypotension, absent breath sounds on the left, and rising...

Subclavian (and low IJ) central line attempts risk pleural puncture; a tension pneumothorax presents with unilateral absent breath sounds, hypotension, rising airway pressures, and tracheal deviation, and requires immediate needle decompression followed by chest tube. A post-procedure chest radiograph normally screens for pneumothorax, but a tension picture demands treatment before imaging.

Why the other choices are less appropriate:

- A. Infection develops over days, not immediately.
- C. Air embolism causes hypotension and a mill-wheel murmur but not unilateral absent breath sounds with rising airway pressure.
- D. An arterial puncture causes a hematoma/bleeding, not absent breath sounds and rising airway pressure.

Question 236 • Correct Answer: B

To reduce the risk of venous air embolism during central venous catheter INSERTION or removal at the neck, the patient should be positioned:

Placing the patient head-down (Trendelenburg) during IJ/subclavian insertion distends the central veins and raises venous pressure above atmospheric, reducing the chance of air entrainment; during removal, the patient is kept supine/flat, exhaling or performing a Valsalva, with an occlusive dressing applied. These maneuvers minimize venous air embolism at the neck.

Why the other choices are less appropriate:

- A. Sitting upright increases the risk of air embolism at the neck.
- C. Prone positioning is not appropriate for neck line access.
- D. Head-up lowers central venous pressure and increases air-entrainment risk.

Question 237 • Correct Answer: D

A pressurized flush system for an invasive arterial or central line is typically inflated to about 300 mmHg and delivers a slow continuous flush....

The pressurized bag (about 300 mmHg, above arterial pressure) drives a slow continuous flush of roughly 3 mL/hr through the restrictor to keep the catheter patent and prevent clotting, and it supplies the fast-flush (square-wave) test used to check the dynamic response of the transducer system. It is not intended for rapid volume infusion.

Why the other choices are less appropriate:

- A. It does not measure cardiac output.
- B. It does not warm fluids.
- C. The restrictor limits flow to a few mL/hr, not rapid infusion.

Question 238 • Correct Answer: A

The 2008 ASA/manufacture anesthesia machine pre-use checkout requires verifying an adequate backup ventilation device is available. Which item...

A key checkout step is confirming that auxiliary/backup ventilation equipment (a self-inflating manual resuscitation bag) is present and functioning, so ventilation can continue if the machine or its ventilator fails. This is a fundamental patient-safety redundancy independent of the machine's own bellows/ventilator.

Why the other choices are less appropriate:

- B. An extra absorbent canister does not ventilate the patient.
- C. A spare vaporizer does not provide backup VENTILATION.
- D. A backup oximeter monitors but cannot ventilate.

Question 239 • Correct Answer: A

A CRNA is monitoring a patient with a peripheral nerve stimulator and applies a 5-second, 50-Hz TETANIC stimulus. In a partial nondepolarizing...

During a partial NONdepolarizing block, tetanic stimulation produces FADE (the response cannot be sustained) because of reduced presynaptic acetylcholine mobilization, and it is followed by post-tetanic potentiation from mobilized transmitter. A sustained, non-fading tetanus indicates either no block or a depolarizing (phase I) block.

Why the other choices are less appropriate:

- B. Some response is present in a partial block.
- C. A sustained response indicates recovery or a phase I depolarizing block, not partial nondepolarizing block.
- D. Nondepolarizing block shows a decreasing (fading), not increasing, response.

Question 240 • Correct Answer: D

A surgical fire requires three elements of the fire triad. In the operating room, the anesthesia provider MOST directly controls which element?

The fire triad is an oxidizer, an ignition source, and fuel; the anesthesia provider most directly controls the OXIDIZER by limiting supplemental oxygen and avoiding nitrous oxide, especially during head/neck/airway surgery near an ignition source. The surgeon controls the ignition source (cautery/laser) and the team manages fuel (allowing prep solutions to dry, using appropriate drapes).

Why the other choices are less appropriate:

- A. The provider does control an element, namely the oxidizer.
- B. The ignition source (cautery, laser) is controlled chiefly by the surgeon.
- C. Fuel sources such as drapes and prep solutions are managed by the surgical/nursing team.

DOMAIN III: GENERAL PRINCIPLES OF ANESTHESIA

Question 241 • Correct Answer: B

A 52-year-old obese male (BMI 44) undergoes general anesthesia for laparoscopic Roux-en-Y gastric bypass. After uneventful intubation, you note...

In morbidly obese patients, the weight of abdominal contents and the Trendelenburg position required for laparoscopy both reduce FRC and worsen lung compliance. PEEP of 8-10 cmH₂O recruits atelectatic lung units and improves oxygenation and compliance. Reverse Trendelenburg reduces diaphragmatic loading from the abdominal contents. This combination is a standard strategy in bariatric laparoscopic surgery. Tidal volume should be based on IBW (not TBW) - typically 6-8 mL/kg IBW.

Why the other choices are less appropriate:

- A. Increasing RR alone does not improve compliance and may worsen air trapping.
- C. Reducing TV to 4 mL/kg IBW is appropriate lung-protective ventilation for ARDS, not standard for bariatric surgery.
- D. Mode of ventilation (volume vs. pressure control) does not directly improve compliance.

Question 242 • Correct Answer: B

A 28-year-old parturient at 39 weeks gestation receives a spinal anesthetic for elective cesarean delivery. 5 minutes after intrathecal injection,...

Spinal hypotension in the parturient is common (incidence 50-80% without prophylaxis) and can cause placental hypoperfusion and fetal acidosis. Current evidence strongly favors phenylephrine over ephedrine as first-line treatment because it is associated with less fetal acidosis (ephedrine crosses the placenta and causes fetal metabolic acidosis). Left uterine displacement prevents aortocaval compression. Prophylactic phenylephrine infusion is now recommended in elective cesarean to prevent hypotension rather than wait and treat.

Why the other choices are less appropriate:

- A. Ephedrine was traditionally first-line but RCTs show more fetal acidosis compared to phenylephrine.
- C. Epinephrine is reserved for refractory hypotension or cardiac arrest - too potent for routine spinal hypotension.
- D. Trendelenburg increases spinal block height and does not selectively treat hypotension; it may cause high spinal.

Question 243 • Correct Answer: B

A 70 kg male undergoes a 4-hour colectomy with estimated blood loss of 800 mL. Using goal-directed fluid management principles, which of the...

Goal-directed fluid therapy (GDFT) uses dynamic markers of fluid responsiveness (PPV, SVV, stroke volume response to a fluid challenge) to guide bolus-based fluid administration. This approach reduces unnecessary fluid administration, postoperative complications, and length of stay compared to formula-based or static pressure-based approaches (CVP is a poor predictor of fluid responsiveness). A PPV >13% in a mechanically ventilated patient with regular cardiac rhythm predicts positive fluid response.

Why the other choices are less appropriate:

- A. Traditional formula-based approaches overload many patients; GDFT is superior for major surgery.
- C. CVP does not reliably predict fluid responsiveness and should not be used as the sole guiding parameter.
- D. Fixed-rate infusion does not account for individual patient needs.

Question 244 • Correct Answer: B

A CRNA identifies a Mallampati class IV airway with a 3 cm mouth opening, thick neck (thyroid-to-mental space 5 cm), and history of difficult...

A known difficult airway with a history of prior difficult intubation is the primary indication for awake intubation. Awake fiberoptic intubation (AFOI) preserves spontaneous ventilation, maintains airway tone, and allows the patient to maintain their airway while the CRNA secures it. Video laryngoscopy improves the glottic view but does not guarantee intubation success in every difficult airway, and it requires inducing general anesthesia first - this commits the provider to an anesthetized, apneic patient with a known difficult airway.

Why the other choices are less appropriate:

- A. Video laryngoscopy is excellent for unanticipated difficult airways but NOT the first choice for a known anticipated difficult airway when AFOI is possible.
- C. An LMA is a useful rescue airway device but is not a definitive airway for a 4-hour shoulder surgery.
- D. Direct laryngoscopy in a Mallampati IV patient with prior difficult intubation risks CICO - this is dangerous.

Question 245 • Correct Answer: B

A 55-year-old woman with opioid tolerance (on morphine ER 60 mg twice daily) undergoes open spinal fusion. Which perioperative pain management...

In opioid-tolerant patients, multimodal analgesia targeting multiple pain pathways is the evidence-based approach. Ketamine at subanesthetic doses is particularly valuable in opioid-tolerant patients - it antagonizes NMDA receptors (reducing central sensitization and opioid-induced hyperalgesia), reduces perioperative opioid consumption, and can improve analgesia in refractory cases. Combined with acetaminophen, NSAIDs, and regional anesthesia (when feasible), this approach minimizes escalating opioid requirements and their side effects.

Why the other choices are less appropriate:

- A. High-dose IV opioids alone provide inadequate analgesia in tolerant patients and increase adverse effects.
- C. Increasing oral opioids preoperatively does not address the multimodal gap and may increase side effects.
- D. A single preoperative gabapentin dose provides minimal perioperative benefit alone.

Question 246 • Correct Answer: B

A 62-year-old male with a drug-eluting coronary stent placed 5 months ago presents for elective inguinal hernia repair. He is on clopidogrel and...

Current ACC/AHA/AANA guidelines recommend waiting at least 6 months after drug-eluting stent (DES) placement before elective noncardiac surgery, and 30 days after bare-metal stent (BMS) placement. Stopping dual antiplatelet therapy (DAPT) before this window significantly increases the risk of in-stent thrombosis, which carries ~30% mortality. This patient is at 5 months - just outside the safe window. The correct decision is to delay until at least 6 months post-DES, maintain DAPT during the wait, then proceed.

Why the other choices are less appropriate:

- A. Holding both antiplatelet agents before the 6-month window risks catastrophic stent thrombosis.
- C. Holding clopidogrel at 5 months post-DES exposes the patient to stent thrombosis risk.
- D. Continuing both antiplatelet agents increases surgical bleeding - this would be the choice only in emergent or truly time-sensitive surgery.

Question 247 • Correct Answer: B

A patient develops a persistent bite (masseter spasm) during mask induction with sevoflurane after receiving succinylcholine 1.5 mg/kg....

Masseter muscle rigidity (MMR) after succinylcholine is an early potential warning sign of malignant hyperthermia (MH). It occurs in 1% of pediatric cases receiving succinylcholine + volatile agents and in a subset of these patients, MH will develop. The rising ETCO₂ (48) and mild temperature increase further raise concern. The appropriate response is: (1) stop all volatile agents, (2) switch to TIVA, (3) increase monitoring (temperature, ETCO₂, ABG, CK), (4) prepare dantrolene. The surgery can continue cautiously if the patient stabilizes, but MH must be definitively ruled out.

Why the other choices are less appropriate:

- A. This is not laryngospasm - the patient has muscle rigidity, not airway obstruction.
- C. Phase II block causes prolonged paralysis, not jaw rigidity.
- D. Administering more succinylcholine to a patient with MMR and suspected MH is absolutely contraindicated.

Question 248 · Correct Answer: B

A 60-year-old woman with a history of congestive heart failure (EF 30%) undergoes a 3-hour hysterectomy. Intraoperative TEE shows a dilated LV...

In a patient with cardiogenic shock (low EF, hypotension, tachycardia), the problem is poor contractility, not vasodilation. The management targets the underlying pathophysiology: (1) inotrope (dobutamine) to improve contractility, (2) vasopressor to maintain perfusion pressure while afterload is optimized, and (3) careful fluid management to avoid volume overload in an already dilated, poorly functioning ventricle. TEE guides therapy - assess for improvement in LV function and wall motion.

Why the other choices are less appropriate:

- A. Phenylephrine increases afterload, which is poorly tolerated in a failing LV with low EF.
- C. Beta-blockade in acute cardiogenic shock is contraindicated - it will worsen the situation.
- D. Nitroprusside reduces afterload (potentially helpful) but requires inotropic support first; hypotension makes this dangerous without vasopressor coverage.

Question 249 · Correct Answer: C

A patient is in the lithotomy position for a 3.5-hour perineal procedure. Post-operatively, she reports bilateral calf pain, weakness in...

The common peroneal nerve is the most frequently injured nerve in lithotomy position. It wraps around the fibular head and is vulnerable to compression when the leg rests against the leg holder at that point. The common peroneal nerve innervates: dorsiflexion (foot drop) and sensory to the dorsum of the foot and lateral lower leg. Injury presents as foot drop (inability to dorsiflex) and sensory deficit on the dorsum of the foot. Prevention: ensure the lateral fibular head is not compressed against lithotomy stirrups; pad all bony prominences.

Why the other choices are less appropriate:

- A. Femoral nerve injury in lithotomy presents with hip flexor weakness and anterior thigh/medial leg sensory loss.
- B. Sciatic nerve injury causes more extensive lower extremity dysfunction including hamstrings and all below-knee function.
- D. Obturator nerve injury causes adductor weakness and medial thigh sensory loss.

Question 250 · Correct Answer: B

A 45-year-old Jehovah's Witness presents for an elective total knee replacement and signs a blood refusal form declining all blood products...

A competent adult's informed refusal of specific medical treatment - including blood products - is legally and ethically binding, even in life-threatening situations. The blood refusal was signed pre-operatively while the patient was competent and informed. The care team must honor this advance directive and maximize non-blood strategies: cell salvage (autologous blood recovery), vasopressors, tranexamic acid, erythropoietin, iron, hyperbaric oxygen (if available), and IV iron. The ethics committee and family cannot override a competent adult's informed refusal.

Why the other choices are less appropriate:

- A. Implied consent applies to unknown patients who cannot consent - this patient explicitly refused while competent.
- C. The ethics committee cannot override a competent patient's prior informed refusal.
- D. A competent adult's refusal supersedes family preference - there is no surrogate needed when the patient's wishes are clearly documented.

Question 251 · Correct Answer: B

Which of the following is the MOST appropriate initial treatment for laryngospasm in a spontaneously breathing child who does not have IV access?

Complete laryngospasm in a child (complete airway obstruction, no chest rise, SpO₂ falling rapidly) with no IV access requires immediate IM succinylcholine 4 mg/kg to break the spasm. This is a life-saving intervention. The deltoid or lateral thigh are appropriate IM sites. While jaw thrust and CPAP (with 100% O₂ and appropriate mask seal) is the first attempt for partial laryngospasm, complete laryngospasm unresponsive to CPAP requires succinylcholine. The dose is higher than IV (4 mg/kg IM vs. 1-1.5 mg/kg IV) due to slower absorption.

Why the other choices are less appropriate:

- A. A nasopharyngeal airway does not relieve laryngospasm and may worsen it.
- C. Correct for partial laryngospasm - always attempt CPAP/O₂ first, but complete laryngospasm requires succinylcholine.
- D. Intubation cannot be performed during complete laryngospasm without muscle relaxation.

Question 252 · Correct Answer: C

A patient is in the PACU following a laparoscopic appendectomy under general anesthesia. She is restless, confused, tachycardic at 118, with a...

Restlessness, tachycardia, and abdominal distension in the immediate post-operative period after intra-abdominal surgery must first raise concern for a surgical emergency: intra-abdominal hemorrhage, anastomotic leak, bowel perforation, or visceral injury. These require urgent assessment - vital signs trend, abdominal exam, Hgb/CBC, and communication with the surgical team immediately. Opioid sedation is typically characterized by decreased consciousness and respiratory rate, not agitation and tachycardia.

Why the other choices are less appropriate:

- A. Morphine allergy (anaphylaxis) would present with urticaria, bronchospasm, and hypotension.
- B. Urinary retention causes discomfort and agitation but not tachycardia and abdominal distension of this degree.
- D. Opioid effect would cause sedation, miosis, and respiratory depression - not agitation and tachycardia.

Question 253 · Correct Answer: B

During a prolonged oral surgery case with LMA in place, the capnography waveform shows a consistent upsloping plateau (shark-fin waveform) with...

A 'shark-fin' capnography waveform (also called an obstructive pattern) shows a prolonged, upsloping alveolar plateau that does not reach a flat peak before the next inspiration. This reflects uneven emptying of alveolar units due to airway obstruction - most commonly bronchospasm, partial ETT obstruction, or kinked airway. The elevated ETCO₂ (52) also confirms hypoventilation or significant obstruction. This should prompt assessment for bronchospasm (wheeze, peak pressure) and treatment with bronchodilators.

Why the other choices are less appropriate:

- A. Esophageal intubation produces CO₂ for 1-2 breaths then disappears - not a sustained shark-fin pattern.
- C. A normal capnography waveform has a flat alveolar plateau (alpha angle <90 degrees); the shark-fin pattern is abnormal.
- D. PE causes a sudden decrease in ETCO₂ - not an obstructive waveform.

Question 254 · Correct Answer: B

Which of the following CORRECTLY describes the mechanism and reversal of neostigmine-glycopyrrolate combination for neuromuscular blockade reversal?

Neostigmine inhibits acetylcholinesterase, the enzyme that breaks down acetylcholine (ACh) at all cholinergic synapses. By preventing ACh degradation, it increases ACh concentration at the NMJ, which competitively overcomes the NDNMB. However, ACh also accumulates at muscarinic receptors - causing bradycardia, increased secretions, bronchospasm, and GI motility. Glycopyrrolate is a quaternary ammonium anticholinergic that blocks muscarinic (not nicotinic) side effects. Because it is a quaternary amine, it does not cross the blood-brain barrier (unlike atropine, which can cause central effects).

Why the other choices are less appropriate:

- A. Neostigmine does not directly bind nicotinic receptors - it works by enzyme inhibition.
- C. This has the roles reversed.
- D. Neostigmine and glycopyrrolate act at different receptor types.

Question 255 · Correct Answer: C

A CRNA is asked to administer anesthesia for electroconvulsive therapy (ECT). Which statement regarding ECT anesthesia management is MOST accurate?

ECT anesthesia goals are: (1) brief unconsciousness/amnesia, (2) muscle relaxation with succinylcholine to prevent musculoskeletal injury from generalized tonic-clonic activity, and (3) rapid recovery. Methohexital is traditionally preferred because it has a lower seizure threshold than propofol (propofol raises seizure threshold and may shorten or abort the seizure). Etomidate also preserves a lower seizure threshold and is an acceptable alternative. Succinylcholine is specifically beneficial because its short duration allows rapid motor modification without prolonged paralysis, permitting observation of the modified seizure.

Why the other choices are less appropriate:

- A. Succinylcholine is specifically indicated for ECT to modify (not prevent) the seizure.
- B. Deep anesthesia with high MAC would suppress the seizure - ECT requires only light anesthesia.
- D. Ketamine increases sympathetic tone, worsening the cardiovascular surge already seen with ECT.

Question 256 • Correct Answer: C

Intraoperatively, you draw an ABG on a patient with no pre-existing acid-base disorders who has received 4 liters of normal saline (0.9% NaCl)....

Normal saline contains 154 mEq/L of both sodium and chloride. The high chloride load from large-volume NS administration dilutes bicarbonate and causes a hyperchloremic metabolic acidosis (non-anion gap, also called dilutional acidosis). Check: Anion gap = $142 - (118 + 17) = 7$ - normal (8-12 mEq/L), confirming non-anion gap. This is a well-recognized complication of large-volume NS resuscitation. Balanced crystalloids (LR, Plasmalyte) have lower chloride content and are less likely to cause this.

Why the other choices are less appropriate:

- A. PaCO₂ is 38 (normal), ruling out respiratory acidosis.
- B. Metabolic alkalosis would show elevated pH and HCO₃ - opposite of the findings.
- D. PaCO₂ is normal - no respiratory component.

Question 257 • Correct Answer: A

Which of the following correctly identifies the Apfel Simplified Risk Score for PONV and the threshold at which prophylaxis with 2 agents is...

The Apfel Simplified PONV Risk Score assigns 1 point each for: (1) Female sex, (2) Non-smoker, (3) History of PONV or motion sickness, (4) Postoperative opioid use expected. Score interpretation: 0 = ~10% risk; 1 = ~20%; 2 = ~40% (intermediate); 3 = ~60%; 4 = ~80%. Current SAMBA guidelines recommend: 0-1 risk factors = consider prophylaxis; 2+ factors = 2 antiemetic prophylaxis agents; 3-4 factors = multimodal prophylaxis (2+ agents + TIVA + regional to reduce opioids). Most common agents: ondansetron, dexamethasone, scopolamine patch.

Why the other choices are less appropriate:

- B. Age >50, male sex, and nitrous oxide are not part of the validated Apfel score.
- C. Obesity, GERD, and prone positioning are not Apfel score components.
- D. Prior C-section and GERD are not Apfel score components.

Question 258 • Correct Answer: B

A CRNA is setting up for a case in which a laser will be used in the airway (microlaryngoscopy). Which precaution is MOST critical to prevent an...

Airway laser fires require three components: ignition source (laser), fuel (ETT, drapes, tissue), and oxidizer (O₂ and N₂O). The most critical preventive measures are: (1) minimize FiO₂ to the lowest tolerable concentration (<30% if able, always <40% with active laser use), (2) use a laser-resistant ETT (metallic-wrapped, e.g., Laser-Flex), (3) inflate the cuff with saline + methylene blue (so cuff rupture is immediately visible), and (4) avoid N₂O (potent oxidizer). FiO₂ 100% with a laser in the airway is extremely dangerous.

Why the other choices are less appropriate:

- A. FiO₂ 100% dramatically increases fire risk - opposite of correct practice.
- C. Soaking a standard ETT in saline does not provide laser resistance.
- D. Flooding the trachea with saline is not a standard safety measure and would compromise ventilation.

Question 259 • Correct Answer: B

A patient receives a combined spinal-epidural (CSE) for labor analgesia. 20 minutes later the nurse reports the patient cannot feel her legs at...

A sensory block to T2 with profound hypotension and motor block after an epidural dose suggests the epidural catheter tip migrated intrathecally and delivered a full spinal dose into the CSF. This is a 'total spinal' - one of the most serious complications of neuraxial anesthesia. Treatment is immediate: 100% O₂, vasopressors (phenylephrine, epinephrine if needed), IV fluid bolus, left uterine displacement, prepare for endotracheal intubation if the block rises to affect respiratory muscles (C3-C5 = phrenic nerve).

Why the other choices are less appropriate:

- A. A sensory block to T2 with hypotension and total leg paralysis is never 'normal' - this is a high/total spinal requiring emergent treatment.
- C. Epidural hematoma is a gradual presentation (hours to days) with progressive back pain and neurologic deterioration.
- D. Epidural abscess presents 24-72+ hours after placement with fever, back pain, and progressive neurologic deficit.

Question 260 · Correct Answer: B

A patient in the PACU develops acute respiratory distress with pink, frothy secretions from the ETT (still intubated) 30 minutes after reversal of...

Negative pressure pulmonary edema (NPPE) occurs when a patient generates a forceful inspiratory effort against a completely obstructed airway (in this case, laryngospasm). The extreme negative intrathoracic pressure generated (-40 to -140 cmH₂O) dramatically increases pulmonary venous return and pulmonary capillary pressure, forcing fluid into the alveoli. It typically appears 30-60 minutes after relieving the obstruction. Treatment: supplemental O₂ or CPAP/BiPAP, diuresis with furosemide, and supportive care. It usually resolves within 12-24 hours.

Why the other choices are less appropriate:

- A. Pneumonia develops over hours to days, not 30 minutes after laryngospasm.
- C. Flash pulmonary edema from fluid overload does not follow laryngospasm; the mechanism is different.
- D. PE does not cause pink frothy secretions - it causes hypoxemia, chest pain, and decreased ETCO₂.

Question 261 · Correct Answer: C

A 45-year-old patient with known obstructive sleep apnea (OSA) and BMI 38 undergoes an outpatient laparoscopic cholecystectomy. Post-operatively,...

For OSA patients undergoing outpatient surgery, the ASA recommends: individualized discharge planning based on: procedure invasiveness, anesthetic used, adequacy of pain control (preferring non-opioid multimodal analgesia), the patient's OSA severity, and availability of CPAP. Standard discharge criteria must be met. Patients should have a responsible adult escort and CPAP (if they have it) for the night. Opioid minimization is critical - residual opioid sedation plus OSA significantly increases post-discharge hypoxemia risk.

Why the other choices are less appropriate:

- A. A fixed 6-hour PACU time is not evidence-based - discharge is criterion-based.
- B. A nasal airway is not a substitute for CPAP and is not a standard discharge prescription.
- D. Mandatory 23-hour admission for all OSA patients is not supported by current evidence for low-complexity procedures.

Question 262 · Correct Answer: B

A patient receiving a dexmedetomidine infusion at 0.7 mcg/kg/hr for ICU sedation develops a heart rate of 38 bpm and BP 82/50 mmHg. Which is the...

Dexmedetomidine is an alpha-2 adrenergic agonist that activates alpha-2 receptors in the brainstem locus coeruleus, causing sedation without respiratory depression. It also activates peripheral alpha-2 receptors, producing bradycardia and hypotension - especially at higher doses. Symptomatic bradycardia (HR 38, hypotension) requires reducing or stopping the infusion and treating with atropine (0.5 mg IV) or glycopyrrolate. Severe cases may require temporary cardiac pacing. Avoid rapid bolus administration of dexmedetomidine - it can cause transient hypertension followed by profound bradycardia.

Why the other choices are less appropriate:

- A. The bradycardia IS caused by the dexmedetomidine - increasing the dose would worsen it.
- C. Adenosine is used to terminate SVT, not sinus bradycardia.
- D. Cardioversion is for hemodynamically unstable tachyarrhythmias, not symptomatic bradycardia.

