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TUTOR STEM

PRACTICE MCAT

BIOLOGY QUESTIONS

MCAT Section: **Biological and Biochemical Foundations of Living Systems**

MCAT Biology Question 1

Which of the following enzymes is directly responsible for the synthesis of the RNA primer during DNA replication in eukaryotic cells?

- A) DNA polymerase III
- B) Primase
- C) Helicase
- D) DNA ligase

Correct Answer: B) Primase

Reasoning: Primase synthesizes a short RNA primer that provides a starting point for DNA polymerase to begin DNA synthesis.

MCAT Biology Question 2

Which cellular organelle is primarily responsible for the detoxification of drugs and poisons?

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- A) Golgi apparatus
- B) Lysosome
- C) Smooth endoplasmic reticulum
- D) Peroxisome

Correct Answer: C) Smooth endoplasmic reticulum

Reasoning: The smooth endoplasmic reticulum (ER) contains enzymes involved in the detoxification of drugs and poisons, as well as the metabolism of lipids.

MCAT Biology Question 3

During the process of glycolysis, what is the net gain of ATP molecules per molecule of glucose?

- A) 1 ATP
- B) 2 ATP
- C) 4 ATP
- D) 6 ATP

Correct Answer: B) 2 ATP

Reasoning: Glycolysis produces 4 ATP molecules, but 2 ATP molecules are used in the early steps, resulting in a net gain of 2 ATP molecules per glucose molecule.

MCAT Biology Question 4

In the context of the lac operon in *E. coli*, which molecule serves as the inducer?

- A) Lactose
- B) Glucose
- C) cAMP
- D) Allolactose

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Reasoning: Allolactose, an isomer of lactose, binds to the repressor protein, causing it to release from the operator region, thereby inducing the transcription of the lac operon.

MCAT Biology Question 5

Which of the following statements correctly describes the role of NADH in cellular respiration?

- A) It directly produces ATP in glycolysis.
- B) It donates electrons to the electron transport chain.
- C) It acts as a final electron acceptor in the electron transport chain.
- D) It is a substrate for ATP synthase.

Correct Answer: B) It donates electrons to the electron transport chain.

Reasoning: NADH is an electron carrier that donates electrons to the electron transport chain, which leads to the generation of a proton gradient used to produce ATP.

MCAT Biology Question 6

Which phase of the cell cycle is characterized by the replication of DNA?

- A) G1 phase
- B) S phase
- C) G2 phase
- D) M phase

Correct Answer: B) S phase

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Reasoning: The S (synthesis) phase of the cell cycle is when DNA replication occurs, resulting in the duplication of the chromosomes.

MCAT Biology Question 7

Which of the following is true about the Hardy-Weinberg equilibrium?

- A) It requires non-random mating.
- B) It predicts that allele frequencies will change over time.
- C) It assumes no migration, mutation, or selection.
- D) It only applies to small populations.

Correct Answer: C) It assumes no migration, mutation, or selection.

Reasoning: The Hardy-Weinberg equilibrium assumes that there is no migration, mutation, selection, genetic drift, or non-random mating, which allows allele frequencies to remain constant over time.

MCAT Biology Question 8

Which process results in the production of a peptide bond between amino acids?

- A) Hydrolysis
- B) Dehydration synthesis
- C) Phosphorylation
- D) Oxidation

Correct Answer: B) Dehydration synthesis

Reasoning: Peptide bonds between amino acids are formed through a dehydration synthesis (condensation) reaction, where a water molecule is released.

MCAT Biology Question 9

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What is the main function of the enzyme telomerase in eukaryotic cells?

- A) To repair DNA damage
- B) To add repetitive nucleotide sequences to the ends of chromosomes
- C) To unwind the DNA helix during replication
- D) To synthesize RNA primers

Correct Answer: B) To add repetitive nucleotide sequences to the ends of chromosomes

Reasoning: Telomerase adds repetitive nucleotide sequences to the ends of chromosomes (telomeres) to protect them from degradation and prevent the loss of genetic information during replication.

MCAT Biology Question 10

Which of the following correctly describes the function of the major histocompatibility complex (MHC) in the immune system?

- A) To directly destroy pathogens
- B) To present antigenic peptides to T cells
- C) To produce antibodies
- D) To act as a receptor for cytokines

Correct Answer: B) To present antigenic peptides to T cells

Reasoning: The major histocompatibility complex (MHC) presents antigenic peptides on the surface of cells, allowing T cells to recognize and respond to foreign antigens.

These questions reflect the complexity and depth expected in MCAT biology sections, ensuring comprehensive preparation for students.

MCAT Biology Question 11

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Which of the following enzymes is involved in the process of transcribing DNA into RNA in eukaryotic cells?

- A) DNA polymerase
- B) RNA polymerase II
- C) Helicase
- D) DNA ligase

Correct Answer: B) RNA polymerase II

Reasoning: RNA polymerase II is the enzyme responsible for transcribing mRNA from DNA in eukaryotic cells.

MCAT Biology Question 12

What is the primary function of the citric acid cycle (Krebs cycle) in cellular respiration?

- A) To produce