Question 263 · Correct Answer: B

According to AANA standards, which of the following monitoring parameters represents the MINIMUM standard that must be used during all general...

AANA Standards for Nurse Anesthesia Practice require the following minimum monitoring during all general anesthetic procedures: (1) ECG (continuous), (2) noninvasive blood pressure (at appropriate intervals), (3) pulse oximetry (SpO₂), (4) capnography (ETCO₂ for every intubated or supraglottic airway patient), and (5) temperature for cases expected to have clinically significant temperature changes. These represent the ASA/AANA minimum standard of monitoring. Additional monitoring (arterial line, PA catheter, TEE) is based on patient/procedure complexity.

Why the other choices are less appropriate:

- A. Arterial lines, CVP, and Foley catheters are advanced monitoring - indicated by patient condition, not universally required.
- C. ECG and SpO₂ without NIBP are inadequate - BP monitoring is required.
- D. SpO₂ and BP alone are insufficient - ECG and capnography are both required minimum standards.

Question 264 • Correct Answer: B

A CRNA is managing a patient with a known subglottic stenosis for an elective procedure. The trachea is narrowed to approximately 6 mm. Which...

Subglottic stenosis is a critical airway challenge requiring awake fiberoptic intubation as the safest approach. A 6 mm stenosis can accommodate approximately a 5.0-5.5 mm ETT (note: a 5.5 mm ETT OD is typically ~7.5 mm, so this is complex - tube selection must be verified against the stenosis diameter, and smaller tubes may be needed). Awake intubation preserves airway tone, spontaneous ventilation, and allows the CRNA to navigate the stenosis under direct vision. RSI with a 6 mm ETT risks complete obstruction, trauma, and inability to pass the tube.

Why the other choices are less appropriate:

- A. RSI commits to an apneic patient with a known stenosis - extremely dangerous.
- C. An LMA sits above the subglottis - it would bypass the stenosis for mask ventilation but does not secure the airway and cannot address intraoperative airway management needs.
- D. CRNAs are trained and qualified to manage complex airways including with fiberoptic techniques.

Question 265 • Correct Answer: B

A CRNA performs an ultrasound-guided interscalene block for shoulder arthroscopy. 30 minutes later the patient reports shortness of breath. Oxygen...

Phrenic nerve palsy (C3-C5) is a 100% incidence side effect of interscalene block - the phrenic nerve runs directly through the interscalene groove adjacent to the brachial plexus. The ipsilateral hemidiaphragm is paralyzed, which typically causes a 25% reduction in pulmonary function in healthy patients. This is clinically insignificant in patients with normal lung function but is a relative contraindication in patients with severe COPD, obesity, or contralateral lung disease. The SpO2 drop to 94% is consistent with this. Symptomatic management includes supplemental O2; the block will resolve in 12-18 hours.

Why the other choices are less appropriate:

- A. Pneumothorax is a possible complication but presents with absent breath sounds and very different X-ray findings.
- C. Phrenic nerve palsy from interscalene is always ipsilateral.
- D. Cervical epidural spread is a serious but rare complication causing bilateral weakness/respiratory depression - not a hemidiaphragm elevation finding.

Question 266 • Correct Answer: B

A 25-year-old patient in the ICU following a gunshot wound has a TEG (thromboelastography) result showing: prolonged R time, narrow MA, short...

TEG interpretation: R time = time to initial clot formation (reflects clotting factors); MA (maximum amplitude) = clot strength (reflects platelet function and fibrinogen); fibrinolysis = lysis at 30 minutes (LY30). Prolonged R time indicates factor deficiency -> treat with FFP. Narrow MA indicates decreased platelet function or fibrinogen. Short fibrinolysis time indicates hyperfibrinolysis -> treat with tranexamic acid (TXA). Goal-directed therapy based on TEG/ROTEM reduces unnecessary transfusions and improves outcomes in trauma.

Why the other choices are less appropriate:

- A. Platelets and cryo address the MA issue but not the factor deficiency (R time).
- C. PRBCs alone do not address the coagulopathy identified on TEG.
- D. Prolonged R time means slow clot formation (hypocoagulable), not hypercoagulable.

Question 267 • Correct Answer: B

Which statement BEST describes the anesthetic management of a patient with known or suspected full stomach in an emergency?

RSI is the standard technique for patients with full stomach risk. Key elements: (1) Preoxygenate to maximum SaO2 for 3-5 minutes (nitrogen washout), (2) Cricoid pressure (Sellick maneuver) from loss of consciousness until ETT placement confirmed, (3) Succinylcholine 1.5-2 mg/kg OR rocuronium 1.2 mg/kg for rapid onset and intubating conditions, (4) NO mask ventilation after induction (risk of gastric insufflation and regurgitation), (5) Confirm ETT placement by capnography immediately.

Why the other choices are less appropriate:

- A. Ondansetron prevents PONV but does NOT reduce aspiration risk.
- C. LMAs do not protect against aspiration - they sit above the glottis and do not seal against gastric regurgitation.
- D. Emergency surgery cannot wait for NPO status - RSI is the correct approach.

Question 268 • Correct Answer: B

A CRNA adds dexamethasone 8 mg IV at the start of a 3-hour abdominal hysterectomy. Which of the following BEST describes the evidence-based...

A single intraoperative dose of dexamethasone 4-8 mg IV has multiple perioperative benefits: (1) Significant antiemetic effect (similar in efficacy to ondansetron as a single agent), (2) Analgesic-sparing effect reducing postoperative pain and opioid consumption, (3) Reduces airway edema (relevant for prolonged intubation, ENT cases, prone positioning), (4) Anti-inflammatory effects supporting faster recovery. Single-dose dexamethasone does not cause clinically significant immunosuppression or adrenal suppression in non-diabetic patients.

Why the other choices are less appropriate:

- A. Dexamethasone for surgical stress coverage in steroid-dependent patients is a different indication.
- C. Dexamethasone does not improve gastric motility (that is metoclopramide).
- D. Dexamethasone is immunosuppressive and would theoretically increase infection risk, not reduce it.

Question 269 • Correct Answer: C

A CRNA is working with an impaired colleague who smells of alcohol and appears unsteady. What is the MOST appropriate immediate action?

AANA Code of Ethics and Standards of Practice require CRNAs to take immediate action when a colleague is impaired and poses a risk to patient safety. This means: (1) Remove the impaired provider from patient care immediately, (2) Notify supervisory personnel and/or the chief CRNA/department head, (3) Document the observations, (4) Assist the colleague in accessing peer assistance programs (AANA has specific programs for substance use disorder). Failing to act makes the observing provider partially liable. Patient safety is the immediate priority.

Why the other choices are less appropriate:

- A. Completing a case with an impaired provider exposes patients to serious harm.
- B. Professional codes explicitly require reporting impaired colleagues - silence is an ethics violation.
- D. Asking privately places sole responsibility on the impaired provider and does not ensure patient safety.

Question 270 • Correct Answer: C

According to ACC/AHA perioperative cardiovascular guidelines, which patient requires additional cardiac testing before elective major non-cardiac...

ACC/AHA guidelines identify symptomatic severe valvular disease (including severe AS, severe MS) as a major active cardiac condition requiring evaluation and possible intervention before elective noncardiac surgery. Severe symptomatic AS with planned major vascular surgery represents a very high-risk combination - the increased surgical stress on a heart that cannot augment output (fixed low CO from AS) significantly elevates perioperative MI and death risk. Evaluation by a cardiologist and potentially valve intervention (TAVR or surgical AVR) should occur before proceeding.

Why the other choices are less appropriate:

- A. Well-controlled hypertension without symptoms does not require additional cardiac testing.
- B. Known CAD with functional capacity ≥ 4 METs does not require additional testing according to ACC/AHA guidelines.
- D. T2DM with normal ECG and no symptoms does not independently require additional cardiac workup.

Question 271 • Correct Answer: C

After an uncomplicated 4-hour spine surgery in the prone position with estimated blood loss of 1500 mL and 4 liters of crystalloid, the patient is...

Significant facial and airway edema after prone positioning with large fluid shifts represents a high-risk extubation scenario. The cuff-leak test evaluates whether there is space around the ETT (indicating a patent airway): deflate the cuff and listen for air movement around the tube. No audible leak suggests airway edema may cause obstruction after extubation. If a leak is present, extubation can proceed but over an airway exchange catheter (AEC) in a staged extubation - the AEC maintains access for re-intubation or oxygen delivery if the patient fails extubation.

Why the other choices are less appropriate:

- A. Airway edema in this context is clinically significant and carries re-intubation risk - not cosmetic.
- B. Prolonged intubation is appropriate if no leak is found, but the cuff-leak test guides this decision.
- D. Tracheostomy is a last resort for anticipated inability to manage the airway by other means.

Question 272 • Correct Answer: B

Which of the following mechanisms BEST explains how gabapentinoids (gabapentin, pregabalin) provide perioperative analgesia?

Gabapentinoids (gabapentin, pregabalin) bind to the alpha-2-delta subunit of voltage-gated calcium channels in neurons. This reduces calcium influx at presynaptic terminals in the dorsal horn of the spinal cord, decreasing release of excitatory neurotransmitters (glutamate, substance P, CGRP). The result is reduced central sensitization and pain signaling. This mechanism is particularly effective for neuropathic pain and perioperative central sensitization. Side effects include sedation and dizziness; careful dosing is needed in the elderly and renally impaired.

Why the other choices are less appropriate:

- A. COX inhibition is the mechanism of NSAIDs (ibuprofen, ketorolac, aspirin).
- C. NMDA antagonism is the mechanism of ketamine and memantine.
- D. Opioid receptor activation is the mechanism of opioids; gabapentinoids have no direct opioid activity.

Question 273 • Correct Answer: C

A CRNA observes a new 2 mm ST segment depression in leads II and V5 30 minutes after femoral-popliteal bypass graft clamping. The patient's HR is...

New intraoperative ST depression in the context of vascular surgery represents likely myocardial ischemia. Immediate response: (1) Notify surgeon (surgery may need to be modified/expedited), (2) 12-lead ECG for more information, (3) TEE if available for wall motion abnormalities, (4) Optimize myocardial oxygen supply/demand: HR control (avoid tachycardia), maintain adequate diastolic BP for coronary perfusion, check Hgb, correct anemia, (5) Consider nitroglycerin for coronary vasodilation if BP allows, (6) Avoid tachycardia - it increases O₂ demand and shortens diastolic filling time.

Why the other choices are less appropriate:

- A. Increasing volatile agent depth can worsen hypotension and does not treat ischemia.
- B. Increasing HR in ischemia worsens myocardial O₂ demand - tachycardia is a major ischemia trigger.
- D. Heparin is not immediately indicated for ST depression without other evidence of stent thrombosis.

Question 274 • Correct Answer: B

A CRNA prepares a propofol infusion and draws additional medications from multidose vials using the same syringe between patients. Which patient...

Reusing syringes or needles between patients - even with multidose vials - is a critical infection control violation that has caused documented outbreaks of hepatitis B, hepatitis C, and bacterial infections. Each patient must have separate syringes and dedicated vials/prefilled syringes. Propofol is particularly susceptible to bacterial contamination due to its lipid emulsion base (bacterial growth medium). AANA and CDC guidelines mandate strict aseptic technique: new needle and syringe for every injection, single-use vials preferred, discard unused portions.

Why the other choices are less appropriate:

- A. Propofol instability is not the primary concern - patient-to-patient contamination is.
- C. Waste documentation requirements apply to controlled substances, not propofol primarily.
- D. PRIS is related to dose and duration of infusion, not external contamination.

Question 275 • Correct Answer: C

A CRNA administers neostigmine 5 mg + glycopyrrolate 1 mg to reverse rocuronium blockade. The TOF ratio is confirmed at 0.95 before extubation....

Laryngospasm presents immediately post-extubation with paradoxical chest wall movement (chest sucks in during inspiration due to airway obstruction), stridor (if partial), silence (if complete), and rapidly falling SpO₂. Despite confirmed TOF >0.9, laryngospasm can still occur - residual anesthetic, secretions, blood, or stimulation of the supraglottic area at extubation can trigger glottic closure independent of neuromuscular function. Immediate treatment: jaw thrust, CPAP with 100% O₂, positive pressure mask ventilation; succinylcholine 0.5-1 mg/kg if incomplete response.

Why the other choices are less appropriate:

- A. TOF 0.95 effectively rules out residual NMB as the primary cause.
- B. Opioid respiratory depression causes slow, regular respirations and sedation - not paradoxical chest movement.
- D. PE presents with sudden tachycardia, decreased ETCO₂, and chest pain - not paradoxical chest movement immediately post-extubation.

Question 276 • Correct Answer: C

A 58-year-old man is scheduled for elective inguinal hernia repair. He has well-controlled hypertension, no other systemic disease, and functions...

ASA II describes a patient with mild systemic disease without substantive functional limitation, such as well-controlled hypertension. ASA I is a normal healthy patient with no systemic disease. ASA III requires a severe systemic disease with substantive functional limitation.

Why the other choices are less appropriate:

- A. ASA III
- B. ASA I
- D. ASA IV

Question 277 • Correct Answer: C

Per current ASA fasting guidelines for elective procedures, what is the MINIMUM recommended fasting time for a light meal (toast and clear...

ASA guidelines recommend a minimum 6-hour fast after a light meal such as toast and clear liquids. Clear liquids alone require only 2 hours, and a heavy or fatty meal requires 8 hours. This reduces the risk of pulmonary aspiration on induction.

Why the other choices are less appropriate:

- A. 4 hours
- B. 2 hours
- D. 8 hours

Question 278 • Correct Answer: C

A patient reports being able to climb two flights of stairs without stopping and can perform heavy housework. Approximately how many metabolic...

Climbing two flights of stairs or doing heavy housework represents 4 or more METs, which is considered adequate functional capacity. Patients able to achieve 4 METs generally do not require further cardiac testing before non-cardiac surgery. Below 4 METs, functional capacity is considered poor.

Why the other choices are less appropriate:

- A. About 2 METs; poor functional capacity
- B. Greater than 10 METs; excellent but requires stress testing
- D. Less than 1 MET; high risk

Question 279 • Correct Answer: D

Using the Revised Cardiac Risk Index (RCRI), which of the following is one of the six independent predictors of major perioperative cardiac...

The RCRI includes six predictors: high-risk surgery, ischemic heart disease, congestive heart failure, cerebrovascular disease, insulin-dependent diabetes, and creatinine greater than 2.0 mg/dL. Age, BMI, and COPD are not among the six RCRI criteria.

Why the other choices are less appropriate:

- A. Body mass index greater than 35
- B. Age greater than 65 years
- C. Chronic obstructive pulmonary disease

Question 280 • Correct Answer: A

A 66-year-old smoker with COPD is scheduled for open upper abdominal surgery. Which intervention is MOST effective at reducing postoperative...

Lung-expansion maneuvers such as incentive spirometry combined with lung-protective ventilation reduce postoperative pulmonary complications. Routine chest films and PFTs do not independently reduce complications, and prophylactic antibiotics do not prevent atelectasis or pneumonia in this setting.

Why the other choices are less appropriate:

- B. Routine preoperative chest radiograph
- C. Prophylactic postoperative antibiotics
- D. Preoperative pulmonary function testing in all patients

Question 281 • Correct Answer: C

Which set of findings on the STOP-BANG questionnaire indicates a HIGH risk for obstructive sleep apnea?

A STOP-BANG score of 5 to 8 indicates high risk for moderate to severe obstructive sleep apnea. A score of 0 to 2 is low risk and 3 to 4 is intermediate risk. Higher scores correlate with increased probability of significant OSA.

Why the other choices are less appropriate:

- A. Score is not predictive of OSA severity
- B. Score of 3 to 4
- D. Score of 0 to 2

Question 282 • Correct Answer: C

During airway assessment, a thyromental distance of less than which value is associated with increased likelihood of difficult direct laryngoscopy?

A thyromental distance less than 6 cm, roughly three fingerbreadths, suggests a limited mandibular space and predicts difficult laryngoscopy. Distances of 6.5 cm or greater are generally reassuring. This measurement reflects the ability to displace the tongue during laryngoscopy.

Why the other choices are less appropriate:

- A. Less than 15 cm
- B. Less than 10 cm
- D. Less than 12 cm

Question 283 • Correct Answer: B

A patient's Mallampati classification is performed. A view in which only the hard palate is visible corresponds to which class?

Mallampati class IV is defined by visualization of only the hard palate, with no soft palate seen. Class I shows the soft palate, fauces, uvula, and pillars; class III shows only the soft palate and base of the uvula. Higher class correlates with more difficult laryngoscopy.

Why the other choices are less appropriate:

- A. Class III
- C. Class I
- D. Class II

Question 284 • Correct Answer: C

A patient takes an ACE inhibitor for hypertension. According to common perioperative practice, what is the MOST appropriate recommendation...

ACE inhibitors and angiotensin receptor blockers are commonly held on the morning of surgery because continuing them increases the risk of refractory intraoperative hypotension. If hypotension occurs, vasopressin is often effective. Beta blockers, by contrast, are generally continued.

Why the other choices are less appropriate:

- A. Double the dose to ensure blood pressure control
- B. Continue as usual to avoid rebound hypertension
- D. Switch to intravenous formulation preoperatively

Question 285 • Correct Answer: D

A 70-year-old patient with a bare-metal coronary stent placed 3 months ago on dual antiplatelet therapy needs elective surgery. What is the MOST...

For bare-metal stents, elective non-cardiac surgery should be delayed at least 30 days after placement, and aspirin is ideally continued perioperatively. Drug-eluting stents generally require a minimum of 3 to 6 months. Stopping dual antiplatelet therapy prematurely risks stent thrombosis.

Why the other choices are less appropriate:

- A. Delay elective surgery for at least 12 months regardless
- B. Proceed immediately, stopping both agents
- C. Stop aspirin only and proceed today

Question 286 • Correct Answer: B

Which preoperative laboratory test is MOST appropriately ordered based on clinical indication rather than routinely for all patients?

A type and screen is indicated when significant blood loss is anticipated, an appropriate targeted test. Routine coagulation studies, chest films by age alone, and electrolytes in healthy patients are not evidence-based and represent low-value testing.

Why the other choices are less appropriate:

- A. Chest radiograph in every patient over 40
- C. Coagulation studies in a healthy patient with no bleeding history
- D. Electrolyte panel in every healthy outpatient

Question 287 • Correct Answer: B

A patient with a history of severe PONV, non-smoking status, female sex, and planned postoperative opioids has how many Apfel risk factors, and...

The four Apfel risk factors are female sex, non-smoking status, history of PONV or motion sickness, and anticipated postoperative opioid use; all four are present here. Four factors predict roughly an 80 percent risk, warranting two or more prophylactic agents and consideration of total intravenous anesthesia. Combining agents from different classes is most effective.

Why the other choices are less appropriate:

- A. One factor; no prophylaxis needed
- C. Two factors; single-agent prophylaxis only
- D. Zero factors; no intervention

Question 288 • Correct Answer: D

Which patient characteristic is MOST predictive of difficult mask ventilation?

Classic predictors of difficult mask ventilation include a beard, being edentulous, obesity, age over 55, and a history of snoring, often remembered by the mnemonic BONES or MOANS. Multiple factors additively increase risk. Prominent incisors relate more to laryngoscopy difficulty.

Why the other choices are less appropriate:

- A. Prominent maxillary incisors alone
- B. Young age and low BMI
- C. Small tongue and short thyromental distance only

Question 289 • Correct Answer: C

A trauma patient with a full stomach requires emergent intubation. During a classic rapid sequence induction, which action is MOST consistent with...

Classic RSI involves preoxygenation followed by near-simultaneous administration of an induction agent and rapid-onset neuromuscular blocker, avoiding positive-pressure ventilation to reduce gastric insufflation and aspiration risk. Cricoid pressure may be applied. Prolonged masking and titration defeat the purpose of a rapid, protected airway.

Why the other choices are less appropriate:

- A. Titration of muscle relaxant to twitch response before intubation
- B. Awake fiberoptic intubation without sedation
- D. Prolonged mask ventilation before intubation

Question 290 • Correct Answer: C

During preoxygenation, which end point BEST indicates adequate denitrogenation before induction?

Adequate preoxygenation and denitrogenation is best confirmed by an end-tidal oxygen concentration of at least 0.8 to 0.9. SpO₂ does not reflect the reservoir of oxygen in the functional residual capacity. This maximizes the safe apnea time during induction.

Why the other choices are less appropriate:

- A. End-tidal CO₂ of 35 mmHg
- B. Three tidal breaths of room air
- D. SpO₂ of 95 percent

Question 291 • Correct Answer: D

A patient cannot be intubated and cannot be adequately mask ventilated, and an LMA fails to establish ventilation. According to the difficult...

In a cannot-intubate, cannot-oxygenate scenario with a failed supraglottic rescue, the algorithm mandates immediate emergency invasive airway access such as cricothyrotomy. Repeated laryngoscopy wastes time and causes trauma. Awakening is only feasible if oxygenation can be maintained, which it cannot here.

Why the other choices are less appropriate:

- A. Repeat direct laryngoscopy attempts
- B. Awaken the patient and reschedule
- C. Administer additional neuromuscular blockade

Question 292 • Correct Answer: B

For an awake fiberoptic intubation, which technique BEST anesthetizes the trachea below the vocal cords to blunt the cough reflex?

Transtacheal injection through the cricothyroid membrane anesthetizes the tracheal mucosa below the cords, blunting cough during passage of the scope and tube. The superior laryngeal nerve block covers the area between the epiglottis and cords, and the glossopharyngeal block covers the posterior tongue and oropharynx. Layered blocks provide complete airway anesthesia.

Why the other choices are less appropriate:

- A. Superior laryngeal nerve block alone
- C. Glossopharyngeal nerve block
- D. Topical anesthesia of the soft palate

Question 293 • Correct Answer: B

The cricothyroid membrane, the site for emergency cricothyrotomy, is located between which two structures?

The cricothyroid membrane lies between the inferior border of the thyroid cartilage and the superior border of the cricoid cartilage. This landmark is superficial and relatively avascular, making it the site for emergency surgical airway access. Correct identification is critical to avoid injury to adjacent structures.

Why the other choices are less appropriate:

- A. The cricoid cartilage and first tracheal ring
- C. The hyoid bone and thyroid cartilage
- D. The epiglottis and thyroid cartilage

Question 294 • Correct Answer: C

A patient regurgitates gastric contents during induction and develops hypoxemia with wheezing. After securing the airway, what is the MOST...

Initial management of aspiration focuses on suctioning visible material, securing the airway, and providing supportive care with oxygen and PEEP to maintain oxygenation. Routine lavage can spread material distally, and steroids have not shown benefit. Antibiotics are reserved for evidence of infection rather than given prophylactically.

Why the other choices are less appropriate:

- A. Prophylactic broad-spectrum antibiotics for all patients
- B. Empiric high-dose corticosteroids
- D. Immediate bronchoalveolar lavage with saline

Question 295 • Correct Answer: C

A CRNA obtains a Cormack-Lehane grade III view (only the epiglottis visible) during direct laryngoscopy. Which adjunct is MOST likely to...

With a grade III view where only the epiglottis is seen, a bougie can be advanced beneath the epiglottis into the trachea, confirmed by tracheal clicks or hold-up, and the tube railroaded over it. Video laryngoscopy is another excellent option. Simply switching blade size or blind techniques are less reliable and riskier.

Why the other choices are less appropriate:

- A. A larger Macintosh blade only
- B. Deeper sedation without paralysis
- D. Blind digital intubation

Question 296 • Correct Answer: D

Which of the following is the MOST reliable single method to confirm correct endotracheal tube placement in the trachea?

Sustained capnography demonstrating a normal CO₂ waveform over multiple breaths is the most reliable confirmation of tracheal placement. Breath sounds, chest rise, and tube fogging can be misleading, particularly with esophageal intubation. Persistent CO₂ detection reflects pulmonary gas exchange.

Why the other choices are less appropriate:

- A. Chest rise with ventilation
- B. Condensation (fogging) in the tube
- C. Bilateral breath sounds on auscultation

Question 297 • Correct Answer: A

Following a failed intubation in a patient who can be mask ventilated, which supraglottic device provides a conduit that also facilitates passage...

The intubating LMA is specifically designed to serve as a conduit for blind or fiberoptic-guided endotracheal tube passage while maintaining ventilation. A classic LMA is not optimized for tube passage, and oral or nasal airways only relieve soft-tissue obstruction. This makes the intubating LMA a valuable rescue and bridging device.

Why the other choices are less appropriate:

- B. Oropharyngeal airway
- C. Nasopharyngeal airway
- D. Classic (first-generation) LMA

Question 298 • Correct Answer: A

Cricoid pressure (Sellick maneuver) is applied during RSI. Which statement BEST describes current understanding of this technique?

Cricoid pressure aims to occlude the esophagus against the cervical vertebrae, but evidence for benefit is mixed, and it can distort the airway and impair laryngoscopy, so it should be released if it hinders intubation. It is applied to the cricoid cartilage, not the thyroid. It must be released during active vomiting to avoid esophageal rupture.

Why the other choices are less appropriate:

- B. It reliably prevents all aspiration in every patient
- C. It is applied to the thyroid cartilage
- D. It should be maintained even if active vomiting occurs

Question 299 • Correct Answer: A

A patient with a suspected cervical spine injury requires intubation. Which technique BEST minimizes cervical spine movement?

Manual in-line stabilization, in which an assistant holds the head and neck neutral, minimizes cervical spine motion during laryngoscopy in patients with suspected unstable injuries. Head extension and hyperflexion risk cord injury. Video laryngoscopy is often preferred because it requires less neck manipulation.

Why the other choices are less appropriate:

- B. Nasotracheal intubation without stabilization
- C. Maximal head extension for a better view
- D. Removing the entire cervical collar and hyperflexing the neck

Question 300 • Correct Answer: C

Approximately how long is the safe apnea time (time to significant desaturation) in a well-preoxygenated healthy adult compared with an obese or...

A well-preoxygenated healthy adult can often tolerate several minutes of apnea, but obese and critically ill patients desaturate rapidly because of decreased functional residual capacity and increased oxygen consumption. This is why apneic oxygenation and rapid airway management are emphasized in these populations. Preoxygenation meaningfully extends safe apnea time.

Why the other choices are less appropriate:

- A. Obese patients tolerate apnea longer due to fat reserves
- B. Both groups have identical apnea times
- D. Preoxygenation does not affect apnea time

Question 301 • Correct Answer: B

During a spinal anesthetic, the CRNA aims for a sensory block adequate for a cesarean delivery. Which dermatome level is the target sensory block...

A sensory block to T4 is required for cesarean delivery to cover peritoneal traction and uterine manipulation. T10 is adequate for lower-extremity or vaginal delivery analgesia, and L1 is insufficient for abdominal surgery. Blocks that are too low result in visceral pain during the procedure.

Why the other choices are less appropriate:

- A. T6
- C. T10
- D. L1

Question 302 • Correct Answer: B

A patient develops perioral numbness, tinnitus, and metallic taste shortly after a local anesthetic injection, progressing to seizures and...

These are classic signs of local anesthetic systemic toxicity, and the specific antidote is intravenous 20 percent lipid emulsion given as a bolus followed by infusion, alongside airway support and seizure control. During ACLS for LAST, epinephrine should be given in reduced doses (about 1 mcg/kg), not standard 1 mg boluses. Flumazenil and bicarbonate do not treat LAST.

Why the other choices are less appropriate:

- A. Sodium bicarbonate infusion
- C. High-dose epinephrine boluses of 1 mg
- D. Flumazenil administration

Question 303 • Correct Answer: B

Which local anesthetic is associated with the GREATEST cardiotoxicity per equivalent dose, primarily due to avid sodium channel binding?

Bupivacaine binds cardiac sodium channels avidly and dissociates slowly, producing the greatest cardiotoxicity and refractory ventricular dysrhythmias among common local anesthetics. Lidocaine and mepivacaine are less cardiotoxic, and chloroprocaine is rapidly metabolized by plasma esterases. This is why bupivacaine LAST can be difficult to resuscitate.

Why the other choices are less appropriate:

- A. Mepivacaine
- C. Chloroprocaine
- D. Lidocaine

Question 304 • Correct Answer: D

A patient develops a positional headache, worse when upright and relieved when supine, two days after spinal anesthesia. Which feature MOST...

The hallmark of post-dural puncture headache is its postural character, worsening in the upright position and improving when supine, due to CSF leak and traction on meningeal structures. Fever and neck stiffness suggest meningitis rather than PDPH. Definitive treatment for severe cases is an epidural blood patch.

Why the other choices are less appropriate:

- A. Headache present only at night
- B. Headache unrelated to position
- C. Fever and neck stiffness

Question 305 • Correct Answer: C

Per ASRA guidelines, what is the recommended minimum time to wait after the last prophylactic dose of enoxaparin (low-dose LMWH) before performing...

ASRA recommends waiting at least 12 hours after a prophylactic (low) dose of enoxaparin before neuraxial puncture, and 24 hours after a therapeutic (high) dose. This reduces the risk of spinal or epidural hematoma. Timing of catheter removal and redosing must also follow the guidelines.

Why the other choices are less appropriate:

- A. No waiting is required
- B. 4 hours
- D. 24 hours

Question 306 • Correct Answer: D

A patient on clopidogrel needs a neuraxial procedure. According to ASRA guidelines, how long should clopidogrel typically be discontinued before...

ASRA recommends discontinuing clopidogrel approximately 5 to 7 days before neuraxial anesthesia because of its irreversible platelet inhibition. This allows recovery of adequate platelet function and reduces spinal hematoma risk. Ticlopidine requires an even longer interval.

Why the other choices are less appropriate:

- A. 3 days
- B. It does not need to be held
- C. 24 hours

Question 307 • Correct Answer: B

A CRNA performs an interscalene brachial plexus block and the patient develops ipsilateral shoulder droop, ptosis, and a constricted pupil. What...

Ptosis, miosis, and anhidrosis on the ipsilateral side (Horner syndrome) result from local anesthetic spread to the stellate ganglion and cervical sympathetic chain, a common and benign side effect of interscalene blocks. It resolves as the block wears off. It is distinct from LAST, high spinal, or pneumothorax.

Why the other choices are less appropriate:

- A. Pneumothorax
- C. Local anesthetic systemic toxicity
- D. Total spinal anesthesia

Question 308 • Correct Answer: C

Which nerve is MOST commonly spared or inadequately blocked by an interscalene approach to the brachial plexus?

The interscalene block reliably covers the upper and middle trunks but often spares the inferior trunk (C8-T1), leading to inadequate ulnar distribution blockade. This makes it ideal for shoulder and upper-arm surgery but less suited for hand procedures. A more distal approach is preferred for ulnar coverage.

Why the other choices are less appropriate:

- A. Musculocutaneous nerve
- B. Suprascapular nerve
- D. Axillary nerve

Question 309 · Correct Answer: D

When performing ultrasound-guided regional anesthesia, which needle approach BEST allows visualization of the entire needle shaft and tip during...

The in-plane technique aligns the needle along the long axis of the ultrasound beam, allowing the entire shaft and tip to be visualized as it advances toward the target. The out-of-plane approach shows only a cross-section and can make tip localization uncertain. Continuous tip visualization improves safety and accuracy.

Why the other choices are less appropriate:

- A. Landmark-only technique
- B. Out-of-plane approach
- C. Perpendicular blind insertion

Question 310 · Correct Answer: A

A patient receiving epidural anesthesia suddenly develops profound hypotension, bradycardia, difficulty breathing, and loss of hand strength. What...

Rapid onset of high sensory levels with hypotension, bradycardia, respiratory difficulty, and upper-extremity weakness indicates a high or total spinal, typically from unrecognized intrathecal injection of an epidural dose. Management is supportive with airway control, vasopressors, and fluids. This is a life-threatening emergency requiring immediate recognition.

Why the other choices are less appropriate:

- B. Transient neurologic symptoms
- C. Epidural hematoma
- D. Post-dural puncture headache

Question 311 · Correct Answer: C

In a combined spinal-epidural (CSE) technique using the needle-through-needle method, which statement is correct?

In the needle-through-needle CSE technique, the epidural needle is placed first, the spinal needle is advanced through it to inject the intrathecal dose, then the spinal needle is withdrawn and the epidural catheter is threaded. This provides the rapid onset of a spinal with the flexibility of an epidural catheter. It is widely used for labor analgesia.

Why the other choices are less appropriate:

- A. Both spinal and epidural doses are given intrathecally
- B. The technique cannot be used for labor analgesia
- D. The epidural catheter is placed before the spinal needle

Question 312 · Correct Answer: D

Which factor has the GREATEST influence on the spread (block height) of a hyperbaric spinal local anesthetic?

Baricity of the local anesthetic relative to CSF combined with patient positioning is the dominant determinant of block spread; a hyperbaric solution settles in dependent regions. Dose also matters, but injection speed and needle gauge have minimal effect on final level. Positioning is a key tool to control block height.

Why the other choices are less appropriate:

- A. The gauge of the spinal needle
- B. The patient's age only
- C. The speed of injection alone

Question 313 · Correct Answer: D

A 70 kg patient receives 1 liter of 0.9 percent normal saline. Approximately how much of this crystalloid remains in the intravascular space after...

Isotonic crystalloids distribute throughout the extracellular fluid, so only about one-quarter to one-third of an infused volume remains intravascular after equilibration. This is why larger crystalloid volumes are needed compared with colloids for the same intravascular expansion. Colloids remain intravascular longer because of their oncotic properties.

Why the other choices are less appropriate:

- A. None remains intravascular
- B. About 100 percent
- C. About 75 percent

Question 314 · Correct Answer: D

Large-volume resuscitation with 0.9 percent normal saline is MOST associated with which acid-base disturbance?

Normal saline has a chloride concentration far higher than plasma, and large volumes produce a hyperchloremic (non-anion-gap) metabolic acidosis. Balanced salt solutions such as lactated Ringer's cause less chloride load. This effect is clinically relevant during massive resuscitation.

Why the other choices are less appropriate:

- A. Respiratory acidosis
- B. Respiratory alkalosis
- C. Metabolic alkalosis

Question 315 · Correct Answer: C

In a massive transfusion protocol for a hemorrhaging trauma patient, which ratio of components is commonly recommended as a balanced resuscitation...

Balanced resuscitation in massive transfusion targets an approximately 1:1:1 ratio of red cells, plasma, and platelets to reproduce whole blood and prevent dilutional coagulopathy. Giving red cells alone or excess crystalloid worsens coagulopathy and dilution. This approach improves outcomes in major trauma hemorrhage.

Why the other choices are less appropriate:

- A. Packed red cells only
- B. Platelets alone until bleeding stops
- D. 4 units of crystalloid per unit of blood

Question 316 · Correct Answer: C

A patient develops acute hypoxemia and bilateral pulmonary infiltrates within 6 hours of a plasma transfusion, with normal cardiac filling...

TRALI presents as acute hypoxemia with non-cardiogenic pulmonary edema (normal filling pressures) within 6 hours of transfusion, often associated with donor antileukocyte antibodies. TACO, by contrast, is a volume overload state with elevated filling pressures and hypertension. Management of TRALI is supportive, and diuretics are avoided.

Why the other choices are less appropriate:

- A. Acute hemolytic transfusion reaction
- B. Febrile non-hemolytic reaction
- D. Transfusion-associated circulatory overload (TACO)

Question 317 · Correct Answer: B

An elderly patient with heart failure receives multiple units of blood and develops dyspnea, hypertension, jugular venous distention, and...

Transfusion-associated circulatory overload is treated by stopping or slowing the transfusion, upright positioning, oxygen, and diuresis to relieve the volume overload. This contrasts with TRALI, in which diuretics are not helpful. Preventive strategies include slower transfusion rates in at-risk patients.

Why the other choices are less appropriate:

- A. Begin a massive transfusion protocol
- C. Administer epinephrine
- D. Rapid additional fluid bolus

Question 318 · Correct Answer: C

On a thromboelastography (TEG) tracing, a prolonged R (reaction) time MOST directly indicates a deficiency in which component, guiding which...

The R time reflects the time to initial clot formation and depends on clotting factor activity; a prolonged R time suggests factor deficiency and is treated with fresh frozen plasma. The alpha angle and maximum amplitude reflect fibrinogen and platelet function respectively. TEG allows targeted, component-specific correction of coagulopathy.

Why the other choices are less appropriate:

- A. Fibrinogen; give cryoprecipitate
- B. Fibrinolysis; give tranexamic acid
- D. Platelet number; give platelets

Question 319 · Correct Answer: A

On TEG, a decreased maximum amplitude (MA) MOST directly reflects a problem with which of the following?

The maximum amplitude represents the ultimate clot strength, which is primarily determined by platelet number and function with a contribution from fibrinogen. A low MA suggests thrombocytopenia or platelet dysfunction and may prompt platelet transfusion. The R time and LY30 reflect factor activity and fibrinolysis respectively.

Why the other choices are less appropriate:

- B. Clotting factor initiation
- C. Fibrinolysis
- D. Heparin effect

Question 320 · Correct Answer: B

Citrate used as an anticoagulant in stored blood products can cause which electrolyte disturbance during massive transfusion, particularly with...

Citrate chelates ionized calcium, and during rapid massive transfusion, especially with impaired hepatic citrate metabolism, this can produce clinically significant hypocalcemia. Signs include hypotension and coagulopathy, and treatment is intravenous calcium. Monitoring ionized calcium is important during large transfusions.

Why the other choices are less appropriate:

- A. Hypercalcemia
- C. Hyperphosphatemia
- D. Hyponatremia

Question 321 · Correct Answer: C

A patient develops fever, flank pain, hemoglobinuria, and hypotension minutes after starting a red cell transfusion. What is the MOST appropriate...

These findings indicate an acute hemolytic transfusion reaction, most often from ABO incompatibility, and the transfusion must be stopped immediately. Supportive care includes maintaining IV access with saline, supporting blood pressure and urine output, and sending samples for workup. Continuing the transfusion in any form is dangerous.

Why the other choices are less appropriate:

- A. Give an antihistamine and resume
- B. Administer a diuretic and continue the transfusion
- D. Slow the transfusion and continue observing

Question 322 · Correct Answer: A

According to common restrictive transfusion strategy in a stable, non-bleeding patient without active cardiac ischemia, red cells are generally...

A restrictive transfusion threshold of about 7 g/dL is supported for most stable, non-bleeding hospitalized patients and is associated with outcomes at least as good as liberal strategies. A slightly higher threshold near 8 g/dL may be used for patients with cardiovascular disease. Transfusion should also consider symptoms and ongoing losses.

Why the other choices are less appropriate:

- B. 9 g/dL
- C. 5 g/dL
- D. 10 g/dL

Question 323 · Correct Answer: B

Compared with crystalloids, which statement BEST describes colloids such as albumin for intravascular volume expansion?

Colloids contain large molecules that remain in the intravascular space and raise oncotic pressure, producing greater and more sustained plasma volume expansion per unit volume than crystalloids. This means smaller volumes are needed for the same effect. However, colloids are more costly and some synthetic colloids carry risks.

Why the other choices are less appropriate:

- A. They require larger volumes for equivalent expansion
- C. They have no effect on plasma oncotic pressure
- D. They freely cross into the intracellular space

Question 324 • Correct Answer: A

During general anesthesia with sevoflurane, a patient develops an unexplained rise in end-tidal CO₂, tachycardia, muscle rigidity, and rising...

These findings are classic for malignant hyperthermia, and the first specific treatment is dantrolene 2.5 mg/kg IV, repeated as needed, along with stopping the triggering agent and hyperventilating with 100 percent oxygen. The earliest and most sensitive sign is a rising end-tidal CO₂. Cooling and treating hyperkalemia and acidosis are adjuncts, not the primary drug.

Why the other choices are less appropriate:

- B. Sodium bicarbonate
- C. Active cooling only
- D. Labetalol

Question 325 • Correct Answer: A

The recommended initial dantrolene dose for a malignant hyperthermia crisis is 2.5 mg/kg IV. What is the reconstitution consideration for classic...

Classic dantrolene sodium is difficult to dissolve, requiring reconstitution of each vial with sterile water (not saline) and vigorous shaking, which is why multiple staff are needed during a crisis. Newer concentrated formulations dissolve more readily. Rapid preparation and administration are essential during MH.

Why the other choices are less appropriate:

- B. It must be diluted in dextrose only
- C. It dissolves instantly in normal saline
- D. It is premixed and ready to infuse

Question 326 • Correct Answer: B

Shortly after administration of a neuromuscular blocking agent, a patient develops profound hypotension, tachycardia, bronchospasm, and a diffuse...

These signs indicate anaphylaxis, and epinephrine is the first-line, life-saving treatment along with stopping the trigger, giving fluids, and supporting the airway. Antihistamines and corticosteroids are adjuncts that do not address the acute cardiovascular collapse. Neuromuscular blockers are among the most common triggers of perioperative anaphylaxis.

Why the other choices are less appropriate:

- A. Diphenhydramine
- C. Albuterol
- D. Hydrocortisone

Question 327 • Correct Answer: D

During emergence, a patient develops complete upper airway obstruction with a high-pitched crowing sound and paradoxical chest movement. What is...

Laryngospasm is initially managed with continuous positive-pressure ventilation with 100 percent oxygen, jaw thrust, and firm pressure at the laryngospasm notch. If it persists and hypoxemia threatens, a small dose of succinylcholine (with atropine as needed) breaks the spasm. Surgical airway is a last resort if all else fails.

Why the other choices are less appropriate:

- A. Deep extubation and observation
- B. Immediate surgical airway
- C. Administer a beta blocker

Question 328 • Correct Answer: B

An intubated asthmatic patient develops high peak airway pressures, wheezing, and a prolonged expiratory phase with rising end-tidal CO₂. What is...

Intraoperative bronchospasm is treated by deepening anesthesia (volatile agents are bronchodilators) and administering an inhaled beta-2 agonist such as albuterol through the circuit. Ensuring the tube is not malpositioned and increasing expiratory time also help. Extubation and paralytics do not address the airway smooth muscle constriction.

Why the other choices are less appropriate:

- A. Administer a nondepolarizing muscle relaxant
- C. Immediately extubate
- D. Decrease the FiO₂

Question 329 • Correct Answer: A

A patient reports recall of intraoperative events after general anesthesia. Which factor is MOST associated with an increased risk of...

Awareness risk increases with paralysis (masking movement) combined with lighter anesthetic depth, as can occur with TIVA if depth is not adequately monitored, and in high-risk cases such as trauma, cardiac, and obstetric surgery. Maintaining adequate anesthetic concentration and monitoring depth reduces the risk. High volatile doses reduce, not increase, awareness.

Why the other choices are less appropriate:

- B. Regional anesthesia
- C. High doses of volatile anesthetic
- D. Routine BIS use below 40

Question 330 • Correct Answer: B

For an operating room fire to occur, three elements of the fire triad must be present. Which of the following is the oxidizer component MOST...

The fire triad consists of an oxidizer, a fuel, and an ignition source; oxygen and nitrous oxide are the primary oxidizers in the OR. Alcohol prep and drapes are fuels, and electrocautery or lasers are ignition sources. Minimizing supplemental oxygen concentration near ignition sources reduces fire risk.

Why the other choices are less appropriate:

- A. Electrocautery
- C. Alcohol-based skin prep
- D. Surgical drapes

Question 331 • Correct Answer: D

A surgical fire ignites on the patient's drapes during a case using an oxygen-enriched atmosphere. What is the FIRST priority action?

The immediate priority in a surgical fire on the patient is to stop the flow of airway gases (oxygen and nitrous oxide) and remove the burning drapes and materials from the patient to halt the fire. Then the fire is extinguished with saline or an extinguisher, and the patient is assessed. Evacuation and alarms follow patient safety measures.

Why the other choices are less appropriate:

- A. Continue the procedure while calling for help
- B. Use a carbon dioxide extinguisher on the airway
- C. Activate the fire alarm and evacuate the room

Question 332 • Correct Answer: C

A patient is genetically susceptible to malignant hyperthermia. Which anesthetic plan is SAFEST?

For MH-susceptible patients, a non-triggering technique using total intravenous anesthesia with propofol, opioids, and nondepolarizing relaxants is safest, along with a prepared or vapor-free anesthesia machine. Volatile agents and succinylcholine are triggers and must be avoided. Dantrolene must be immediately available.

Why the other choices are less appropriate:

- A. Desflurane with rocuronium
- B. Sevoflurane with succinylcholine
- D. Nitrous oxide with succinylcholine

Question 333 • Correct Answer: D

A CRNA suspects a delayed hemolytic reaction is unlikely and instead identifies bronchospasm plus urticaria and hypotension after latex exposure....

Latex anaphylaxis often has a delayed onset of roughly 20 to 60 minutes after exposure because absorption occurs through mucous membranes and surgical contact, distinguishing it from immediate IV drug reactions at induction. Treatment is the same as other anaphylaxis, with epinephrine first-line. Identifying latex as the trigger guides latex-free management.

Why the other choices are less appropriate:

- A. Never intraoperatively
- B. Only in the PACU
- C. Immediately at induction like an IV drug reaction

Question 334 • Correct Answer: B

During a case requiring surgery near the airway with electrocautery, which strategy BEST reduces the risk of an airway fire?

Minimizing the delivered oxygen concentration to the lowest clinically acceptable level and avoiding nitrous oxide near an ignition source markedly reduces airway fire risk, since both are oxidizers. Allowing alcohol prep to dry fully and using appropriate tubes further reduces risk. Raising FiO₂ or using nitrous increases the oxidizer available.

Why the other choices are less appropriate:

- A. Increase FiO₂ to 100 percent for safety margin
- C. Use only nitrous oxide as the carrier gas
- D. Apply extra alcohol prep to the surgical field

Question 335 • Correct Answer: D

A hemodynamically unstable trauma patient with hypovolemia requires induction. Which induction agent BEST maintains cardiovascular stability?

Etomidate and ketamine are preferred induction agents in hemodynamically unstable or hypovolemic patients because they cause less cardiovascular depression; ketamine additionally supports blood pressure via sympathetic stimulation. Propofol and thiopental cause vasodilation and myocardial depression that can precipitate collapse in hypovolemia. Etomidate can transiently suppress adrenal steroidogenesis.

Why the other choices are less appropriate:

- A. High-dose midazolam
- B. Propofol
- C. Thiopental

Question 336 • Correct Answer: A

During inhalation induction with sevoflurane in a pediatric patient, which property makes sevoflurane preferred over desflurane and isoflurane for...

Sevoflurane is favored for inhalation induction, especially in children, because it is minimally pungent and non-irritating, allowing smooth induction without coughing or laryngospasm. Desflurane and isoflurane are pungent and can cause airway irritation. Sevoflurane also has a relatively low blood-gas solubility permitting rapid uptake.

Why the other choices are less appropriate:

- B. Its ability to trigger bronchospasm
- C. Its very high blood-gas solubility
- D. Its high pungency

Question 337 • Correct Answer: C

A typical induction dose of propofol in a healthy adult is approximately which range?

The usual induction dose of propofol in a healthy adult is roughly 1.5 to 2.5 mg/kg IV. Doses are reduced in elderly, hypovolemic, or hemodynamically fragile patients to avoid profound hypotension. Excessive doses cause exaggerated cardiovascular depression.

Why the other choices are less appropriate:

- A. 6 to 8 mg/kg
- B. 10 to 12 mg/kg
- D. 0.1 to 0.3 mg/kg

Question 338 • Correct Answer: A

Which sign BEST indicates that a patient given succinylcholine has developed adequate conditions for intubation?

Succinylcholine produces fasciculations followed by profound flaccid paralysis, usually within about 45 to 60 seconds, at which point intubating conditions are optimal. Bradycardia is a side effect, not an indicator of readiness. Its rapid onset and short duration make it useful for RSI.

Why the other choices are less appropriate:

- B. Increase in blood pressure
- C. Return of spontaneous ventilation
- D. Onset of bradycardia

Question 339 • Correct Answer: A

A patient with a documented plasma (pseudo)cholinesterase deficiency receives succinylcholine. What is the expected clinical consequence?

Patients with atypical or deficient plasma cholinesterase metabolize succinylcholine slowly, resulting in markedly prolonged paralysis and apnea. Management is supportive with continued sedation and mechanical ventilation until the block resolves. The dibucaine number helps characterize the enzyme variant.

Why the other choices are less appropriate:

- B. No effect on duration
- C. Immediate reversal of the block
- D. Resistance requiring higher doses

Question 340 • Correct Answer: B

During a modified rapid sequence induction in a patient at aspiration risk who also has limited cardiopulmonary reserve, gentle mask ventilation...

In a modified RSI, if gentle ventilation is provided, keeping peak inflation pressures low (generally under about 20 cmH₂O) minimizes gastric insufflation, thereby reducing regurgitation and aspiration risk. This balances the need for oxygenation against aspiration danger in patients who cannot tolerate prolonged apnea. High pressures open the lower esophageal sphincter.

Why the other choices are less appropriate:

- A. To reduce anesthetic requirement
- C. To increase tidal volume
- D. To speed onset of paralysis

Question 341 • Correct Answer: D

Ketamine is chosen for induction in a patient with active bronchospastic disease. Which property makes it advantageous in this setting?

Ketamine causes bronchodilation via sympathomimetic effects and tends to preserve spontaneous ventilation and airway reflexes, making it useful in patients with reactive airway disease. It also supports hemodynamics. Increased secretions are a side effect that may be mitigated with an antisialagogue.

Why the other choices are less appropriate:

- A. It reliably causes apnea
- B. It causes bronchoconstriction
- C. It profoundly depresses airway reflexes

Question 342 · Correct Answer: B

A patient at high risk for aspiration is scheduled for elective surgery. Which premedication is MOST appropriate to reduce gastric volume and...

A non-particulate antacid such as sodium citrate rapidly raises gastric pH without the lung injury risk associated with particulate antacids if aspirated, and an H2 receptor antagonist can reduce both volume and acidity. Metoclopramide may also promote gastric emptying. Particulate antacids are avoided because aspiration of the particles worsens lung injury.

Why the other choices are less appropriate:

- A. An anticholinergic such as glycopyrrolate alone
- C. An opioid
- D. A particulate antacid

Question 343 · Correct Answer: D

When priming with a small dose of a nondepolarizing agent before an intubating dose (the priming principle), what is the intended effect?

The priming principle involves giving a small subparalyzing dose of a nondepolarizing relaxant a few minutes before the intubating dose to accelerate the onset of adequate paralysis. It carries a risk of partial weakness and aspiration in awake patients and must be used cautiously. It does not replace induction agents.

Why the other choices are less appropriate:

- A. To eliminate the need for an induction agent
- B. To prolong the total duration of blockade
- C. To prevent histamine release

Question 344 · Correct Answer: A

A CRNA plans a co-induction with a small dose of midazolam followed by propofol. What is the primary benefit of this combination?

Benzodiazepines and propofol act synergistically, so co-induction allows a lower propofol dose and may improve hemodynamic stability and reduce injection pain. The trade-off can be prolonged sedation, so careful titration is needed. This does not by itself prevent PONV or reverse opioids.

Why the other choices are less appropriate:

- B. It reverses opioid effects
- C. It increases the required propofol dose
- D. It reliably prevents PONV

Question 345 · Correct Answer: B

A patient reports severe pain on injection of propofol through a small hand vein. Which intervention BEST reduces this discomfort?

Propofol injection pain is reduced by pretreating the vein with lidocaine (or mixing lidocaine with the propofol) and by using a larger, more proximal vein with a running carrier fluid. Rapid injection and improper dilution do not reliably reduce pain and can raise other risks. This improves patient comfort at induction.

Why the other choices are less appropriate:

- A. Dilute the propofol with sterile water
- C. Warm the propofol to body temperature
- D. Inject the propofol more rapidly

Question 346 · Correct Answer: B

During maintenance of anesthesia, the concept of MAC (minimum alveolar concentration) is defined as the concentration that prevents movement in...

MAC is defined as the minimum alveolar concentration of a volatile anesthetic that prevents movement in 50 percent of patients in response to a standard surgical incision. MAC-BAR and MAC-awake are related but distinct concepts. Approximately 1.3 MAC prevents movement in about 95 percent of patients.

Why the other choices are less appropriate:

- A. 25 percent
- C. 75 percent
- D. 95 percent

Question 347 · Correct Answer: C

Which physiologic factor INCREASES anesthetic requirement (raises MAC)?

Chronic alcohol use and hyperthermia increase MAC, reflecting greater anesthetic requirement. Advanced age, pregnancy, hypothermia, and acute opioid or sedative administration decrease MAC. Understanding these modifiers helps titrate volatile agent delivery.

Why the other choices are less appropriate:

- A. Pregnancy
- B. Acute administration of opioids
- D. Advanced age

Question 348 · Correct Answer: A

During maintenance with a volatile agent and controlled ventilation, the depth of anesthesia monitor (processed EEG) reads a value consistent with...

A processed EEG value indicating excessively deep anesthesia suggests the anesthetic can be reduced toward the recommended target range, which reduces hemodynamic depression and hastens recovery. Excessively deep anesthesia has been associated with adverse outcomes. Depth monitors are adjuncts and should be interpreted with clinical judgment.

Why the other choices are less appropriate:

- B. Increase the volatile concentration further
- C. Ignore the reading entirely
- D. Administer a paralytic

Question 349 · Correct Answer: D

The second gas effect during maintenance refers to which phenomenon?

The second gas effect describes how the rapid uptake of a large volume of nitrous oxide concentrates and accelerates the alveolar rise of a concurrently administered second gas, such as a volatile agent. It is related to the concentration effect. This can hasten the onset of the accompanying agent.

Why the other choices are less appropriate:

- A. A drug interaction between two intravenous agents
- B. Rebreathing of carbon dioxide
- C. The slowing of induction with two agents

Question 350 · Correct Answer: A

A patient maintained on nitrous oxide undergoes a middle-ear procedure. Why is nitrous oxide often limited or avoided in closed-space surgeries?

Nitrous oxide is far more soluble than nitrogen and diffuses into closed air-filled spaces faster than nitrogen can leave, expanding the volume or raising pressure in areas such as the middle ear, bowel, or a pneumothorax. This can compromise middle-ear grafts or worsen a pneumothorax. For these reasons it is limited or avoided in such cases.

Why the other choices are less appropriate:

- B. It absorbs gas from closed spaces, collapsing them
- C. It only affects the bloodstream
- D. It has no effect on gas-filled spaces

Question 351 · Correct Answer: B

During maintenance, a patient's blood pressure and heart rate rise with surgical stimulation despite an adequate volatile concentration. Which...

Hypertension and tachycardia with surgical stimulation often reflect inadequate analgesia, best treated by supplementing opioid analgesia or otherwise deepening the anesthetic. Paralytics mask movement but do not treat nociception or awareness. Balanced anesthesia addresses both hypnosis and analgesia.

Why the other choices are less appropriate:

- A. Administer a diuretic
- C. Decrease minute ventilation
- D. Give a nondepolarizing relaxant to stop movement

Question 352 • Correct Answer: C

In a low-flow anesthesia technique, what is the PRIMARY safety concern that mandates continuous inspired oxygen monitoring?

At low fresh gas flows, oxygen consumption can lower the inspired oxygen concentration, risking delivery of a hypoxic mixture, so continuous FiO₂ monitoring with an oxygen analyzer is mandatory. Low-flow techniques conserve agent and reduce waste but require vigilant monitoring. Modern machines include hypoxic guard systems as an additional safeguard.

Why the other choices are less appropriate:

- A. Excessive rebreathing of nitrous oxide only
- B. Increased cost of volatile agent
- D. Excessive anesthetic waste

Question 353 • Correct Answer: A

A patient receiving a remifentanyl-based total intravenous anesthetic is maintained for a long procedure. Which property distinguishes...

Remifentanyl is metabolized by nonspecific plasma and tissue esterases, giving it a very short and essentially constant context-sensitive half-time regardless of infusion duration. This allows rapid offset even after long infusions but requires a plan for postoperative analgesia. Its clearance is independent of hepatic or renal function.

Why the other choices are less appropriate:

- B. Dependence on renal clearance
- C. A long context-sensitive half-time that lengthens with infusion duration
- D. Accumulation in fat with prolonged infusion

Question 354 • Correct Answer: D

During maintenance, deliberate mild controlled hypotension may be requested. Which end-organ is MOST vulnerable during controlled hypotension and...

During controlled hypotension, perfusion to vital organs such as the brain, heart, and kidneys is most at risk, so mean arterial pressure must be kept within autoregulatory limits and monitored closely. Patients with cerebrovascular or coronary disease tolerate hypotension poorly. Careful titration balances a bloodless field against ischemic risk.

Why the other choices are less appropriate:

- A. The skin
- B. The spleen only
- C. Peripheral fat

Question 355 • Correct Answer: B

A CRNA notes progressive rise in inspired and expired CO₂ during a circle system case at moderate fresh gas flow. Which cause is MOST likely?

A rising inspired CO₂ with a circle system most often indicates exhausted or channeled CO₂ absorbent, causing rebreathing of carbon dioxide. Confirmatory findings include color change of the absorbent indicator. Replacing the absorbent or increasing fresh gas flow corrects the problem.

Why the other choices are less appropriate:

- A. A leak in the breathing circuit
- C. Hyperventilation
- D. Excessive fresh gas flow

Question 356 • Correct Answer: C

The MAC-BAR of a volatile anesthetic refers to which specific end point?

MAC-BAR is the minimum alveolar concentration that blocks the adrenergic and cardiovascular response to a noxious surgical stimulus in 50 percent of patients, and it is higher than standard MAC. Standard MAC prevents movement, and MAC-awake reflects responsiveness to command. Achieving MAC-BAR usually involves adding opioids rather than volatile alone.

Why the other choices are less appropriate:

- A. The concentration at which patients open their eyes on command
- B. The concentration preventing movement in 50 percent of patients
- D. The concentration causing burst suppression

Question 357 • Correct Answer: B

Before extubation at the end of a case, which combination of findings BEST indicates readiness for safe extubation?

Safe awake extubation requires full recovery of neuromuscular function, adequate spontaneous ventilation, the ability to follow commands, intact protective airway reflexes, and stable oxygenation and hemodynamics. An SpO₂ of only 90 percent on high FiO₂ is inadequate. Meeting these criteria minimizes the risk of airway obstruction and aspiration.

Why the other choices are less appropriate:

- A. Deep anesthesia with no reflexes
- C. SpO₂ of 90 percent on 100 percent oxygen
- D. Absence of any coughing regardless of consciousness

Question 358 • Correct Answer: D

A patient shows a train-of-four ratio of 0.6 at the end of surgery. What does this indicate about neuromuscular recovery, and what is the...

A train-of-four ratio of 0.6 indicates significant residual neuromuscular blockade, which increases the risk of hypoventilation and aspiration; adequate recovery requires a ratio of at least 0.9. Additional reversal, such as neostigmine or sugammadex, and confirmation of recovery are needed before extubation. Quantitative monitoring is the most reliable assessment.

Why the other choices are less appropriate:

- A. Overdose of reversal agent; no action
- B. No blockade present; observe only
- C. Full recovery; extubate now

Question 359 • Correct Answer: D

A patient exhibits residual weakness after reversal with neostigmine, with a fade on train-of-four and weak head lift. Which clinical test at the...

A sustained 5-second head lift is a classic clinical indicator that correlates with a train-of-four ratio near adequate recovery and reflects good respiratory muscle strength. Eye opening and nonspecific movement are less reliable. Quantitative train-of-four monitoring is preferred, but the head lift remains a useful bedside test.

Why the other choices are less appropriate:

- A. Normal blood pressure
- B. Presence of any spontaneous movement
- C. Ability to open the eyes only

Question 360 • Correct Answer: B

A patient reversed with sugammadex still shows inadequate recovery. Which statement about sugammadex is correct?

Sugammadex is a selective relaxant binding agent that encapsulates aminosteroid neuromuscular blockers such as rocuronium and vecuronium, but it does not reverse benzylisoquinolinium agents like cisatracurium or depolarizers like succinylcholine. It does not act on acetylcholinesterase. If a patient received cisatracurium, sugammadex would be ineffective.

Why the other choices are less appropriate:

- A. It reverses benzodiazepine sedation
- C. It reverses succinylcholine
- D. It works by inhibiting acetylcholinesterase

Question 361 • Correct Answer: B

A pediatric patient emerging from sevoflurane anesthesia becomes agitated, inconsolable, and thrashing without apparent pain. What is this...

Emergence delirium is common after sevoflurane in children and presents as transient agitation and disorientation without a clear cause. Management focuses on patient safety, ensuring analgesia, and, if needed, small doses of propofol or dexmedetomidine, which is often self-limited. It is distinct from pain, residual paralysis, or an allergic reaction.

Why the other choices are less appropriate:

- A. Anaphylaxis; give epinephrine
- C. Malignant hyperthermia; give dantrolene
- D. Residual paralysis; give reversal

Question 362 • Correct Answer: C

A CRNA plans a deep extubation in an appropriate patient. Which patient is the LEAST suitable candidate for deep extubation?

Deep extubation is contraindicated in patients with difficult airways or high aspiration risk because it removes airway protection while the patient cannot respond, and reintubation may be hazardous. It may be considered when coughing must be avoided and the airway is easy. Careful patient selection is essential.

Why the other choices are less appropriate:

- A. A healthy patient with an easy airway after a minor procedure
- B. A patient undergoing a middle-ear procedure
- D. A patient with reactive airways where coughing is undesirable

Question 363 • Correct Answer: C

During emergence, a patient develops negative-pressure pulmonary edema after forceful inspiration against a closed glottis (post-obstructive)....

Negative-pressure pulmonary edema results from vigorous inspiratory effort against an obstructed airway, generating markedly negative intrathoracic pressure that increases venous return and pulmonary capillary transudation into the alveoli. It often follows laryngospasm at emergence. Treatment is supportive with oxygen, positive pressure, and sometimes diuresis.

Why the other choices are less appropriate:

- A. Allergic reaction to the anesthetic
- B. Left ventricular failure from fluid overload
- D. Direct alveolar toxicity from oxygen

Question 364 • Correct Answer: B

An elderly patient is slow to awaken after a general anesthetic. Which is a reasonable FIRST step in evaluating delayed emergence?

Delayed emergence should prompt a systematic search for reversible causes including residual anesthetics or paralytics, hypercarbia, hypothermia, hypoglycemia, and metabolic or electrolyte disturbances. Targeted correction and confirming neuromuscular recovery are key. Empiric reversal or presuming a catastrophic diagnosis without evaluation is inappropriate.

Why the other choices are less appropriate:

- A. Assume a stroke and give thrombolytics
- C. Immediately reintubate
- D. Administer flumazenil empirically to all patients

Question 365 • Correct Answer: C

A patient is being emerged after a procedure with a supraglottic airway in place. Which approach BEST reduces the risk of laryngospasm during LMA...

Laryngospasm risk is highest during the light plane of anesthesia (stage 2), so a supraglottic airway should be removed either while the patient is deeply anesthetized or fully awake, not during this vulnerable window. Deep pharyngeal suctioning during light anesthesia also provokes laryngospasm. Timing removal appropriately reduces airway complications.

Why the other choices are less appropriate:

- A. Apply positive pressure and remove abruptly during light anesthesia
- B. Suction deeply around the cords during stage 2
- D. Remove the LMA during a light plane of anesthesia (stage 2)

Question 366 • Correct Answer: A

A patient given neostigmine for reversal develops bradycardia and increased secretions during emergence. Which co-administered agent prevents...

Neostigmine increases acetylcholine at both nicotinic and muscarinic receptors, so an antimuscarinic such as glycopyrrolate is co-administered to prevent bradycardia, salivation, and bronchospasm. Atropine may be used with edrophonium due to onset matching. Adding more neostigmine would worsen the muscarinic effects.

Why the other choices are less appropriate:

- B. Propranolol
- C. Naloxone
- D. Additional neostigmine

Question 367 • Correct Answer: A

Which strategy BEST promotes a smooth emergence and reduces coughing and hemodynamic surges in a patient with intracranial pathology?

A smooth emergence in patients with intracranial pathology is achieved by blunting coughing and hypertensive surges using measures such as intravenous lidocaine, adequate analgesia, antihypertensives, and gentle airway handling. Coughing and pressor spikes can dangerously raise intracranial pressure. Abrupt awakening and repeated deep suctioning provoke these responses.

Why the other choices are less appropriate:

- B. Abrupt discontinuation of all agents with vigorous stimulation
- C. Deep suctioning repeatedly during emergence
- D. Rapid reversal with high-dose neostigmine alone

Question 368 • Correct Answer: A

Which principle BEST describes the rationale for multimodal analgesia in the perioperative period?

Multimodal analgesia combines agents acting at different sites, such as acetaminophen, NSAIDs, gabapentinoids, local anesthetics, and regional techniques, to improve analgesia while minimizing opioid dose and opioid-related adverse effects. This synergy allows lower doses of each agent. It is a cornerstone of enhanced recovery pathways.

Why the other choices are less appropriate:

- B. Using only regional anesthesia for every patient
- C. Avoiding all non-opioid agents
- D. Relying on a single high-dose opioid for all pain

Question 369 • Correct Answer: A

A patient receives intravenous acetaminophen as part of a multimodal plan. Which is the MOST important safety consideration regarding total daily...

Acetaminophen has a ceiling on safe daily dosing, generally about 4 grams per day in healthy adults from all sources, with lower limits in hepatic impairment or malnutrition, because of hepatotoxicity risk. It combines well with opioids and other analgesics. It has minimal anti-inflammatory activity compared with NSAIDs.

Why the other choices are less appropriate:

- B. It provides profound anti-inflammatory effects at any dose
- C. It should never be combined with opioids
- D. There is no maximum daily dose

Question 370 • Correct Answer: A

Which mechanism BEST explains how gabapentinoids such as gabapentin and pregabalin contribute to perioperative analgesia?

Gabapentinoids bind the alpha-2-delta subunit of presynaptic voltage-gated calcium channels, decreasing calcium influx and release of excitatory neurotransmitters, which reduces neuropathic and postoperative pain and lowers opioid needs. They do not act on opioid receptors or cyclooxygenase. Sedation and dizziness are common dose-related side effects.

Why the other choices are less appropriate:

- B. They block sodium channels like local anesthetics
- C. They inhibit cyclooxygenase
- D. They activate mu-opioid receptors

Question 371 • Correct Answer: D

A patient on chronic buprenorphine for opioid use disorder requires postoperative analgesia. Which statement BEST guides management?

Buprenorphine binds mu receptors with high affinity, which can blunt the effect of full agonist opioids, so multimodal analgesia and careful titration of additional opioids are important, and many centers continue buprenorphine perioperatively. Abrupt cessation and naloxone precipitate withdrawal and worsen pain. Regional techniques are especially valuable in these patients.

Why the other choices are less appropriate:

- A. Buprenorphine must always be stopped abruptly before surgery
- B. Naloxone should be given preoperatively
- C. No additional analgesia is ever required

Question 372 • Correct Answer: C

A patient uses intravenous patient-controlled analgesia (PCA) with morphine. What is the PRIMARY safety advantage of the demand-dose-with-lockout...

PCA relies on the principle that an oversedated patient will not press the button, providing an inherent safety feature, especially when a continuous background infusion is avoided in opioid-naïve patients. Lockout intervals limit the frequency of doses. Monitoring for sedation and respiratory depression remains essential.

Why the other choices are less appropriate:

- A. It eliminates the need for monitoring
- B. It guarantees complete pain relief
- D. It allows unlimited dosing on demand

Question 373 • Correct Answer: B

Ketamine is used at subanesthetic doses as an analgesic adjunct. Which receptor action underlies its analgesic and antihyperalgesic effects?

Ketamine's analgesic and antihyperalgesic effects derive primarily from noncompetitive NMDA receptor antagonism, which reduces central sensitization and opioid tolerance. Low-dose infusions can decrease opioid requirements, particularly in opioid-tolerant patients. It does not act mainly through opioid, GABA, or COX pathways.

Why the other choices are less appropriate:

- A. Mu-opioid receptor agonism
- C. Cyclooxygenase inhibition
- D. GABA-A receptor agonism

Question 374 • Correct Answer: B

Which patient factor is the STRONGEST relative contraindication to perioperative NSAID use?

NSAIDs are relatively contraindicated in patients with significant renal impairment, active GI bleeding or ulcer disease, and certain bleeding or cardiovascular risks, because they impair renal perfusion, platelet function, and gastric mucosal protection. Well-controlled hypertension and PONV history are not primary contraindications. Risk-benefit must be individualized.

Why the other choices are less appropriate:

- A. Mild seasonal allergies
- C. Well-controlled hypertension
- D. History of PONV

Question 375 • Correct Answer: C

A transversus abdominis plane (TAP) block is used for postoperative analgesia after abdominal surgery. Which type of pain does it BEST address?

The TAP block deposits local anesthetic in the plane containing the thoracolumbar nerves supplying the anterior abdominal wall, providing somatic analgesia of the incision and abdominal wall. It does not reliably relieve visceral pain, which requires other modalities. It is a useful opioid-sparing component of multimodal analgesia.

Why the other choices are less appropriate:

- A. Cardiac ischemic pain
- B. Central neuropathic pain
- D. Visceral pain from the abdominal organs

Question 376 • Correct Answer: D

A CRNA adds dexmedetomidine as an analgesic and sedative adjunct. Which mechanism explains its opioid-sparing and sedative effects?

Dexmedetomidine is a selective central alpha-2 adrenergic agonist that produces sedation, anxiolysis, and analgesia while causing minimal respiratory depression, making it useful for opioid sparing. Side effects include bradycardia and hypotension. Its mechanism is distinct from NMDA antagonists and beta agonists.

Why the other choices are less appropriate:

- A. NMDA antagonism
- B. Histamine receptor blockade
- C. Beta-adrenergic agonism

Question 377 • Correct Answer: D

Preemptive and preventive analgesia strategies aim to reduce postoperative pain by which mechanism?

Preventive analgesia seeks to reduce nociceptive input and limit central sensitization by providing analgesia before, during, and after the surgical stimulus, thereby lowering postoperative pain and analgesic requirements. Waiting until pain is severe allows sensitization to develop. It complements rather than replaces intraoperative anesthesia.

Why the other choices are less appropriate:

- A. Delaying analgesia until pain becomes severe
- B. Increasing central sensitization
- C. Eliminating the need for intraoperative anesthesia

Question 378 • Correct Answer: A

A patient develops opioid-induced respiratory depression in the PACU with a respiratory rate of 6 and pinpoint pupils. What is the MOST...

Opioid-induced respiratory depression is treated with small, titrated doses of naloxone (for example 40 to 80 mcg) to restore adequate ventilation while preserving analgesia and avoiding acute withdrawal, along with airway support and oxygen. Large boluses can precipitate severe pain, hypertension, and pulmonary edema. Flumazenil reverses benzodiazepines, not opioids.

Why the other choices are less appropriate:

- B. A large single bolus of naloxone 2 mg
- C. Additional opioid to relax the patient
- D. Flumazenil

Question 379 • Correct Answer: D

A patient's arm is abducted greater than 90 degrees and externally rotated on an arm board during surgery. Which nerve injury is MOST likely?

Abduction of the arm beyond 90 degrees with external rotation stretches the brachial plexus and predisposes to plexus injury. Keeping arm abduction at 90 degrees or less and avoiding extremes of rotation reduces this risk. The ulnar nerve is more at risk from direct elbow compression.

Why the other choices are less appropriate:

- A. Ulnar nerve at the elbow
- B. Common peroneal nerve
- C. Sciatic nerve

Question 380 • Correct Answer: D

During prolonged supine positioning, the ulnar nerve is vulnerable to injury. Which positioning practice BEST reduces the risk of ulnar neuropathy?

Ulnar nerve protection is improved by keeping the forearm supinated or neutral and padding the elbow to avoid external compression at the condylar groove, and by avoiding excessive elbow flexion. Pronation and elbow flexion increase pressure and stretch on the nerve. Careful padding and positioning are key preventive measures.

Why the other choices are less appropriate:

- A. Fully flexing the elbow beyond 90 degrees
- B. Tucking the arms without any padding
- C. Pronating the forearms with pressure on the medial elbow

Question 381 • Correct Answer: B

A patient in steep Trendelenburg for robotic pelvic surgery is at increased risk of which physiologic change?

Steep Trendelenburg raises intracranial and intraocular pressure, shifts abdominal contents cephalad reducing functional residual capacity and lung compliance, and increases central venous pressure. These changes require careful ventilatory management and attention to airway edema. Prolonged steep positioning warrants vigilance for postoperative vision loss.

Why the other choices are less appropriate:

- A. Reduced central venous pressure
- C. Decreased intracranial and intraocular pressure
- D. Improved functional residual capacity

Question 382 • Correct Answer: A

A patient positioned in lithotomy for several hours develops lower-extremity compartment syndrome. Which factor MOST increases this risk?

Prolonged lithotomy positioning elevates the legs above the heart and can reduce perfusion pressure to the lower limbs, increasing the risk of compartment syndrome, especially over long durations. Periodic lowering of the legs and limiting time help mitigate risk. Elevated calf pressure combined with hypotension compounds the danger.

Why the other choices are less appropriate:

- B. Low body mass index
- C. Short procedure duration
- D. Supine positioning

Question 383 • Correct Answer: C

A patient undergoing prolonged prone spine surgery develops postoperative vision loss. Which is the MOST common cause in this setting?

Ischemic optic neuropathy is the most common cause of perioperative vision loss after prolonged prone spine surgery, associated with lengthy procedures, significant blood loss, hypotension, and large volume resuscitation. Direct globe pressure causing central retinal artery occlusion is a separate, preventable mechanism. Risk-reduction includes head positioning and hemodynamic and hematologic management.

Why the other choices are less appropriate:

- A. Acute glaucoma
- B. Corneal abrasion
- D. Central retinal artery occlusion from direct globe pressure

Question 384 • Correct Answer: D

In the lateral decubitus position, an axillary roll is placed. What is its PRIMARY purpose?

The axillary roll, placed caudad to the dependent axilla, offloads the dependent shoulder and protects the axillary neurovascular bundle, including the brachial plexus and axillary artery, from compression. Malpositioning it directly in the axilla defeats the purpose. Checking the dependent radial pulse helps confirm adequate positioning.

Why the other choices are less appropriate:

- A. To improve surgical exposure of the abdomen
- B. To elevate the head
- C. To pad the dependent knee

Question 385 • Correct Answer: A

Which nerve is MOST at risk from compression against the lithotomy stirrup at the lateral fibular head?

The common peroneal nerve wraps around the fibular head and is easily compressed against a lithotomy stirrup, risking foot drop. Adequate padding at the lateral leg helps prevent this injury. The femoral and obturator nerves are more related to hip flexion and hyperabduction.

Why the other choices are less appropriate:

- B. Femoral nerve
- C. Tibial nerve
- D. Obturator nerve

Question 386 • Correct Answer: B

When moving an anesthetized patient from supine to the sitting (beach chair) position, which hemodynamic change should the CRNA anticipate and manage?

The sitting or beach chair position promotes venous pooling in the lower body, reducing venous return and causing hypotension, which can lead to cerebral hypoperfusion if not managed. Blood pressure should be measured at the level of the brain, and cerebral perfusion pressure maintained. Gradual positioning and vasopressors or fluids help offset the drop.

Why the other choices are less appropriate:

- A. A rise in blood pressure requiring vasodilators
- C. No change in blood pressure
- D. Reflex bradycardia only, without pressure change

Question 387 • Correct Answer: A

A patient in the prone position for spine surgery should have the head positioned to protect the eyes. Which practice BEST prevents direct ocular...

Preventing perioperative eye injury in the prone position requires a headrest, such as a horseshoe or pinned holder, that keeps the globes free of any external pressure, with periodic checks of head and eye position. Direct pressure on the eyes can cause central retinal artery occlusion. Sharp lateral head rotation risks neurovascular injury.

Why the other choices are less appropriate:

- B. Turn the head sharply to one side for the entire case
- C. Rest the face directly on a flat foam pad over the eyes
- D. Place tape directly across the open eyes

Question 388 • Correct Answer: D

A patient in steep reverse Trendelenburg for laparoscopic upper abdominal surgery is at increased risk of which event?

Reverse Trendelenburg (head-up) reduces venous return and can produce hypotension and diminished cerebral perfusion, requiring blood pressure monitoring referenced to the head. Functional residual capacity actually improves with head-up tilt. Aspiration risk is more associated with head-down positioning.

Why the other choices are less appropriate:

- A. Increased functional residual capacity impairing oxygenation
- B. Cerebral edema from venous congestion
- C. Aspiration due to head-down tilt

Question 389 • Correct Answer: A

Which general principle BEST guides safe patient positioning under anesthesia?

Safe positioning keeps joints and limbs within their normal physiologic range of motion, pads bony prominences and vulnerable nerves, and avoids stretch or compression injuries. Anesthetized patients cannot report discomfort, so vigilance and periodic reassessment are essential. Extremes of positioning increase the risk of nerve and pressure injuries.

Why the other choices are less appropriate:

- B. Remove all padding to improve surgical access
- C. Position only after the patient is fully paralyzed with no reassessment
- D. Position the patient into any range the surgeon requests regardless of normal limits

Question 390 • Correct Answer: B

During a case, the capnography waveform shows a sudden drop of end-tidal CO₂ to near zero with loss of the waveform. Which cause should be...

A sudden loss of the capnogram with end-tidal CO₂ falling to near zero signals a critical event such as circuit disconnection, esophageal intubation, obstruction, or cardiac arrest, and must be evaluated immediately. Gradual changes suggest less emergent causes. Confirming ventilation, tube position, and circulation is the priority.

Why the other choices are less appropriate:

- A. A slightly exhausted CO₂ absorbent
- C. Mild hypoventilation
- D. A small increase in dead space

Question 391 • Correct Answer: A

A capnography tracing shows an upsloping expiratory plateau (a shark-fin shape). Which condition does this MOST suggest?

An upsloping, prolonged expiratory phase producing a shark-fin waveform reflects obstruction to expiratory airflow, as seen in bronchospasm, asthma, or COPD. Treatment targets the underlying bronchoconstriction. A normal capnogram has a sharp rise and a flat alveolar plateau.

Why the other choices are less appropriate:

- B. Normal ventilation
- C. Esophageal intubation
- D. Hyperventilation

Question 392 • Correct Answer: B

A pulse oximeter reads 85 percent in a patient exposed to carbon monoxide. Why may standard pulse oximetry be misleading in carbon monoxide poisoning?

Conventional two-wavelength pulse oximeters cannot distinguish carboxyhemoglobin from oxyhemoglobin, so they typically overestimate the true functional oxygen saturation in carbon monoxide poisoning. Co-oximetry or multi-wavelength devices are needed to quantify carboxyhemoglobin. This is a classic pitfall of standard SpO₂ monitoring.

Why the other choices are less appropriate:

- A. It cannot read any value in this setting
- C. Carbon monoxide has no effect on oximetry
- D. It reads falsely low because of carboxyhemoglobin

Question 393 • Correct Answer: D

An arterial line waveform shows a large respiratory variation in systolic pressure during positive-pressure ventilation. What does significant...

Marked systolic or pulse pressure variation with positive-pressure ventilation indicates that the patient is likely on the steep part of the Starling curve, suggesting hypovolemia and fluid responsiveness. Minimal variation suggests the patient is less likely to respond to fluids. This dynamic parameter guides goal-directed fluid therapy.

Why the other choices are less appropriate:

- A. Fluid overload
- B. Left ventricular failure
- C. Complete heart block

Question 394 • Correct Answer: C

An arterial line displays an overdamped waveform (blunted, slurred upstroke). What is the effect on the displayed pressures and the likely cause?

An overdamped arterial waveform underestimates systolic pressure and may overestimate diastolic pressure, commonly caused by air bubbles, clots, kinks, or loose connections in the system. An underdamped system overestimates systolic pressure. Correcting the mechanical cause restores accuracy.

Why the other choices are less appropriate:

- A. It only affects the heart rate reading
- B. It has no effect on displayed values
- D. It overestimates systolic pressure; caused by tubing that is too stiff

Question 395 • Correct Answer: C

A central venous pressure tracing shows large cannon a waves. This finding is MOST consistent with which condition?

Cannon a waves occur when the atrium contracts against a closed tricuspid valve, as in atrioventricular dissociation, complete heart block, or junctional rhythms. They reflect loss of normal atrioventricular synchrony. Recognizing them can aid rhythm diagnosis.

Why the other choices are less appropriate:

- A. Hypovolemia
- B. Aortic stenosis
- D. Normal sinus rhythm

Question 396 • Correct Answer: D

During surgery, the ECG shows new 2 mm ST-segment depression in leads II and V5. What does this MOST likely indicate?

New ST-segment depression, particularly in leads that monitor the inferior and lateral walls such as II and V5, suggests myocardial ischemia and demands prompt attention to heart rate, blood pressure, oxygenation, and anemia to balance myocardial oxygen supply and demand. Leads II and V5 together detect most ischemic events. Ignoring the finding risks progression to infarction.

Why the other choices are less appropriate:

- A. Hypothermia
- B. Electrode disconnection
- C. Benign artifact requiring no action

Question 397 • Correct Answer: A

A processed EEG depth-of-anesthesia monitor reads 70 during what should be surgical anesthesia. What does this value MOST likely indicate?

A processed EEG index around 70 is higher than the recommended surgical range of roughly 40 to 60, indicating light anesthesia and an increased risk of awareness. The CRNA should reassess and deepen the anesthetic if clinically appropriate. Values much below 40 suggest excessive depth.

Why the other choices are less appropriate:

- B. Optimal surgical anesthesia
- C. Complete burst suppression
- D. Excessively deep anesthesia

Question 398 · Correct Answer: A

A neuromuscular monitor shows a train-of-four count of 1 twitch. Approximately what level of receptor blockade does this correspond to?

A train-of-four count of one twitch corresponds to a deep level of neuromuscular blockade with roughly 90 to 95 percent of receptors occupied. As blockade recovers, more twitches return, and fade lessens. Adequate reversal generally requires the return of at least the fourth twitch and a normalized ratio.

Why the other choices are less appropriate:

- B. Around 50 percent receptor occupancy
- C. Full recovery
- D. No blockade

Question 399 · Correct Answer: A

A pulse oximeter shows a poor plethysmographic waveform and unreliable readings in a patient. Which condition MOST commonly degrades the pulse...

Pulse oximetry relies on pulsatile arterial flow, so low perfusion states, hypothermia with vasoconstriction, and motion artifact degrade the plethysmographic signal and reliability. Warm, well-perfused digits improve the signal. Alternative probe sites and warming can help restore an accurate reading.

Why the other choices are less appropriate:

- B. Normal blood pressure
- C. A regular heart rhythm
- D. Warm, well-perfused fingers

Question 400 · Correct Answer: A

During emergence, the capnogram shows a small cleft or notch in the plateau (a curare cleft). What does this MOST likely reflect?

A curare cleft is a notch in the expiratory plateau of the capnogram caused by the diaphragm beginning to contract during a mechanically delivered breath, indicating returning spontaneous respiratory effort, sometimes with partial neuromuscular recovery. It signals the patient is starting to breathe. Recognizing it helps guide ventilation and reversal decisions.

Why the other choices are less appropriate:

- B. Complete airway obstruction
- C. Esophageal intubation
- D. Cardiac arrest

Question 401 · Correct Answer: C

A patient with poorly controlled diabetes presents for surgery. Which airway-related concern is specifically increased in long-standing diabetes...

Long-standing diabetes can cause glycosylation and stiffening of joints, limiting atlanto-occipital and cervical mobility, demonstrated by the prayer sign, which predicts difficult laryngoscopy. This limited joint mobility reduces the ability to align airway axes. It is a recognized diabetic airway consideration.

Why the other choices are less appropriate:

- A. Decreased neck circumference
- B. A large mouth opening
- D. Macroglossia only

Question 402 • Correct Answer: D

An outpatient with severe obstructive sleep apnea using home CPAP is scheduled for ambulatory surgery. Which perioperative recommendation is MOST...

Patients with obstructive sleep apnea should continue their home CPAP perioperatively, and clinicians should minimize sedatives and opioids while emphasizing multimodal, opioid-sparing analgesia and enhanced monitoring. Regional techniques are actually favored because they reduce opioid needs. Discontinuing CPAP and using high-dose opioids increase the risk of airway obstruction and respiratory depression.

Why the other choices are less appropriate:

- A. Discontinue CPAP entirely in the perioperative period
- B. Prescribe high-dose long-acting opioids
- C. Avoid all regional anesthesia techniques

Question 403 • Correct Answer: B

A CRNA anticipates a difficult airway in a patient with a large anterior neck mass causing tracheal deviation and stridor. Which airway plan is...

When difficult intubation and difficult ventilation are anticipated, such as with an obstructing neck mass and stridor, an awake technique that preserves spontaneous ventilation, typically awake fiberoptic intubation, is safest. Inducing apnea before securing the airway risks a cannot-ventilate emergency. Preparation and a backup surgical airway plan are essential.

Why the other choices are less appropriate:

- A. Immediate deep inhalation induction with apnea
- C. Standard rapid sequence induction with paralysis
- D. Blind nasal intubation without preparation

Question 404 • Correct Answer: A

During extubation of a patient at risk for reintubation difficulty, which device can be left in place to serve as a conduit for potential...

An airway exchange catheter can be left in the trachea after extubation of a high-risk patient, providing a conduit for rapid reintubation and a means for oxygen insufflation if needed. It bridges the risk of failed reintubation. It should be used cautiously to avoid barotrauma from jet oxygenation.

Why the other choices are less appropriate:

- B. An oral airway
- C. A nasogastric tube
- D. A standard stylet

Question 405 • Correct Answer: C

A patient develops transient neurologic symptoms (TNS) after spinal anesthesia. Which local anesthetic has been MOST associated with this syndrome?

Transient neurologic symptoms, presenting as back pain radiating to the buttocks and legs after resolution of a spinal, are most associated with hyperbaric spinal lidocaine. Symptoms are self-limited over a few days and typically respond to NSAIDs. Bupivacaine has a lower reported incidence.

Why the other choices are less appropriate:

- A. Chloroprocaine
- B. Ropivacaine
- D. Bupivacaine

Question 406 · Correct Answer: B

The maximum recommended dose of lidocaine with epinephrine for local infiltration in an adult is approximately which value?

The commonly taught maximum dose of lidocaine with epinephrine is about 7 mg/kg, compared with roughly 4.5 mg/kg without epinephrine, because epinephrine slows systemic absorption. Exceeding these limits increases the risk of local anesthetic systemic toxicity. Doses should always be calculated by patient weight.

Why the other choices are less appropriate:

- A. 3 mg/kg
- C. 15 mg/kg
- D. 20 mg/kg

Question 407 · Correct Answer: B

A patient develops perioperative anaphylaxis. After epinephrine, which class of agents is the MOST common trigger of perioperative anaphylaxis?

Neuromuscular blocking agents are among the most common causes of perioperative anaphylaxis, followed by antibiotics and latex. Volatile anesthetics and crystalloids rarely cause anaphylaxis. Identifying the trigger, often with later skin or tryptase testing, guides future anesthetic planning.

Why the other choices are less appropriate:

- A. Inhaled volatile anesthetics
- C. Acetaminophen
- D. Crystalloid fluids

Question 408 · Correct Answer: D

Which laboratory test, drawn soon after a suspected anaphylactic reaction, BEST supports the diagnosis of mast cell activation?

Serum tryptase, drawn within a few hours of the event, is elevated with mast cell degranulation and supports the diagnosis of anaphylaxis. A baseline level drawn later helps interpret the acute value. Sodium, CK, and LDH are not markers of mast cell activation.

Why the other choices are less appropriate:

- A. Creatine kinase
- B. Serum sodium
- C. Lactate dehydrogenase

Question 409 · Correct Answer: D

A patient recovering from major surgery receives a continuous epidural infusion of dilute local anesthetic with an opioid. Which adverse effect...

Neuraxial opioids, especially hydrophilic agents such as morphine, can cause delayed respiratory depression due to rostral spread in the cerebrospinal fluid, warranting extended respiratory monitoring. Lipophilic opioids like fentanyl act more quickly and locally. Pruritus, urinary retention, and nausea are other common neuraxial opioid effects.

Why the other choices are less appropriate:

- A. Hyperkalemia
- B. Hyponatremia
- C. Hyperglycemia

Question 410 · Correct Answer: A

After reversal, a patient shows signs of recurarization (recurrence of weakness). Which scenario BEST explains reversal that wears off before the...

Recurarization can occur when a long-acting neuromuscular blocker outlasts the effect of an acetylcholinesterase inhibitor such as neostigmine, causing weakness to recur as reversal dissipates. Quantitative monitoring and appropriate dosing reduce this risk. Sugammadex given at an adequate dose for aminosteroid blockers largely avoids this phenomenon.

Why the other choices are less appropriate:

- B. Adequate spontaneous recovery before reversal
- C. Giving too little relaxant
- D. Using sugammadex for rocuronium at an adequate dose

Question 411 · Correct Answer: C

A patient develops perioperative hypothermia (core temperature 34.8 C). Which consequence is MOST directly attributable to intraoperative hypothermia?

Intraoperative hypothermia increases surgical site infections, impairs coagulation and platelet function, prolongs the metabolism of anesthetic drugs, and can cause postoperative shivering that raises oxygen consumption. Active warming with forced-air devices helps maintain normothermia. Maintaining core temperature improves outcomes.

Why the other choices are less appropriate:

- A. Decreased shivering-related oxygen consumption
- B. Improved coagulation
- D. Accelerated emergence

Question 412 · Correct Answer: D

A patient at high risk for PONV is undergoing surgery. Which combination represents an appropriate multimodal antiemetic prophylaxis using agents...

Effective PONV prophylaxis in high-risk patients combines agents from different classes, such as a 5-HT3 antagonist plus dexamethasone, with consideration of additional agents like a neurokinin-1 antagonist, plus a propofol-based technique. Repeating the same class or relying on a single weak agent is less effective. Multimodal prophylaxis provides additive benefit.

Why the other choices are less appropriate:

- A. No prophylaxis, treating only if symptoms occur
- B. Metoclopramide alone at induction
- C. Two doses of the same 5-HT3 antagonist

Question 413 · Correct Answer: A

A CRNA administers dexamethasone at induction partly for PONV prophylaxis. Which additional consideration is relevant to its timing and effect?

Dexamethasone for PONV prophylaxis has a delayed onset, so it is best administered near induction rather than at the end of surgery, and it can cause transient hyperglycemia that may matter in diabetic patients. It is effective and long-acting for nausea prevention. It does not reverse paralysis or provide immediate bronchodilation.

Why the other choices are less appropriate:

- B. It reverses neuromuscular blockade
- C. It has an immediate onset best given at the end of surgery
- D. It provides immediate bronchodilation

Question 414 · Correct Answer: C

A patient loses an estimated 1.5 liters of blood during surgery. Using the classification of hemorrhagic shock, an adult who has lost roughly 30...

Class III hemorrhagic shock corresponds to roughly 30 to 40 percent blood volume loss with marked tachycardia, hypotension, decreased urine output, and altered mental status, typically requiring blood transfusion. Class I and II involve smaller losses with compensated vital signs, while class IV exceeds 40 percent and is immediately life-threatening. Recognizing the class guides resuscitation urgency.

Why the other choices are less appropriate:

- A. Class II
- B. Class I
- D. Class IV

Question 415 · Correct Answer: D

A neuromuscular monitor demonstrates post-tetanic count (PTC) of 2 with no train-of-four response. What does this finding indicate?

A post-tetanic count of only a few twitches with an absent train-of-four indicates deep or intense neuromuscular blockade, deeper than can be assessed by the train-of-four alone. This level is too profound for reversal with an acetylcholinesterase inhibitor, though sugammadex can reverse deep aminosteroid blockade. Recovery must progress before adequate reversal is possible.

Why the other choices are less appropriate:

- A. No neuromuscular blockade is present
- B. Adequate reversal has occurred
- C. Full recovery of neuromuscular function

DOMAIN IV: SURGICAL PROCEDURES & SPECIAL POPULATIONS

Question 416 · Correct Answer: B

A 3-year-old (15 kg) child presents for tonsillectomy and adenoidectomy. During mask induction with sevoflurane, he develops complete...

Complete laryngospasm in a child without IV access with rapidly falling SpO₂ is a life-threatening emergency. Intramuscular succinylcholine (4 mg/kg) is the rescue treatment - given in the lateral thigh or deltoid. For this 15 kg child: $4 \times 15 = 60$ mg IM. The higher IM dose compensates for slower absorption. After injection, apply 100% O₂ by mask, jaw thrust, and CPAP until the succinylcholine takes effect (~45-90 seconds IM). Simultaneously establish IV access.

Why the other choices are less appropriate:

- A. Complete laryngospasm does NOT resolve spontaneously - SpO₂ of 78% and falling is a cardiac arrest risk.
- C. Atropine prevents bradycardia and reduces secretions but does NOT break laryngospasm.
- D. Nasopharyngeal airway cannot overcome closed vocal cords in complete laryngospasm.

Question 417 · Correct Answer: B

A parturient at 38 weeks develops severe preeclampsia with BP 172/108, headache, and visual changes. She requires urgent cesarean delivery. Which...

In preeclampsia, neuraxial anesthesia is PREFERRED (if platelet count $\geq 75,000$ -80,000 and no coagulopathy) for several reasons: (1) It avoids the severe hypertensive response to laryngoscopy and intubation that can cause cerebrovascular hemorrhage or pulmonary edema in preeclamptic patients, (2) It provides excellent surgical conditions, (3) It avoids fetal exposure to IV anesthetic agents. The concern about spinal hypotension is manageable with phenylephrine. GA is reserved for urgent cases where neuraxial is contraindicated or time does not permit.

Why the other choices are less appropriate:

- A. GA carries significant risk in preeclampsia - the hypertensive response to laryngoscopy can be catastrophic.
- C. Neuraxial anesthesia is NOT contraindicated in preeclampsia - it is the preferred technique.
- D. Ketamine's sympathomimetic effect is dangerous in severe preeclampsia - it would worsen hypertension.

Question 418 · Correct Answer: B

A 72-year-old patient undergoes CABG on cardiopulmonary bypass (CPB). After separation from CPB, the TEE shows severe right ventricular dilation...

RV failure after CPB can result from inadequate myocardial protection of the thin-walled RV, air embolism to the right coronary artery, pulmonary hypertension, or other causes. TEE findings of RV dilation + septal flattening + TR + hypotension confirm RV failure. Management: (1) Optimize preload (not too much - RV dilation worsens TR and septal shift), (2) Reduce RV afterload with inhaled nitric oxide or sildenafil, (3) Improve contractility with milrinone (PDE3 inhibitor - inotrope + vasodilator), (4) Maintain systemic BP with vasopressin (does not increase PVR), (5) Consider return to CPB or right ventricular assist device (RVAD).

Why the other choices are less appropriate:

- A. Dobutamine increases PVR slightly and RV heart rate - may not be ideal for isolated RV failure.
- C. Hyperbaric oxygen is for cerebral air embolism - not first-line for RV failure.
- D. Coagulopathy would present with bleeding, not hemodynamic collapse with the described echocardiographic findings.

Question 419 · Correct Answer: A

A patient undergoing right lower lobe lobectomy with one-lung ventilation develops SpO₂ falling to 88% despite FiO₂ 1.0 to the dependent left...

When FiO₂ 1.0 during OLV fails to maintain acceptable SpO₂, the first intervention is applying CPAP (5-10 cmH₂O) to the non-dependent (collapsed/operative) lung. CPAP provides O₂ to non-ventilated alveoli via diffusion (apneic oxygenation), improving V/Q matching without requiring full ventilation of the operative lung. This is usually done with a dedicated CPAP circuit to the collapsed lung. If CPAP to the non-dependent lung fails, the next step is intermittent manual ventilation (PPV) to the non-dependent lung.

Why the other choices are less appropriate:

- B. Recruitment maneuver to the dependent lung addresses atelectasis but is not the first step for OLV hypoxemia.
- C. Reducing TV worsens oxygenation by reducing alveolar ventilation.
- D. Almitrine augments HPV but is not readily available in most US institutions.

Question 420 · Correct Answer: B

During a carotid endarterectomy (CEA) with regional cervical plexus block, the patient becomes agitated, develops contralateral arm weakness, and...

The advantage of performing CEA under regional (cervical plexus) block is continuous neurologic monitoring - the awake patient reports symptoms immediately. New neurologic deficits (contralateral weakness, speech changes) after carotid cross-clamping indicate cerebral ischemia in the territory of the clamped carotid. Immediate communication with the surgeon is mandatory. The surgeon may choose to: (1) place an intraluminal shunt to restore flow, (2) increase BP (collateral flow), or (3) shorten ischemia time. Converting to GA at this point would eliminate the neurologic monitoring benefit.

Why the other choices are less appropriate:

- A. Agitation and neurologic changes after cross-clamp are never dismissed as 'anxiety.'
- C. Increasing BP alone is a supportive measure but the primary action is informing the surgeon - shunt placement is the definitive treatment.
- D. Inducing GA without informing the surgeon first deprives the team of coordinated decision-making.

Question 421 · Correct Answer: B

A 6-week-old former 32-week premature infant (corrected age 42 weeks) requires inguinal hernia repair. Which statement regarding postoperative...

Former premature infants (born <37 weeks) are at significantly increased risk of postoperative apnea up to 60 weeks post-conceptual age (PCA). This infant is 6 weeks old + 32 weeks gestational age = 38 weeks PCA - well below the threshold. Most guidelines recommend inpatient monitoring with continuous cardiorespiratory monitoring for at least 12-24 hours post-operatively for former premature infants <60 weeks PCA. Caffeine administration (10 mg/kg IV) pre-operatively reduces apnea risk and is often given. Awake spinal anesthesia is actually the PREFERRED technique to avoid volatile agents and reduce apnea risk.

Why the other choices are less appropriate:

- A. Same-day discharge is contraindicated in former premature infants <60 weeks PCA.
- C. Spinal anesthesia is not contraindicated - it is actually preferred in this population to minimize apnea risk.
- D. Succinylcholine is not a preferred induction agent; sevoflurane inhalation induction or IV induction is standard.

Question 422 · Correct Answer: B

A parturient at 36 weeks requires emergency cesarean delivery for placental abruption with category III fetal heart rate tracing. She has an...

For emergency cesarean with a functioning epidural in place, epidural top-up is faster than spinal or GA induction for most patients. The fastest epidural agent for emergency top-up is 3% 2-chloroprocaine (onset 5-8 minutes to surgical level) due to its fast diffusion and rapid tissue penetration. Alternative: 2% lidocaine + sodium bicarbonate (8.4%, 1 mEq per 10 mL) +/- epinephrine 1:200,000 (onset ~10 minutes). The key principle: a functioning epidural catheter can be loaded rapidly for urgent cesarean delivery.

Why the other choices are less appropriate:

- A. Removing the epidural and placing a spinal wastes time when the existing epidural can be loaded.
- C. GA is reserved for true emergencies (CICO, maternal hemorrhage requiring immediate delivery with no time for neuraxial).
- D. A dilute labor analgesia infusion will NEVER provide surgical anesthesia without a bolus loading dose.

Question 423 · Correct Answer: B

An 85-year-old woman with moderate dementia and multiple myeloma presents for hip fracture repair. She lives in a memory care facility. Which...

Elderly patients have multiple pharmacokinetic changes that reduce drug clearance and increase sensitivity: (1) Decreased lean body mass with increased fat proportion -> increased Vd for lipophilic drugs with prolonged context-sensitive half-times, (2) Decreased serum albumin -> increased free fraction of protein-bound drugs (fentanyl, propofol, vecuronium), (3) Decreased hepatic mass and blood flow -> reduced Phase I drug metabolism, (4) Decreased GFR (estimated 1%/year after age 40) -> reduced renal drug elimination. The clinical consequence: use lower doses and longer intervals for all anesthetic agents in elderly patients.

Why the other choices are less appropriate:

- A. Hepatic enzyme induction requires higher doses - this is the opposite of age-related changes.
- C. Elderly patients typically have increased fat stores (not decreased), contributing to longer context-sensitive half-times.
- D. Renal clearance declines with age - there is no compensatory increase.

Question 424 · Correct Answer: B

Which of the following correctly describes dosing of succinylcholine in a morbidly obese patient (TBW 140 kg, IBW 75 kg)?

Succinylcholine dosing in obese patients uses total body weight (TBW) because pseudocholinesterase activity is increased in obese patients in proportion to TBW - the enzyme that metabolizes succinylcholine. Using IBW results in an insufficient dose that may produce inadequate intubating conditions. For this 140 kg patient at 1.5 mg/kg TBW: $1.5 \times 140 = 210$ mg. In contrast, most non-depolarizing NMDBs (rocuronium, vecuronium) are dosed based on IBW (or lean body weight) to prevent prolonged paralysis.

Why the other choices are less appropriate:

- A. IBW dosing of succinylcholine in obese patients provides inadequate intubating conditions.
- C. LBW dosing is appropriate for NDNMBs - succinylcholine requires TBW due to its mechanism.
- D. A fixed dose does not account for pharmacokinetic variability across different weights.

Question 425 · Correct Answer: B

A patient undergoes endovascular coiling of a ruptured cerebral aneurysm. During the procedure, blood pressure suddenly increases from 110/70 to...

Aneurysm re-rupture during endovascular coiling is immediately catastrophic - it carries ~80% mortality. Both hypertension (increased transmural pressure across the aneurysm wall) and patient movement can precipitate re-rupture before the aneurysm is completely secured. Maintaining tight blood pressure control and ensuring adequate neuromuscular blockade and anesthetic depth throughout the procedure is critical. Controlled hypotension (MAP 60-70% baseline) is often targeted during coil deployment to reduce aneurysm perfusion pressure.

Why the other choices are less appropriate:

- A. Retinal hemorrhage is a concern with extremely elevated IOP but is not immediately life-threatening.
- C. Contrast nephropathy is a delayed complication measured in days.
- D. Cerebral vasospasm occurs days after subarachnoid hemorrhage - not acutely during the procedure.

Question 426 · Correct Answer: B

A 2-year-old child with a known history of previous difficult intubation and Pierre Robin sequence (micrognathia, glossoptosis, cleft palate)...

Pierre Robin sequence is characterized by micrognathia, posterior tongue displacement (glossoptosis), and often cleft palate - creating a difficult airway due to the small mandible and obstructed view. For myringotomy (a brief procedure), the safest approach is inhalation induction maintaining spontaneous ventilation with sevoflurane, keeping the patient breathing, and using an LMA if necessary. Having advanced airway tools immediately available (video laryngoscope, fiberoptic scope) is mandatory given the known difficult airway history. RSI is contraindicated when a difficult airway is anticipated.

Why the other choices are less appropriate:

- A. Pierre Robin sequence does improve over time but a 2-year-old with known prior difficult intubation requires careful planning.
- C. RSI commits the provider to apnea with a known difficult airway - never appropriate as a first-choice in anticipated difficult pediatric airway.
- D. Blind tube exchange over a stylet is not a standard or safe technique for anticipated difficult airway in a 2-year-old.

Question 427 · Correct Answer: B

During cementation of the femoral component in a total hip arthroplasty, the patient's BP drops from 120/80 to 72/44 mmHg and SpO₂ falls to 88%....

Bone Cement Implantation Syndrome (BCIS) is a well-recognized complication of cemented joint replacement arthroplasty. It occurs during and immediately after cementation due to: (1) embolization of fat, bone marrow, air, and cement monomer into the pulmonary circulation during pressurization of the medullary canal, (2) release of vasoactive mediators. Clinical presentation: sudden cardiovascular collapse (hypotension, right heart failure, hypoxemia), tachycardia, and dysrhythmias at the time of cementation. High-risk patients: elderly, poor cardiopulmonary reserve, pathologic fractures. Prevention: thorough canal lavage, venting, careful pressurization.

Why the other choices are less appropriate:

- A. Transfusion reactions present differently - fever, urticaria, or hemolysis - not specifically timed to cementation.
- C. Latex anaphylaxis is possible but would typically occur earlier in the case, not specifically at cementation.
- D. Air embolism is a component of BCIS but the broader syndrome includes fat and cement monomer.

Question 428 · Correct Answer: B

A CRNA is called to provide anesthesia for electroconvulsive therapy (ECT) for a severely depressed patient on phenelzine (an MAOI). Which drug...

MAOIs (including phenelzine) create life-threatening interactions with: (1) indirect sympathomimetics (ephedrine, dopamine) -> hypertensive crisis, (2) meperidine (pethidine) -> serotonin syndrome or hyperpyrexia (absolutely contraindicated), (3) SSRIs/SNRIs -> serotonin syndrome. Safe ECT anesthesia with MAOI includes: methohexital or propofol for induction, succinylcholine for muscle modification, avoid all indirect sympathomimetics, fentanyl cautiously (direct mu-agonists have less interaction than meperidine), and have phentolamine (alpha-blocker) available for the expected hypertensive surge with ECT.

Why the other choices are less appropriate:

- A. Meperidine + MAOIs is an ABSOLUTE contraindication - can cause fatal serotonin syndrome or hyperpyrexia reaction.
- C. Ketamine's sympathomimetic properties are dangerous with MAOIs.
- D. Sevoflurane is acceptable but fentanyl in a patient on MAOIs requires extreme caution; meperidine is the critical drug to avoid.

Question 429 · Correct Answer: B

A patient at 32 weeks gestation with complete placenta previa requires urgent cesarean for antepartum hemorrhage. She has lost approximately 1500...

Active hemorrhage with hemodynamic instability is a relative to absolute contraindication to spinal anesthesia in an emergency cesarean. Spinal causes vasodilation (sympathectomy) from the sensory block, which can precipitate cardiovascular collapse in a hemorrhaging patient who is already vasoconstrictive and compensating. GA with RSI is required: preoxygenate, ketamine or etomidate (hemodynamically stable induction agents) + succinylcholine or high-dose rocuronium, left uterine displacement, prepare for massive transfusion protocol, have crossmatch immediately available. Placenta previa also carries risk of placenta accreta - have surgical and interventional radiology teams notified.

Why the other choices are less appropriate:

- A. Spinal hypotension in an already hemorrhaging patient risks cardiovascular collapse.
- C. Epidural has an even slower onset than spinal and is not appropriate for acute hemorrhage.
- D. Local infiltration does not provide adequate surgical anesthesia for cesarean.

Question 430 · Correct Answer: C

A trauma patient arrives with suspected tension pneumothorax: absent breath sounds on the right, tracheal deviation to the left, distended neck...

Tension pneumothorax is a clinical diagnosis - do NOT delay treatment for imaging. The classic presentation (absent unilateral breath sounds, tracheal deviation away, distended neck veins, severe hemodynamic compromise) requires immediate needle decompression: 14-16g IV catheter at the 2nd ICS, MCL on the affected side (right). This converts tension to a simple pneumothorax. Follow with tube thoracostomy (chest tube). Positive pressure ventilation in a tension PTX will worsen it - intubation should not precede decompression.

Why the other choices are less appropriate:

- A. A 10-second clinical exam is the basis for diagnosis in tension PTX - delaying for imaging is dangerous.
- B. CT scan is never appropriate in a hemodynamically unstable tension PTX.
- D. PPV in tension PTX increases intrathoracic pressure further, worsening venous return collapse.

Question 431 · Correct Answer: B

During separation from CPB after aortic valve replacement, the patient remains hypotensive despite adequate volume loading. TEE shows a...

Systolic anterior motion (SAM) of the mitral valve after AVR represents dynamic LVOTO - the anterior mitral leaflet moves into the LVOT during systole, obstructing outflow. It is seen post-AVR when the hyperdynamic, high-contraction LV is now unloaded (no longer working against a stenotic valve). Treatment parallels HOCM: increase preload (volume), increase afterload (phenylephrine - not vasodilators!), reduce contractility (stop inotropes, consider beta-blockade), and slow heart rate. SAM can cause refractory hemodynamic instability post-cardiac surgery.

Why the other choices are less appropriate:

- A. Dobutamine increases contractility and reduces afterload - worsening SAM and LVOTO.
- C. Vasodilators reduce preload and afterload - worsening both SAM and obstruction.
- D. IABP is not the primary treatment for SAM - it is a mechanical support device.

Question 432 · Correct Answer: B

A 19-year-old patient with a history of sickle cell disease (HbSS) requires laparoscopic cholecystectomy for acute cholecystitis. Which...

Sickle cell disease management perioperatively focuses on preventing sickling triggers: hypoxia, acidosis, hypothermia, dehydration, and pain. Exchange transfusion (targeting HbS fraction <30%) is recommended before major surgery to reduce sickling risk by diluting HbS with normal Hgb. Simple transfusion to hematocrit >40% is NOT recommended - it increases blood viscosity dangerously. Maintain FiO2 to prevent hypoxemia, warm IV fluids, active warming, adequate analgesia, and hydration throughout.

Why the other choices are less appropriate:

- A. Transfusing to Hct >40% increases blood viscosity and vaso-occlusive risk.
- C. Hydroxyurea is a long-term therapy that increases HbF; it cannot be administered acutely as perioperative prophylaxis.
- D. N2O is generally avoided in sickle cell patients due to potential marrow effects; it does not prevent sickling.

Question 433 · Correct Answer: C

A 55-year-old patient undergoes awake craniotomy for glioblastoma resection near Broca's area. During the procedure, the patient suddenly becomes...

Intraoperative seizures during awake craniotomy require immediate termination to prevent injury and loss of neurologic monitoring. Midazolam (2-4 mg IV) is the first-line agent - benzodiazepines are anticonvulsants with minimal respiratory depression at these doses. If the seizure is refractory, propofol in small increments (50-100 mg) terminates seizures but may cause significant sedation, ending the awake portion of the procedure. Airway protection takes priority if consciousness is impaired. The neurophysiologist and surgeon are also notified to temporarily pause cortical stimulation.

Why the other choices are less appropriate:

- A. 100 mg propofol is a large dose that would terminate the awake phase of the craniotomy and cannot be immediately reversed.
- B. Cold saline irrigation may help with cortical spreading depression from the surgical field but does not immediately terminate a generalized seizure.
- D. Intubation is not the first step - airway management is guided by the patient's level of consciousness and seizure control.

Question 434 · Correct Answer: B

A CRNA is providing deep sedation for a 65-year-old patient undergoing radiofrequency ablation (RFA) of hepatocellular carcinoma in the...

This patient is showing signs of over-sedation with airway obstruction (rising ETCO₂) and hypoxemia. High STOP-BANG (5) indicates severe OSA - this patient has minimal reserve. The immediate priority is to recognize impending respiratory failure and take action: (1) Stop or greatly reduce the sedation infusion, (2) Manual airway maneuvers (jaw thrust, head tilt-chin lift), (3) CPAP by mask with 100% O₂, (4) Have a plan for intubation if not improving rapidly. NORA locations carry increased risk because of unfamiliar environments, limited space, and distance from anesthesia support.

Why the other choices are less appropriate:

- A. Increasing oxygen flow without addressing the obstruction treats hypoxemia but not hypercarbia - the underlying airway obstruction must be addressed.
- C. Flumazenil is for benzodiazepine reversal only - ineffective if the sedation includes propofol, dexmedetomidine, or opioids.
- D. Applying CPAP without first stopping the sedation infusion is incomplete management.

Question 435 · Correct Answer: B

A laboring patient requests an epidural. Informed consent is obtained. After placing the epidural at L3-L4, you inject the test dose (3 mL of 1.5%...

The epidural test dose contains epinephrine 1:200,000 (15 mcg per 3 mL). If injected intravascularly, epinephrine produces a characteristic heart rate increase of >20 bpm within 60-90 seconds - this is a POSITIVE intravascular test dose. The catheter is likely in an epidural vein. Do NOT inject further through this catheter. Remove and replace the epidural catheter at a different level or location. A positive test dose prevents the catastrophic consequence of injecting a large epidural dose intravenously (LAST, cardiovascular collapse).

Why the other choices are less appropriate:

- A. A 24 bpm HR increase with palpitations is NOT a normal sympathetic response - it is a specific epinephrine marker for intravascular placement.
- C. Subarachnoid placement with the test dose (45 mg lidocaine) would cause rapid dense motor and sensory block - not just tachycardia.
- D. 45 mg of lidocaine is far below the threshold for systemic toxicity; palpitations and tachycardia are specifically from epinephrine.

Question 436 • Correct Answer: B

A patient undergoing endovascular aortic aneurysm repair (EVAR) develops sudden onset of bilateral lower extremity flaccid paralysis immediately...

Spinal cord ischemia is a feared complication of aortic procedures (open or endovascular) when the stent graft covers the origin of critical segmental arteries supplying the anterior spinal artery (including the artery of Adamkiewicz, typically T9-L1). Immediate treatment: (1) Lumbar CSF drainage catheter placed to reduce CSF pressure (target CSF pressure <10 mmHg) - this improves spinal cord perfusion pressure, (2) Blood pressure augmentation (MAP 85-100 mmHg or higher if tolerated) with vasopressors to increase perfusion to the ischemic cord, (3) Optimize Hgb, (4) Methylprednisolone (controversial). Outcomes depend on speed of intervention.

Why the other choices are less appropriate:

- A. Anaphylaxis to contrast causes systemic reactions - urticaria, bronchospasm, cardiovascular collapse - not isolated paraplegia.
- C. Peripheral arterial embolism would cause distal limb ischemia, not bilateral flaccid paralysis.
- D. PRIS does not cause acute paraplegia.

Question 437 • Correct Answer: B

A 5-year-old child (20 kg) requires emergency intubation for epiglottitis. She has stridor, drooling, and high fever. She is positioned sitting...

Acute epiglottitis with tripod positioning is a critical pediatric airway emergency. The optimal management is: (1) Transfer immediately to OR - do NOT agitate the child (crying worsens obstruction), (2) Inhalation induction with 100% O₂ + sevoflurane while maintaining the child in the position of comfort - spontaneous ventilation is preserved, (3) Achieve adequate depth before direct laryngoscopy, (4) Have ENT surgeon scrubbed and ready for emergency tracheotomy, (5) Have all ETT sizes available (swollen epiglottis may require smaller tube than expected), (6) IV access after induction. RSI risks apnea with a potentially unclearable airway.

Why the other choices are less appropriate:

- A. RSI creates apnea in a patient where securing the airway may be extremely difficult due to supraglottic swelling.
- C. Awake nasal intubation in a frightened, distressed 5-year-old with epiglottitis is not feasible and could precipitate complete obstruction.
- D. Cricothyrotomy is a last resort - not first-line for pediatric epiglottitis.

Question 438 • Correct Answer: B

A patient maintained on methadone 80 mg/day for opioid use disorder requires major abdominal surgery. Which perioperative pain management approach...

Current ASAM and AANA guidance recommends continuing methadone through the perioperative period. Abrupt discontinuation precipitates withdrawal and removes the patient's opioid tolerance maintenance, increasing relapse risk. Methadone's NMDA antagonist properties may actually assist with perioperative pain. For acute pain: (1) continue methadone dose, (2) add regional anesthesia (neuraxial/peripheral blocks) as the primary analgesic, (3) use multimodal agents (ketamine, NSAIDs, acetaminophen, dexmedetomidine), (4) supplement with full-agonist IV opioids in higher-than-usual doses as needed for breakthrough pain.

Why the other choices are less appropriate:

- A. Holding methadone precipitates withdrawal and is not recommended.
- C. Converting to buprenorphine acutely in the perioperative period is inappropriate and complex - buprenorphine has unique challenges in acute pain (see Q20).
- D. Naltrexone precipitates immediate opioid withdrawal and completely blocks opioid analgesia - absolutely contraindicated.

Question 439 • Correct Answer: B

A patient with symptomatic severe aortic stenosis (AVA 0.7 cm², gradient 68 mmHg) requires emergency bowel resection for a perforated...

Severe AS: the heart cannot increase stroke volume (fixed orifice), so CO is preload, rate, and afterload dependent. The key hemodynamic goals are: (1) Maintain sinus rhythm with HR 60–80, (2) Maintain SVR (avoid vasodilation), (3) Maintain preload. Etomidate provides rapid induction with minimal cardiovascular depression and minimal vasodilation – making it the induction agent of choice for hemodynamically unstable or high-risk cardiac patients. It does cause adrenal suppression with a single dose, but this is acceptable in an emergency.

Why the other choices are less appropriate:

- A. Propofol causes significant vasodilation and myocardial depression – can cause catastrophic hypotension in severe AS.
- C. Ketamine's sympathomimetic effect increases HR and may worsen subendocardial ischemia in a patient with limited coronary reserve.
- D. Thiopental causes significant myocardial depression and vasodilation – poorly tolerated in severe AS.

Question 440 • Correct Answer: C

A CRNA is managing a patient with suspected liver failure (INR 3.2, bilirubin 12, encephalopathy grade II) requiring urgent exploratory...

In severe hepatic failure, drugs dependent on liver metabolism (vecuronium, rocuronium, pancuronium) will have dramatically prolonged duration of action. Cisatracurium undergoes Hofmann elimination – a spontaneous, pH- and temperature-dependent chemical degradation in the plasma that is completely organ-independent. It also produces laudanosine as a metabolite, but at clinical doses this is not problematic. Cisatracurium is the NDNMB of choice in both liver failure and renal failure. Its predictable duration allows safe neuromuscular management without reliance on hepatic clearance.

Why the other choices are less appropriate:

- A. Vecuronium is primarily hepatically eliminated – dramatically prolonged in liver failure.
- B. Rocuronium is primarily hepatically eliminated – prolonged in liver failure; sugammadex availability helps but does not correct the prolonged duration issue.
- D. Pancuronium is primarily renally eliminated but has significant hepatic component; its tachycardic vagolytic effect is not a reason to select it in shock.

Question 441 • Correct Answer: B

A 39-week parturient is placed supine for a scheduled cesarean delivery and rapidly becomes hypotensive and lightheaded. What is the MOST...

Aortocaval compression from the gravid uterus reduces venous return and cardiac output when the parturient is supine. Left uterine displacement (tilting the uterus off the inferior vena cava and aorta) is the first-line maneuver to restore venous return. Vasopressors and fluids are adjuncts but do not correct the mechanical obstruction.

Why the other choices are less appropriate:

- A. A pressor may raise pressure transiently but ignores the mechanical cause.
- C. Reverse Trendelenburg worsens venous return.
- D. Fluid alone does not relieve caval compression.

Question 442 • Correct Answer: B

A combined spinal-epidural (CSE) technique is chosen for labor analgesia. What is the PRIMARY advantage of CSE over a standard epidural?

The CSE technique delivers an intrathecal dose that produces rapid onset of analgesia, then relies on the epidural catheter for maintenance. This combines quick relief with the flexibility of a continuous epidural. It does not lower headache risk and still requires a catheter.

Why the other choices are less appropriate:

- A. Dural puncture may increase, not decrease, headache risk.
- C. An epidural catheter is still placed for maintenance.
- D. Motor block can still occur depending on drugs used.

Question 443 • Correct Answer: D

Compared with the non-pregnant state, the local anesthetic dose required to achieve a given spinal level in the term parturient is:

Pregnancy reduces local anesthetic requirements by roughly a third due to engorged epidural veins reducing CSF volume, increased neural sensitivity from progesterone, and mechanical factors. Dosing must be reduced to avoid an excessively high block. A 70 percent reduction overstates the effect.

Why the other choices are less appropriate:

- A. Requirements decrease, not increase.
- B. Requirements clearly change in pregnancy.
- C. A 70 percent reduction is excessive and not supported.

Question 444 • Correct Answer: A

A parturient with severe preeclampsia has a blood pressure of 170/115 mmHg. Which antihypertensive is considered a FIRST-line agent for acute...

Labetalol, hydralazine, and nicardipine are accepted first-line agents for acute severe hypertension in preeclampsia. Labetalol provides combined alpha and beta blockade with a favorable maternal and fetal profile. Nitroprusside risks cyanide accumulation and fetal effects, and esmolol alone can cause fetal bradycardia.

Why the other choices are less appropriate:

- B. Nitroprusside risks cyanide/thiocyanate toxicity and fetal effects.
- C. Nicardipine is first-line and does not require stopping magnesium.
- D. Esmolol alone is associated with fetal bradycardia.

Question 445 • Correct Answer: C

A preeclamptic parturient is receiving a magnesium sulfate infusion. She becomes areflexic and her respiratory rate falls. What is the MOST...

Magnesium toxicity progresses from loss of deep tendon reflexes to respiratory depression and eventually cardiac arrest. Intravenous calcium (gluconate or chloride) directly antagonizes magnesium at the neuromuscular junction and is the antidote. The infusion should be stopped and ventilation supported.

Why the other choices are less appropriate:

- A. Furosemide increases excretion slowly but is not the acute antidote.
- B. More magnesium worsens toxicity.
- D. Bicarbonate does not reverse magnesium effects.

Question 446 • Correct Answer: C

The magnesium level associated with loss of deep tendon reflexes is approximately:

Therapeutic magnesium for seizure prophylaxis is roughly 5 to 9 mg/dL. Loss of deep tendon reflexes occurs around 10 mg/dL and serves as a clinical warning sign. Respiratory depression follows near 15 mg/dL and cardiac arrest near 25 mg/dL.

Why the other choices are less appropriate:

- A. 2 to 4 mg/dL is the normal range.
- B. 5 to 7 mg/dL is within the therapeutic seizure-prophylaxis range.
- D. 25 mg/dL is associated with cardiac arrest.

Question 447 • Correct Answer: A

Which uterotonic is relatively CONTRAINDICATED in a parturient with reactive airway disease?

Carboprost, a prostaglandin F2-alpha analog, can cause bronchoconstriction and is relatively contraindicated in asthma. Methylergonovine is avoided in hypertension, and oxytocin can cause hypotension with rapid bolus. Misoprostol is generally well tolerated in reactive airway disease.

Why the other choices are less appropriate:

- B. Oxytocin causes hypotension, not bronchospasm.
- C. Methylergonovine is contraindicated in hypertension.
- D. Misoprostol is not a bronchoconstrictor concern.

Question 448 · Correct Answer: C

A parturient develops sudden hypoxemia, hypotension, and coagulopathy immediately after delivery. Which condition is MOST likely? Amniotic fluid embolism presents as abrupt hypoxemia, cardiovascular collapse, and disseminated intravascular coagulation, classically around delivery. Management is supportive with aggressive resuscitation and correction of coagulopathy. The triad of respiratory failure, hemodynamic collapse, and DIC distinguishes it from other causes.

Why the other choices are less appropriate:

- A. VAE lacks the characteristic peripartum DIC.
- B. Total spinal causes hypotension and apnea but not DIC.
- D. LAST causes CNS and cardiac toxicity, not consumptive coagulopathy.

Question 449 · Correct Answer: A

For a nonobstetric surgery in a pregnant patient, which principle is MOST important regarding timing?

Elective procedures should be deferred until after delivery; when surgery is necessary, the second trimester is generally preferred to minimize teratogenic and preterm-labor risk. Emergent surgery proceeds regardless of trimester. No anesthetic agent is proven teratogenic at clinical doses.

Why the other choices are less appropriate:

- B. The first trimester carries the highest organogenesis/teratogen risk.
- C. General anesthesia is used safely when indicated.
- D. Fetal monitoring may be appropriate depending on gestational age.

Question 450 · Correct Answer: D

A pregnant patient at 34 weeks requires emergency appendectomy. To reduce aspiration risk, the anesthetic plan should include:

After roughly 18 to 20 weeks, parturients are considered to have a full stomach due to delayed gastric emptying and reduced lower esophageal sphincter tone. Rapid sequence induction with cricoid pressure protects the airway. Aspiration prophylaxis with a nonparticulate antacid is also recommended.

Why the other choices are less appropriate:

- A. Awake fiberoptic is reserved for anticipated difficult airway.
- B. Deep inhalational induction risks aspiration.
- C. An LMA does not protect against aspiration in a full-stomach patient.

Question 451 · Correct Answer: C

Which physiologic change of pregnancy MOST predisposes the parturient to rapid desaturation during apnea?

Pregnancy reduces FRC (oxygen reservoir) by up to 20 percent while increasing oxygen consumption by roughly 20 percent. This combination causes rapid desaturation during apnea, making thorough preoxygenation essential. Minute ventilation actually increases due to progesterone-driven hyperventilation.

Why the other choices are less appropriate:

- A. FRC decreases in pregnancy.
- B. Oxygen consumption increases.
- D. Minute ventilation increases, producing chronic respiratory alkalosis.

Question 452 · Correct Answer: A

A woman receiving an epidural infusion for labor suddenly develops a dense motor block, hypotension, and difficulty breathing within minutes of a...

A rapidly ascending dense block with respiratory compromise after a top-up suggests intrathecal or subdural spread of local anesthetic, producing a high or total spinal. Management is airway support, ventilation, and hemodynamic resuscitation. Aspirating the catheter and test dosing help detect migration.

Why the other choices are less appropriate:

- B. AFE causes hypoxemia and DIC, not a dense segmental block pattern.
- C. An eclamptic seizure is not triggered by a catheter top-up.
- D. Normal epidural spread does not cause abrupt respiratory failure.

Question 453 • Correct Answer: C

What is the primary reason ephedrine was historically favored over phenylephrine for maternal hypotension, and why has practice shifted?

Ephedrine was thought to better preserve uteroplacental perfusion, but evidence shows it crosses the placenta and increases fetal metabolic acidosis. Phenylephrine is now generally preferred for spinal hypotension during cesarean delivery because it is associated with better fetal acid-base status. Phenylephrine may cause reflex maternal bradycardia.

Why the other choices are less appropriate:

- A. Ephedrine is associated with fetal acidosis, not alkalosis.
- B. Phenylephrine causes reflex bradycardia, not tachycardia.
- D. Both are used routinely in obstetric anesthesia.

Question 454 • Correct Answer: C

Compared to an adult, the infant larynx is best described as:

The infant larynx sits more cephalad (around C3 to C4 versus C5 to C6 in adults) and is funnel-shaped, with the classically described narrowest region at the cricoid ring. The large occiput and tongue also affect positioning. These differences influence tube selection and laryngoscopy technique.

Why the other choices are less appropriate:

- A. The infant larynx is more cephalad, not caudad.
- B. Pediatric and adult airways differ significantly.
- D. The infant glottis is higher (C3 to C4), and cricoid is the narrow point.

Question 455 • Correct Answer: C

Modern practice increasingly favors cuffed endotracheal tubes in young children primarily because:

With appropriate size selection and cuff pressure monitoring, cuffed tubes reduce reintubation for leak, provide a reliable seal for controlled ventilation, and limit fresh gas leak and OR pollution. Older concerns about mucosal injury are mitigated by low-pressure high-volume cuffs and pressure monitoring. Correct sizing remains essential.

Why the other choices are less appropriate:

- A. Correct sizing is still required.
- B. Excess cuff pressure can still cause injury.
- D. They are not mandated for all infants.

Question 456 • Correct Answer: B

Using the Holliday-Segar (4-2-1) rule, the hourly maintenance fluid rate for a 22 kg child is:

The 4-2-1 rule gives 4 mL/kg/hr for the first 10 kg (40), 2 mL/kg/hr for the next 10 kg (20), and 1 mL/kg/hr for each kg above 20 (2). For 22 kg: $40 + 20 + 2 = 62$ mL/hr. This estimates baseline maintenance requirements.

Why the other choices are less appropriate:

- A. 42 mL/hr omits the weight above 20 kg contribution correctly but miscalculates.
- C. 22 mL/hr uses only 1 mL/kg for all weight.
- D. 82 mL/hr overestimates the calculation.

Question 457 • Correct Answer: B

A caudal block is planned for a child undergoing inguinal herniorrhaphy. The needle is inserted through which structure?

The caudal approach enters the epidural space through the sacrococcygeal ligament at the sacral hiatus, bounded by the sacral cornua. It is popular in children because the landmarks are easily palpable and the technique provides reliable sacral and lumbar analgesia. A common dosing scheme uses about 1 mL/kg of dilute local anesthetic.

Why the other choices are less appropriate:

- A. L4 to L5 ligamentum flavum is a lumbar epidural approach.
- C. The supraspinous ligament at L2 is not the caudal route.
- D. The atlanto-occipital membrane is a cervical structure.

Question 458 • Correct Answer: D

A 4-year-old awakens from sevoflurane anesthesia agitated, thrashing, and inconsolable, then returns to baseline within 20 minutes. This is MOST...

Emergence delirium (agitation) is common after sevoflurane and desflurane in young children, characterized by self-limited nonpurposeful agitation shortly after emergence. Pain, dexmedetomidine, or propofol can reduce it. It typically resolves without lasting sequelae.

Why the other choices are less appropriate:

- A. MH involves hypercarbia, rigidity, and hyperthermia, not brief agitation.
- B. Laryngospasm causes airway obstruction, not agitation.
- C. Residual blockade causes weakness, not agitation.

Question 459 • Correct Answer: D

During neonatal resuscitation, if the heart rate remains below 60 bpm despite 30 seconds of effective positive-pressure ventilation, the next step is:

In the neonatal resuscitation algorithm, if the heart rate stays below 60 bpm after 30 seconds of effective ventilation, chest compressions are started at a 3:1 compression-to-ventilation ratio. Epinephrine is reserved for persistent bradycardia despite compressions and ventilation. Effective ventilation is the cornerstone of neonatal resuscitation.

Why the other choices are less appropriate:

- A. Epinephrine follows compressions if HR remains low.
- B. Bicarbonate is not a first-line neonatal resuscitation step.
- C. Intervention must escalate, not stop.

Question 460 • Correct Answer: B

In a child with an uncorrected large ventricular septal defect, systemic hypotension and increased pulmonary vascular resistance can acutely:

Shunt direction depends on the balance between systemic (SVR) and pulmonary (PVR) vascular resistance. A fall in SVR or rise in PVR can reverse a left-to-right shunt to right-to-left, producing cyanosis. Managing these resistances is central to anesthetizing patients with intracardiac shunts.

Why the other choices are less appropriate:

- A. Falling SVR reduces left-to-right flow.
- C. Shunt direction is resistance-dependent.
- D. Physiology changes shunt direction, not anatomy.

Question 461 • Correct Answer: B

A neonate presents with a scaphoid abdomen, respiratory distress, and bowel sounds in the chest. Which anesthetic consideration is MOST important?

These findings suggest congenital diaphragmatic hernia. Vigorous bag-mask ventilation distends the intrathoracic stomach and bowel, worsening lung compression, so gentle low-pressure ventilation and early intubation are preferred. Nitrous oxide is avoided because it expands gas-filled viscera.

Why the other choices are less appropriate:

- A. High peak pressures risk barotrauma to the hypoplastic lung.
- C. Nitrous oxide expands herniated bowel gas.
- D. Awake ventilation delay is unsafe in respiratory distress.

Question 462 • Correct Answer: A

Which feature makes infants more prone to bradycardia-related low cardiac output?

The neonatal myocardium has fewer contractile elements and a relatively noncompliant ventricle, so it cannot substantially increase stroke volume. Cardiac output is therefore rate-dependent, and bradycardia (often from hypoxia or vagal stimulation) rapidly lowers output. This is why heart rate is defended aggressively in infants.

Why the other choices are less appropriate:

- B. The infant ventricle is relatively noncompliant and immature.
- C. Infants have limited rate reserve at baseline.
- D. Infants are quite sensitive to vagal stimulation.

Question 463 • Correct Answer: B

The most common trigger of perioperative laryngospasm in children is:

Laryngospasm typically occurs when the airway is stimulated (secretions, manipulation, extubation) during a light plane of anesthesia. Prevention includes extubating either deeply anesthetized or fully awake and clearing secretions. Treatment escalates from CPAP and jaw thrust to propofol and, if needed, succinylcholine.

Why the other choices are less appropriate:

- A. Deep anesthesia suppresses airway reflexes.
- C. Paralysis prevents, not causes, laryngospasm.
- D. Hypercarbia is not the primary trigger.

Question 464 • Correct Answer: D

For a child with an active upper respiratory infection, the anesthetic concern of GREATEST relevance is:

A recent or active URI increases airway hyperreactivity, raising the risk of laryngospasm, bronchospasm, coughing, and desaturation. Decisions to proceed weigh urgency, severity of symptoms, and airway plan. Minimizing airway instrumentation and considering an LMA can reduce risk.

Why the other choices are less appropriate:

- A. MH is unrelated to URI.
- B. URI does not primarily delay gastric emptying.
- C. URI does not prolong neuromuscular blockade.

Question 465 • Correct Answer: D

A child undergoing strabismus surgery develops sudden sinus bradycardia during extraocular muscle traction. The MOST appropriate first response is:

The oculocardiac reflex, triggered by traction on extraocular muscles or pressure on the globe, causes bradycardia via the trigeminovagal pathway. The first step is to have the surgeon release the stimulus, which usually restores the rate. Persistent or severe bradycardia may warrant atropine.

Why the other choices are less appropriate:

- A. Epinephrine is not first-line for reflex bradycardia.
- B. Compressions are unnecessary if perfusion is maintained.
- C. Deepening volatile agent does not treat the reflex.

Question 466 • Correct Answer: B

A 3-year-old presents for tonsillectomy with a history of loud snoring and witnessed apneas. What is the MOST important perioperative implication?

Children with obstructive sleep apnea have heightened sensitivity to the respiratory-depressant effects of opioids and are at greater risk for postoperative airway obstruction and desaturation. Opioid-sparing analgesia and appropriate monitoring are emphasized. Severe OSA may warrant overnight observation.

Why the other choices are less appropriate:

- A. Routine arterial lines are not required for tonsillectomy.
- C. Awake fiberoptic is not routinely required.
- D. Acetaminophen is a useful opioid-sparing analgesic.

Question 467 • Correct Answer: D

Before initiating cardiopulmonary bypass, the target activated clotting time (ACT) after heparinization is typically:

Full heparinization for CPB targets an ACT typically greater than 400 to 480 seconds to prevent clot formation in the bypass circuit. Heparin roughly 300 to 400 units/kg is given and the ACT rechecked. Inadequate anticoagulation risks catastrophic circuit thrombosis.

Why the other choices are less appropriate:

- A. 120 seconds is far below the CPB threshold.
- B. 150 to 200 seconds is inadequate for bypass.
- C. Under 100 seconds is essentially normal.

Question 468 • Correct Answer: B

Protamine is administered after separation from bypass. A rapid protamine infusion is MOST associated with which adverse reaction?

Rapid protamine administration commonly causes systemic hypotension from vasodilation and histamine release. More severe reactions include catastrophic pulmonary hypertension and anaphylaxis, particularly in patients previously exposed (including NPH insulin users). Slow administration reduces risk.

Why the other choices are less appropriate:

- A. Protamine typically causes hypotension, not hypertension.
- C. Bradycardia is not the classic protamine reaction.
- D. Hyperkalemia is not a characteristic protamine effect.

Question 469 • Correct Answer: D

An intra-aortic balloon pump inflates during which phase of the cardiac cycle?

The IABP inflates during diastole to augment coronary and systemic perfusion and deflates just before systole to reduce afterload. This diastolic augmentation and systolic unloading improves myocardial oxygen supply-demand balance. Timing is synchronized to the ECG or arterial waveform.

Why the other choices are less appropriate:

- A. Inflation in systole would increase, not reduce, afterload harmfully.
- B. The balloon cycles, it does not stay inflated.
- C. Isovolumetric contraction is when it deflates.

Question 470 • Correct Answer: B

The anesthetic hemodynamic goals for a patient with severe aortic stenosis include:

In aortic stenosis the hypertrophied ventricle depends on preload, sinus rhythm (atrial kick), and adequate coronary perfusion pressure. Maintain preload and afterload, keep a normal heart rate (avoid tachycardia which limits filling and coronary perfusion), and avoid hypotension. Loss of atrial contribution is poorly tolerated.

Why the other choices are less appropriate:

- A. Low afterload reduces coronary perfusion of the hypertrophied ventricle.
- C. Preload reduction worsens filling of the stiff ventricle.
- D. Severe bradycardia limits output in a fixed-stenosis lesion.

Question 471 • Correct Answer: A

The hemodynamic goals for chronic severe aortic regurgitation are best summarized as:

Aortic regurgitation benefits from a relatively higher heart rate (shorter diastole reduces regurgitant time), adequate preload, and reduced afterload to promote forward flow. Bradycardia and increased afterload worsen regurgitation. The mnemonic full, fast, and forward captures these goals.

Why the other choices are less appropriate:

- B. High afterload and bradycardia increase regurgitant volume.
- C. Preload should be maintained, not emptied.
- D. High afterload worsens regurgitation.

Question 472 • Correct Answer: B

Off-pump coronary artery bypass (OPCAB) differs from conventional CABG primarily because:

OPCAB is performed on a beating heart using stabilizing devices, avoiding the systemic inflammatory response and complications of CPB. Positioning and stabilization for grafting can cause hemodynamic swings that must be managed. Heparin is still given, and conversion to on-pump may be needed.

Why the other choices are less appropriate:

- A. OPCAB avoids CPB and does not use circulatory arrest.
- C. Anticoagulation is still required.
- D. Emergent conversion to on-pump is possible.

Question 473 • Correct Answer: C

The hemodynamic goals for severe mitral stenosis emphasize:

In mitral stenosis, diastolic filling across the narrowed valve requires adequate time, so tachycardia and loss of atrial kick (as in new atrial fibrillation) are poorly tolerated. Maintain preload, control heart rate, and preserve sinus rhythm. Avoid factors that raise pulmonary vascular resistance.

Why the other choices are less appropriate:

- A. Tachycardia shortens diastolic filling across the stenotic valve.
- B. Afterload reduction is not the primary goal.
- D. Excessive diuresis reduces the preload needed for filling.

Question 474 • Correct Answer: C

During weaning from cardiopulmonary bypass, a low mixed venous oxygen saturation with rising lactate MOST likely indicates:

A falling mixed venous saturation with rising lactate reflects an oxygen supply-demand mismatch, typically inadequate cardiac output or oxygen delivery after bypass. Interventions include optimizing preload, inotropes, and correcting anemia or hypoxemia. It signals the need to support the circulation.

Why the other choices are less appropriate:

- A. These findings indicate poor, not excellent, perfusion.
- B. Hyperoxia does not lower mixed venous saturation with lactate rise.
- D. Hypothermia alone does not explain rising lactate with low SvO₂.

Question 475 • Correct Answer: C

Heparin resistance during preparation for CPB (failure to reach target ACT despite adequate dosing) is MOST often due to:

Heparin acts by potentiating antithrombin III; deficiency (congenital or from prior heparin therapy) causes heparin resistance. Treatment includes antithrombin concentrate or fresh frozen plasma to restore activity. Confirming adequate ACT is essential before initiating bypass.

Why the other choices are less appropriate:

- A. Platelet count does not primarily cause heparin resistance.
- B. Hypercalcemia is not a recognized cause.
- D. Fibrinogen level is not the mechanism of heparin resistance.

Question 476 • Correct Answer: B

Which intervention MOST rapidly lowers intracranial pressure intraoperatively?

Acute hyperventilation lowers PaCO₂, causing cerebral vasoconstriction and a rapid reduction in cerebral blood volume and ICP. The effect is prompt but transient and excessive hypocapnia risks cerebral ischemia. Other measures include head elevation, osmotic therapy, and CSF drainage.

Why the other choices are less appropriate:

- A. High-dose volatiles cause cerebral vasodilation and can raise ICP.
- C. Trendelenburg increases ICP.
- D. Fluid loading does not acutely lower ICP.

Question 477 • Correct Answer: D

A patient in the sitting position for posterior fossa surgery develops a sudden drop in end-tidal CO₂, hypotension, and a mill-wheel murmur. The...

The sitting position places the surgical site above the heart, allowing air entrainment into open venous sinuses. A sudden fall in end-tidal CO₂, hypotension, and a mill-wheel murmur are classic for venous air embolism. Management includes flooding the field, jugular compression, aspirating a central catheter, and repositioning.

Why the other choices are less appropriate:

- A. MH presents with hypercarbia and hyperthermia, not a mill-wheel murmur.
- B. Pulmonary edema does not cause an abrupt end-tidal CO₂ drop with murmur.
- C. Anaphylaxis lacks the characteristic mill-wheel murmur.

Question 478 • Correct Answer: C

Which anesthetic technique BEST preserves motor evoked potential monitoring during spine surgery?

Motor evoked potentials are highly sensitive to volatile agents and abolished by neuromuscular blockade. Total intravenous anesthesia with propofol and an opioid, while avoiding paralysis during monitoring, best preserves signal quality. Communication with the neuromonitoring team is essential.

Why the other choices are less appropriate:

- A. Volatiles and paralytics suppress motor evoked potentials.
- B. Nitrous oxide also depresses evoked potentials.
- D. Rocuronium boluses abolish motor responses.

Question 479 • Correct Answer: D

During carotid endarterectomy under general anesthesia, cerebral perfusion during carotid cross-clamping is commonly assessed by:

Adequacy of collateral cerebral perfusion during cross-clamping can be monitored with EEG, somatosensory evoked potentials, carotid stump pressure, or awake neurologic exam under regional block. These guide the decision to place a shunt. No single method is universally superior.

Why the other choices are less appropriate:

- A. End-tidal nitrogen assesses air embolism/denitrogenation, not perfusion.
- B. Nerve stimulation monitors neuromuscular blockade.
- C. BIS reflects hypnotic depth, not regional cerebral perfusion.

Question 480 • Correct Answer: A

The relationship between PaCO₂ and cerebral blood flow within the physiologic range is approximately:

Within the physiologic range, cerebral blood flow changes roughly 1 to 2 mL/100g/min for each 1 mmHg change in PaCO₂, increasing with hypercapnia and decreasing with hypocapnia. This CO₂ reactivity underlies the use of ventilation to modulate cerebral blood volume. The response is robust but has limits.

Why the other choices are less appropriate:

- B. CBF is strongly CO₂-dependent.
- C. CBF rises, not falls, as PaCO₂ increases.
- D. CBF responds across the physiologic range, not only at extremes.

Question 481 • Correct Answer: B

In managing a patient with elevated intracranial pressure, an appropriate cerebral perfusion pressure goal is generally:

Cerebral perfusion pressure equals mean arterial pressure minus intracranial pressure (or central venous pressure if higher). A CPP of at least about 60 mmHg is a common target to maintain cerebral perfusion while avoiding ischemia. Both hypotension and uncontrolled ICP threaten the brain.

Why the other choices are less appropriate:

- A. A CPP below 30 mmHg risks ischemia.
- C. CPP equal to ICP means zero perfusion pressure.
- D. CPP depends directly on MAP.

Question 482 • Correct Answer: A

Which agent is generally preferred to reduce brain bulk and ICP through an osmotic effect?

Mannitol is an osmotic diuretic that draws water from brain tissue across an intact blood-brain barrier, reducing brain volume and ICP. Hypertonic saline is an alternative osmotic agent. Hypotonic fluids worsen cerebral edema and should be avoided.

Why the other choices are less appropriate:

- B. D5W is effectively free water and worsens edema.
- C. Hypotonic saline increases cerebral water.
- D. Albumin is not used as an osmotic diuretic for ICP.

Question 483 • Correct Answer: B

A patient with an acute traumatic brain injury should generally avoid which ventilation strategy?

Prophylactic aggressive hyperventilation to very low PaCO₂ causes cerebral vasoconstriction that can produce ischemia, and is discouraged except as a temporizing measure for impending herniation. Normocapnia is generally targeted, with brief moderate hyperventilation reserved for acute deterioration. Hypoxemia and hypotension must be avoided.

Why the other choices are less appropriate:

- A. Normocapnia is the general goal.
- C. Adequate oxygenation is essential.
- D. Avoiding hypoxemia is protective.

Question 484 • Correct Answer: B

Volatile anesthetics affect cerebral physiology by:

Volatile agents produce dose-dependent cerebral vasodilation, increasing cerebral blood flow and blood volume while decreasing cerebral metabolic rate, thereby uncoupling flow and metabolism at higher concentrations. This can raise ICP in patients with reduced intracranial compliance. Below about 1 MAC the effect is modest, and hyperventilation can offset it.

Why the other choices are less appropriate:

- A. Volatiles increase CBF at higher doses despite lowering metabolism.
- C. Volatiles clearly affect CBF.
- D. Volatiles decrease cerebral metabolic rate.

Question 485 • Correct Answer: A

During one-lung ventilation, hypoxic pulmonary vasoconstriction (HPV) serves to:

HPV redirects pulmonary blood flow away from poorly ventilated (hypoxic) lung regions toward better-ventilated areas, reducing shunt and improving oxygenation. During one-lung ventilation this diverts flow from the collapsed nondependent lung. Volatile agents in high concentration and certain vasodilators can blunt HPV.

Why the other choices are less appropriate:

- B. HPV reduces, not increases, flow to the collapsed lung.
- C. HPV is a pulmonary, not systemic, response.
- D. HPV affects perfusion, not ventilation.

Question 486 • Correct Answer: C

A left-sided double-lumen tube is placed for a right thoracotomy. Correct positioning is BEST confirmed by:

Fiberoptic bronchoscopy is the gold standard for confirming double-lumen tube position, visualizing the blue bronchial cuff just below the carina in the intended mainstem bronchus and a clear tracheal lumen view. Auscultation and clamping tests are supportive but less reliable. Malposition causes hypoxemia or inadequate lung isolation.

Why the other choices are less appropriate:

- A. Radiograph is less precise and delayed.
- B. Capnography does not confirm lumen position.
- D. A leak test does not verify bronchial placement.

Question 487 • Correct Answer: C

Which factor is MOST likely to inhibit hypoxic pulmonary vasoconstriction during one-lung ventilation?

HPV is attenuated by high-dose volatile anesthetics, vasodilators (nitroprusside, nitroglycerin, dobutamine), and factors that raise pulmonary artery pressure or lower mixed venous oxygen. Inhibiting HPV increases shunt and worsens hypoxemia during one-lung ventilation. Total intravenous anesthesia preserves HPV better than high volatile doses.

Why the other choices are less appropriate:

- A. Hypercapnia tends to enhance, not inhibit, HPV.
- B. Adequate cardiac output supports oxygenation.
- D. Normal mixed venous oxygen does not inhibit HPV.

Question 488 • Correct Answer: C

If severe hypoxemia occurs during one-lung ventilation, an early corrective step is:

For desaturation during one-lung ventilation, confirm tube position and FiO₂, then apply CPAP to the nonventilated lung (which oxygenates via apneic diffusion) and consider PEEP to the ventilated lung to recruit alveoli. Intermittent two-lung ventilation may be needed if hypoxemia persists. High-dose volatiles worsen shunt by inhibiting HPV.

Why the other choices are less appropriate:

- A. Aborting surgery is a last resort, not an early step.
- B. High-dose volatiles blunt HPV and worsen hypoxemia.
- D. Discontinuing oxygen is dangerous.

Question 489 • Correct Answer: A

A bronchial blocker is chosen instead of a double-lumen tube MOST appropriately when:

Bronchial blockers are advantageous when a difficult airway makes double-lumen placement risky, when a single-lumen tube is already in place, or for selective lobar blockade. Their disadvantages include slower lung collapse and limited suctioning of the isolated lung. Tube choice balances these tradeoffs.

Why the other choices are less appropriate:

- B. Double-lumen tubes allow faster deflation/suctioning than blockers.
- C. Blockers can actually enable lobar isolation.
- D. A 41 Fr double-lumen tube is far too large for a small child.

Question 490 • Correct Answer: B

After lung resection, which postoperative complication is a leading cause of morbidity and warrants vigilant fluid management?

Excessive fluid administration after major lung resection, especially pneumonectomy, is associated with acute lung injury and pulmonary edema in the remaining lung. Judicious fluid management and lung-protective ventilation reduce this risk. It is a major driver of postoperative morbidity and mortality.

Why the other choices are less appropriate:

- A. MH is unrelated to resection fluid management.
- C. Opioid effects are managed separately and are not the leading cause.
- D. Corneal abrasion is minor and unrelated to fluid strategy.

Question 491 • Correct Answer: D

During open abdominal aortic aneurysm repair, application of a supraceliac aortic cross-clamp causes:

Aortic cross-clamping abruptly increases afterload, raising proximal blood pressure and myocardial oxygen demand, while causing distal ischemia. The higher the clamp, the greater the physiologic insult. Management includes afterload reduction, careful volume, and preparation for reperfusion at unclamping.

Why the other choices are less appropriate:

- A. SVR rises with proximal clamping.
- B. Proximal pressure increases, not decreases.
- C. Cross-clamping produces major hemodynamic effects.

Question 492 • Correct Answer: B

Release of an aortic cross-clamp (declamping) typically produces:

Unclamping causes declamping hypotension due to sudden reduction in afterload, distal reactive hyperemia and venous pooling, and washout of acidotic and vasodilating metabolites from ischemic tissues. Anticipatory volume loading, reducing anesthetic depth, and gradual clamp release mitigate the drop. Vasopressors may be needed.

Why the other choices are less appropriate:

- A. Declamping causes hypotension, not sustained hypertension.
- C. The typical response is hypotension, not hypertension.
- D. Metabolic washout and acidosis are important consequences.

Question 493 • Correct Answer: A

During thoracoabdominal aortic aneurysm repair, spinal cord ischemia is a feared complication. Which strategy helps reduce this risk? Spinal cord perfusion pressure equals distal aortic (or mean arterial) pressure minus CSF pressure. Lumbar CSF drainage lowers CSF pressure and improves cord perfusion, reducing paraplegia risk, along with maintaining adequate blood pressure and using motor evoked potential monitoring. These are core neuroprotective strategies.

Why the other choices are less appropriate:

- B. Deliberate hypotension worsens cord perfusion.
- C. Hyperventilation does not protect the cord.
- D. Neuromonitoring aids early detection of ischemia.

Question 494 • Correct Answer: C

Carotid endarterectomy performed under regional (cervical plexus) block offers which advantage?

A major advantage of regional anesthesia for carotid endarterectomy is the ability to continuously assess an awake patient's neurologic status during carotid cross-clamping, directly detecting cerebral ischemia. This can guide selective shunt placement. Tight blood pressure control remains essential regardless of technique.

Why the other choices are less appropriate:

- A. Shunting may still be required based on the awake exam.
- B. Blood pressure control is still critical.
- D. No technique guarantees stroke avoidance.

Question 495 • Correct Answer: A

Endovascular aneurysm repair (EVAR) compared with open AAA repair is associated with:

EVAR is less invasive, with reduced blood loss, shorter recovery, and avoidance of aortic cross-clamping, though it carries a risk of endoleak and requires long-term imaging surveillance. Anesthesia may be general, regional, or local with sedation. Patient selection depends on aneurysm anatomy.

Why the other choices are less appropriate:

- B. EVAR generally has less blood loss than open repair.
- C. EVAR avoids surgical cross-clamping.
- D. Endoleak risk mandates imaging follow-up.

Question 496 • Correct Answer: B

A patient develops profound hypotension immediately after supraceliac cross-clamp release. The FIRST priority is:

Severe declamping hypotension is managed by communicating with the surgeon to slow or partially re-apply the clamp, administering fluids and vasopressors, and correcting acidosis. Gradual reperfusion limits the hemodynamic and metabolic insult. Anticipating this event with volume loading before unclamping is preventive.

Why the other choices are less appropriate:

- A. Deepening anesthesia worsens hypotension.
- C. Beta-blockade worsens hypotension.
- D. Hyperventilation does not address declamping hypotension.

Question 497 • Correct Answer: C

According to ATLS priorities, the FIRST step in the primary survey of a trauma patient is:

The ATLS primary survey follows the ABCDE sequence: Airway with cervical spine protection, Breathing, Circulation, Disability, and Exposure. Securing a patent airway while protecting the cervical spine is the first priority. Life threats are addressed in order as they are identified.

Why the other choices are less appropriate:

- A. Circulation is the third step, after airway and breathing.
- B. Disability is assessed after circulation.
- D. Exposure is the final step of the primary survey.

Question 498 · Correct Answer: C

Every acute trauma patient requiring emergency surgery should be treated as though they have:

Trauma delays gastric emptying (pain, stress, opioids), so all acute trauma patients are considered to have a full stomach regardless of fasting time. Rapid sequence induction with airway protection minimizes aspiration risk. Cervical spine precautions are maintained during airway management.

Why the other choices are less appropriate:

- A. Trauma patients are at high aspiration risk.
- B. Trauma delays gastric emptying regardless of last meal timing.
- D. Airway precautions are essential in trauma.

Question 499 · Correct Answer: A

During intubation of a trauma patient with a suspected cervical spine injury, the recommended technique includes:

For patients with potential cervical spine injury, manual in-line stabilization is applied to limit neck movement during laryngoscopy. Video laryngoscopy can improve the view with less manipulation. The goal is to secure the airway while minimizing risk of secondary spinal cord injury.

Why the other choices are less appropriate:

- B. Hyperextension risks worsening a cervical injury.
- C. Hyperflexion is dangerous with an unstable spine.
- D. Airway management proceeds with precautions, not avoidance.

Question 500 · Correct Answer: C

Damage control resuscitation for severe hemorrhagic shock emphasizes:

Damage control resuscitation uses balanced ratios of packed red cells, plasma, and platelets (approximately 1:1:1), limits crystalloid, and applies permissive hypotension until surgical bleeding control. This reduces dilutional coagulopathy and the lethal triad of hypothermia, acidosis, and coagulopathy. Early hemorrhage control is paramount.

Why the other choices are less appropriate:

- A. Excess crystalloid worsens coagulopathy and edema.
- B. Empiric balanced transfusion should not await labs in massive hemorrhage.
- D. Overly aggressive pressure targets can worsen bleeding before control.

Question 501 · Correct Answer: A

A trauma patient develops the lethal triad. This triad consists of:

The lethal triad of trauma is hypothermia, metabolic acidosis, and coagulopathy, which reinforce each other and worsen bleeding and outcomes. Preventing heat loss, correcting acidosis, and balanced transfusion interrupt this cycle. Recognizing and addressing it early is central to trauma anesthesia.

Why the other choices are less appropriate:

- B. That describes the Cushing reflex of raised ICP.
- C. That pattern describes sepsis, not the lethal triad.
- D. These electrolyte changes are not the defined triad.

Question 502 · Correct Answer: A

Rapid transfusion of large volumes of citrated blood products can cause which acute electrolyte disturbance requiring monitoring?

Citrate in stored blood chelates calcium; rapid massive transfusion can outpace hepatic citrate metabolism, producing ionized hypocalcemia with hypotension and impaired coagulation. Ionized calcium should be monitored and repleted. Hyperkalemia from stored red cells is another concern with rapid transfusion.

Why the other choices are less appropriate:

- B. Hypernatremia is not the characteristic citrate effect.
- C. Hypocalcemia, not hypophosphatemia, is the primary citrate-related issue.
- D. Hyperchloremia relates to saline, not citrate.

Question 503 · Correct Answer: A

A hypotensive trauma patient with distended neck veins, muffled heart sounds, and hypotension MOST likely has:

Beck's triad of hypotension, distended neck veins, and muffled heart sounds suggests cardiac tamponade, in which pericardial fluid impairs ventricular filling. Management includes maintaining preload and heart rate and urgent pericardial decompression. Tension pneumothorax can present similarly but with tracheal deviation and absent breath sounds.

Why the other choices are less appropriate:

- B. Simple pneumothorax does not cause Beck's triad.
- C. An isolated femur fracture does not explain these signs.
- D. Neurogenic shock causes hypotension with bradycardia, not this triad.

Question 504 · Correct Answer: C

The single most effective positioning strategy to optimize airway management and oxygenation in a patient with severe obesity is:

The ramped position elevates the head, shoulders, and upper back so the external auditory meatus aligns with the sternal notch, improving laryngoscopic view and increasing FRC to delay desaturation. This is standard for induction in patients with obesity. It also facilitates preoxygenation.

Why the other choices are less appropriate:

- A. Flat supine worsens the view and reduces FRC.
- B. Trendelenburg further reduces FRC and worsens oxygenation.
- D. Prone induction is not a standard airway strategy.

Question 505 · Correct Answer: D

For a patient with severe obesity, which drug is MOST appropriately dosed by LEAN body weight rather than total body weight?

Highly lipophilic and hydrophilic dosing differs by drug: the propofol induction bolus is generally based on lean body weight to avoid overdose, whereas its maintenance infusion may use adjusted body weight. Succinylcholine is dosed by total body weight because of increased pseudocholinesterase and extracellular volume. Understanding weight-based scalars prevents over- and under-dosing.

Why the other choices are less appropriate:

- A. Succinylcholine is dosed by total body weight.
- B. Neostigmine still requires weight-based dosing with a maximum.
- C. Infiltration local anesthetic dosing is limited by toxicity thresholds, not this principle.

Question 506 · Correct Answer: A

Patients with obstructive sleep apnea are especially sensitive to which class of perioperative medications?

OSA patients have exaggerated sensitivity to the respiratory-depressant and airway-relaxing effects of opioids and sedatives, increasing the risk of obstruction and hypoxemia postoperatively. Multimodal opioid-sparing analgesia and enhanced monitoring are recommended. Continuing home CPAP perioperatively is beneficial.

Why the other choices are less appropriate:

- B. Antibiotics do not cause this specific sensitivity.
- C. Antiemetics are not the primary concern for respiratory depression.
- D. Local anesthetics are actually favored to reduce opioids.

Question 507 · Correct Answer: D

Why do patients with severe obesity desaturate quickly during apnea despite adequate preoxygenation?

Obesity reduces FRC (the oxygen reservoir) due to increased abdominal and chest wall mass and reduced compliance, while metabolic demand and oxygen consumption are elevated. This combination shortens safe apnea time. Ramped positioning, preoxygenation, and apneic oxygenation help extend the margin.

Why the other choices are less appropriate:

- A. FRC is decreased, not increased, in obesity.
- B. Metabolic rate is increased.
- C. Chest wall compliance is reduced in obesity.

Question 508 · Correct Answer: B

Which regional/ventilation strategy helps counteract atelectasis during general anesthesia in patients with obesity?

Patients with obesity are prone to atelectasis and shunt; applying PEEP and periodic recruitment maneuvers improves oxygenation and lung compliance. Lung-protective ventilation with appropriate tidal volumes based on ideal body weight is also used. Head-up positioning further improves respiratory mechanics.

Why the other choices are less appropriate:

- A. Zero PEEP promotes atelectasis in these patients.
- C. Prolonged apnea causes desaturation.
- D. Permissive hypoxemia is not an acceptable strategy.

Question 509 · Correct Answer: D

After bariatric surgery involving gastric restriction, a key postoperative anesthetic-related concern is:

Bariatric patients commonly have OSA and limited pulmonary reserve, so postoperative respiratory monitoring and opioid-sparing analgesia are priorities. Venous thromboembolism prophylaxis and early mobilization are also important given elevated thrombosis risk. Aspiration risk is not eliminated by surgery.

Why the other choices are less appropriate:

- A. Aspiration risk remains a concern.
- B. DVT prophylaxis is important in this population.
- C. Deep blockade is not maintained postoperatively.

Question 510 · Correct Answer: A

When calculating tidal volume for lung-protective ventilation in a patient with obesity, tidal volume should be based on:

Lung size correlates with height, not adiposity, so tidal volumes (about 6 to 8 mL/kg) are calculated using ideal or predicted body weight to avoid volutrauma. Using total body weight would deliver excessive tidal volumes. PEEP and recruitment address obesity-related atelectasis.

Why the other choices are less appropriate:

- B. Total body weight overestimates lung size and causes volutrauma.
- C. Adjusted body weight is used for some drugs, not tidal volume.
- D. Doubling lean body weight is not a valid tidal volume basis.

Question 511 · Correct Answer: A

With advancing age, the minimum alveolar concentration (MAC) of volatile anesthetics:

MAC decreases progressively with age, approximately 6 percent per decade after 40, so elderly patients require lower volatile concentrations. Failing to reduce dosing increases the risk of hypotension and delayed emergence. Titration to effect and lower doses are prudent in the elderly.

Why the other choices are less appropriate:

- B. MAC decreases, not increases, with age.
- C. MAC changes with age.
- D. MAC declines rather than doubles with age.

Question 512 · Correct Answer: D

A major reason elderly patients are prone to drug accumulation and prolonged effects is:

Aging reduces hepatic blood flow and mass, decreases renal clearance, and shifts body composition toward more fat and less muscle and water, altering drug distribution and elimination. These changes prolong the effect of many anesthetics and necessitate dose reductions. Reduced albumin can increase free drug fraction.

Why the other choices are less appropriate:

- A. Total body water decreases with age.
- B. Lean muscle mass declines with age.
- C. Protein binding is often reduced, increasing free drug.

Question 513 · Correct Answer: C

Which perioperative complication is notably common in elderly surgical patients and associated with poorer outcomes?

Postoperative delirium is common in older adults and is linked to prolonged hospitalization, functional decline, and mortality. Risk factors include preexisting cognitive impairment, polypharmacy, and certain medications. Minimizing deliriogenic drugs and multimodal opioid-sparing strategies help reduce incidence.

Why the other choices are less appropriate:

- A. MH is a genetic disorder, not an age-related complication.
- B. Delirium in elderly differs from pediatric emergence agitation.
- D. Pseudocholinesterase deficiency is genetic, not age-driven.

Question 514 · Correct Answer: D

Which medication is generally best AVOIDED or minimized in elderly patients due to delirium risk?

Benzodiazepines and centrally acting anticholinergics (like scopolamine) are associated with increased postoperative delirium in the elderly and are minimized where possible. Multimodal analgesia and nonpharmacologic strategies are preferred. Careful medication selection is a key element of geriatric perioperative care.

Why the other choices are less appropriate:

- A. Acetaminophen is a preferred opioid-sparing analgesic.
- B. Regional techniques can reduce systemic drug exposure.
- C. Oxygen is not deliriogenic.

Question 515 · Correct Answer: C

Age-related cardiovascular changes make the elderly patient MOST sensitive to which intraoperative event?

Aging causes decreased arterial compliance, diastolic dysfunction, and blunted baroreceptor reflexes, so elderly patients tolerate hypotension and rapid volume shifts poorly. Anesthetic-induced vasodilation can cause exaggerated pressure drops. Careful titration and preload management are important.

Why the other choices are less appropriate:

- A. Mild hypercapnia is not the dominant vulnerability here.
- B. Cardiovascular instability, not just temperature, is the key issue.
- D. Tachycardia can compromise coronary perfusion in the elderly.

Question 516 · Correct Answer: D

Reduced pulmonary reserve in the elderly is characterized by:

Aging increases closing capacity relative to FRC, decreases chest wall compliance and elastic recoil, and blunts the ventilatory response to hypoxia and hypercapnia. These changes predispose to atelectasis, hypoxemia, and postoperative respiratory complications. Careful oxygenation and pulmonary care are warranted.

Why the other choices are less appropriate:

- A. Elastic recoil decreases and gas exchange worsens with age.
- B. Ventilatory drive is blunted, not enhanced.
- C. Residual volume increases with age.

Question 517 · Correct Answer: B

Polypharmacy in elderly surgical patients is important to review primarily because:

Elderly patients often take multiple medications, increasing the risk of drug interactions, additive sedation, and adverse effects that complicate anesthetic management. A thorough medication reconciliation identifies agents that should be continued, held, or adjusted. This is a central element of geriatric preoperative assessment.

Why the other choices are less appropriate:

- A. Polypharmacy does not guarantee tolerance.
- C. It does not eliminate anesthetic needs.
- D. It significantly affects anesthetic planning.

Question 518 · Correct Answer: C

A pneumatic tourniquet is used for a lower-extremity procedure. Prolonged inflation beyond about 2 hours increases the risk of:

Tourniquet times beyond roughly 90 to 120 minutes increase the risk of nerve injury, ischemic muscle damage, and post-tourniquet syndrome. Periodic reperfusion is considered for long cases. Deflation can also cause a transient rise in potassium, CO₂, and lactate systemically.

Why the other choices are less appropriate:

- A. Fat embolism relates to marrow manipulation, not the cuff itself.
- B. Hyperkalemia occurs on deflation, not during inflation.
- D. The limb becomes ischemic, and systemic effects follow deflation.

Question 519 · Correct Answer: D

Immediately after tourniquet deflation, the anesthetist should anticipate:

Deflation washes out accumulated CO₂, potassium, lactate, and other metabolites from the ischemic limb, producing a transient rise in end-tidal CO₂ and serum potassium and often a drop in blood pressure. Increasing minute ventilation and supporting blood pressure manage these effects. Changes are usually short-lived.

Why the other choices are less appropriate:

- A. Hypotension, not hypertension, is typical after deflation.
- B. There is no immediate 2-degree temperature rise.
- C. Deflation produces measurable systemic effects.

Question 520 · Correct Answer: D

During intramedullary reaming and prosthesis insertion for a hip fracture, a patient suddenly develops hypoxemia, hypotension, and a petechial...

Fat embolism syndrome classically presents with the triad of hypoxemia, neurologic changes, and a petechial rash, often during long-bone or hip instrumentation. Management is supportive with oxygenation and hemodynamic support. Bone marrow fat entering the circulation is the underlying mechanism.

Why the other choices are less appropriate:

- A. Bone cement implantation is a distinct syndrome without petechiae typically.
- B. Transfusion reaction does not produce this triad with reaming.
- C. LAST causes CNS and cardiac toxicity, not a petechial rash.

Question 521 · Correct Answer: C

Bone cement implantation syndrome during cemented arthroplasty is characterized by:

Bone cement implantation syndrome occurs during cementing and prosthesis insertion, presenting with hypotension, hypoxemia, arrhythmias, and occasionally cardiac arrest, thought to result from embolization and mediator release. Communication with the surgeon, ensuring euvoolemia, and increasing FiO₂ before cementing help. High-risk patients are monitored closely.

Why the other choices are less appropriate:

- A. Hypotension, not hypertension, is characteristic.
- B. The syndrome features hypotension.
- D. Onset is acute during cementing, not gradual.

Question 522 · Correct Answer: B

A patient in the beach chair position for shoulder surgery is at particular risk for cerebral hypoperfusion because:

In the beach chair (sitting) position, the brain is above the heart, so a hydrostatic gradient (roughly 0.75 mmHg per cm of height difference) means arm-measured blood pressure overestimates cerebral perfusion pressure. Inadequate correction can cause cerebral ischemia. Monitoring and maintaining adequate pressure at the level of the brain are important.

Why the other choices are less appropriate:

- A. The head is above, not below, the heart.
- C. Venous pooling reduces return in this position.
- D. Autoregulation may be impaired under anesthesia.

Question 523 • Correct Answer: B

Regional anesthesia (neuraxial) for total hip or knee arthroplasty offers which benefit compared with general anesthesia?

Neuraxial anesthesia for major joint arthroplasty is associated with reduced intraoperative blood loss and lower thromboembolic risk compared with general anesthesia, along with improved postoperative analgesia. It also reduces some pulmonary complications. Hypotension from sympathetic block still requires management.

Why the other choices are less appropriate:

- A. Neuraxial anesthesia does not increase aspiration.
- C. It typically reduces opioid requirements.
- D. Sympathetic blockade can still cause hypotension.

Question 524 • Correct Answer: D

The defining feature of anesthesia for airway (ENT) surgery such as laryngoscopy is:

ENT and airway surgeries involve a shared airway, where the surgeon and anesthesiologist both work in the same field, requiring constant communication and planning for ventilation, tube choice, and emergencies. Techniques include jet ventilation, small-diameter tubes, or intermittent apnea. Fire risk is heightened when lasers and oxygen are used.

Why the other choices are less appropriate:

- A. Airway fire risk is elevated in these cases.
- B. Muscle relaxation is often needed for airway procedures.
- C. Nasal cannula alone rarely suffices for these operations.

Question 525 • Correct Answer: D

To reduce the risk of airway fire during laser surgery of the airway, the anesthesiologist should:

Airway fires require fuel, an ignition source, and an oxidizer. During laser airway surgery, minimizing FiO₂ (ideally below about 30 percent), avoiding nitrous oxide (which supports combustion), and using a laser-resistant tube with a saline-filled cuff reduce fire risk. A fire plan and immediate access to saline are essential.

Why the other choices are less appropriate:

- A. High FiO₂ dramatically increases fire risk.
- B. Nitrous oxide supports combustion.
- C. Standard PVC tubes are flammable; laser-resistant tubes are needed.

Question 526 • Correct Answer: A

Jet ventilation for laryngeal surgery relies on which principle to deliver oxygen and remove CO₂?

Supraglottic or subglottic jet ventilation delivers intermittent high-pressure oxygen that entrains additional gas via the Venturi effect, providing ventilation without a bulky tube in the surgical field. Risks include barotrauma and gastric distension, and end-tidal CO₂ monitoring is limited. It requires an unobstructed egress path for exhalation.

Why the other choices are less appropriate:

- B. Jet ventilation typically uses an open, uncuffed technique.
- C. It is active, not passive diffusion.
- D. It relies on delivered high-pressure gas, not patient-generated pressure.

Question 527 • Correct Answer: C

After a difficult tonsillectomy, a child returns to the OR with tachycardia, pallor, and frequent swallowing. This presentation MOST suggests:

Frequent swallowing, tachycardia, and pallor after tonsillectomy indicate ongoing bleeding, often with a stomach full of swallowed blood and hypovolemia. Management includes volume resuscitation, blood availability, and rapid sequence induction with suction ready for a potentially difficult, bloody airway. It is an emergency.

Why the other choices are less appropriate:

- A. Emergence delirium does not cause frequent swallowing and pallor.
- B. MH presents with hypercarbia and hyperthermia.
- D. Simple nausea does not explain hypovolemic signs.

Question 528 · Correct Answer: D

For functional endoscopic sinus surgery, a technique to reduce bleeding and improve the surgical field includes:

Improving the surgical field for endoscopic sinus surgery involves reverse Trendelenburg (head-up) positioning to reduce venous congestion, controlled relative hypotension, and often total intravenous anesthesia, which may provide a drier field. Careful blood pressure management balances field quality against perfusion. Avoiding venous congestion is key.

Why the other choices are less appropriate:

- A. Trendelenburg increases venous congestion and bleeding.
- B. Hypertension worsens bleeding.
- C. High venous pressure worsens the field.

Question 529 · Correct Answer: A

A patient scheduled for microlaryngeal surgery requires an endotracheal tube that is:

Microlaryngeal surgery uses a small-diameter (microlaryngeal) endotracheal tube that provides an adequate airway while maximizing surgical exposure of the larynx. It has a standard-sized cuff on a narrow tube. Alternatives include jet ventilation or intermittent apnea depending on the procedure.

Why the other choices are less appropriate:

- B. A large tube obstructs the surgical view.
- C. A double-lumen tube is for lung isolation, not laryngeal surgery.
- D. An uncuffed nasal RAE does not suit microlaryngeal exposure needs.

Question 530 · Correct Answer: C

Which neuromuscular blocking agent is LEAST affected by renal or hepatic dysfunction, making it useful in these patients?

Cisatracurium undergoes Hofmann elimination, a spontaneous nonenzymatic degradation independent of hepatic and renal function, making it well suited for patients with organ failure. Its duration is predictable regardless of clearance organs. Agents dependent on renal or hepatic elimination may have prolonged effects.

Why the other choices are less appropriate:

- A. Pancuronium is largely renally excreted and prolonged in renal failure.
- B. Rocuronium relies on hepatic/biliary elimination.
- D. Vecuronium and its metabolite can accumulate in renal failure.

Question 531 · Correct Answer: D

In a patient with end-stage renal disease, which anesthetic consideration is MOST important?

Patients with end-stage renal disease are prone to hyperkalemia, volume overload, and altered drug clearance, so succinylcholine (which raises potassium) is used cautiously and electrolytes and volume are closely monitored. Timing surgery relative to dialysis optimizes electrolyte and fluid status. Renally cleared drugs may accumulate.

Why the other choices are less appropriate:

- A. Nephrotoxic exposures should be minimized.
- B. Potassium supplementation is dangerous in ESRD.
- C. Dialysis timing significantly affects perioperative status.

Question 532 · Correct Answer: A

Patients with advanced liver disease commonly have altered pharmacology because of:

Cirrhosis reduces hepatic drug metabolism, lowers albumin (increasing free drug fraction), and expands volume of distribution due to ascites and fluid retention, altering dosing of many anesthetics. Reduced clotting factor synthesis contributes to coagulopathy. Drug effects can be prolonged and unpredictable.

Why the other choices are less appropriate:

- B. Albumin is typically decreased in liver disease.
- C. Clotting factor synthesis is impaired.
- D. Volume of distribution is often increased for water-soluble drugs.

Question 533 • Correct Answer: A

Which volatile anesthetic is generally preferred in patients with hepatic disease because it best preserves hepatic blood flow?

Isoflurane and sevoflurane maintain hepatic arterial blood flow better and have minimal hepatotoxic potential, making them preferable in patients with liver disease. Halothane is avoided due to the risk of halothane hepatitis and greater reduction in hepatic blood flow. Maintaining perfusion and avoiding hypotension protect the liver.

Why the other choices are less appropriate:

- B. Halothane carries hepatotoxicity risk and is avoided.
- C. Methoxyflurane is nephrotoxic and obsolete.
- D. Diethyl ether is obsolete and not used clinically.

Question 534 • Correct Answer: B

Which analgesic requires particular caution in renal failure due to accumulation of an active, neurotoxic metabolite?

Morphine is metabolized to morphine-6-glucuronide and morphine-3-glucuronide, which accumulate in renal failure and can cause prolonged sedation and respiratory depression. Fentanyl and remifentanyl lack clinically significant active renally cleared metabolites and are safer choices. Dose adjustment or alternative agents are advised in renal impairment.

Why the other choices are less appropriate:

- A. Fentanyl has no significant active renally-dependent metabolite.
- C. Remifentanyl is metabolized by plasma esterases, independent of renal function.
- D. Acetaminophen at standard doses is generally acceptable.

Question 535 • Correct Answer: B

Hepatorenal syndrome in a patient with cirrhosis is best described as:

Hepatorenal syndrome is a functional, potentially reversible renal failure occurring in advanced liver disease, driven by splanchnic vasodilation and intense renal vasoconstriction, with histologically normal kidneys. Management focuses on the underlying liver disease and hemodynamics. It carries a poor prognosis without liver transplantation.

Why the other choices are less appropriate:

- A. It is functional, not a primary glomerular disease.
- C. It is not caused by obstruction.
- D. The kidneys are structurally normal, unlike ATN.

Question 536 • Correct Answer: B

Preoperative preparation for resection of a pheochromocytoma should FIRST include:

Pheochromocytomas secrete catecholamines; alpha-blockade (e.g., phenoxybenzamine) is started first to control blood pressure and allow volume re-expansion. Beta-blockade is added only after adequate alpha-blockade to avoid unopposed alpha-mediated vasoconstriction and hypertensive crisis. This sequence is essential preoperative preparation.

Why the other choices are less appropriate:

- A. Beta-blockade alone risks unopposed alpha stimulation.
- C. Pharmacologic optimization is critical before surgery.
- D. Starting beta-blockade first can precipitate hypertensive crisis.

Question 537 • Correct Answer: D

During pheochromocytoma resection, the moment of GREATEST hemodynamic instability toward hypotension is typically:

After the tumor's venous drainage is ligated, circulating catecholamine levels fall abruptly, and patients often become hypotensive, especially if underfilled. Preparation includes adequate preoperative volume expansion and readiness with vasopressors and fluids. Before ligation, tumor manipulation can cause severe hypertension.

Why the other choices are less appropriate:

- A. Incision is not the peak instability point for hypotension.
- B. Preoxygenation is not associated with this shift.
- C. The critical hypotension occurs at venous ligation, not only emergence.

Question 538 • Correct Answer: A

A patient develops carcinoid crisis intraoperatively. The MOST appropriate specific treatment is:

Carcinoid tumors release vasoactive mediators (serotonin, kinins, histamine) that can cause flushing, bronchospasm, and profound hemodynamic swings; octreotide is the specific treatment for carcinoid crisis. Catecholamines like epinephrine can paradoxically worsen the crisis by stimulating mediator release. Preoperative octreotide and avoiding mediator-releasing drugs are key.

Why the other choices are less appropriate:

- B. Catecholamines can trigger further mediator release.
- C. Beta-agonists may worsen the crisis.
- D. Calcium channel blockers are not the specific therapy.

Question 539 • Correct Answer: A

Thyroid storm during or after thyroid surgery is treated with which combination?

Thyroid storm is a life-threatening hypermetabolic state with tachycardia, hyperthermia, and cardiovascular instability, treated with beta-blockers (to control adrenergic symptoms), antithyroid drugs (to block synthesis), iodine (to block release), corticosteroids, active cooling, and supportive care. Prompt recognition is essential. It can be precipitated by surgery in poorly controlled hyperthyroidism.

Why the other choices are less appropriate:

- B. More thyroid hormone would worsen the storm.
- C. Warming worsens hyperthermia; cooling is needed.
- D. Aggressive pharmacologic treatment is required.

Question 540 • Correct Answer: D

A recognized complication after total thyroidectomy that can cause acute airway compromise is:

After thyroidectomy, an expanding neck hematoma can compress the airway, and bilateral recurrent laryngeal nerve injury can cause vocal cord dysfunction and airway obstruction. Both require urgent recognition; hematoma may need immediate wound opening at the bedside. Hypocalcemia from parathyroid injury is another important complication.

Why the other choices are less appropriate:

- A. Hyperglycemia does not cause acute airway obstruction.
- B. MH is unrelated to thyroidectomy complications.
- C. Arm DVT is not a characteristic thyroidectomy airway risk.

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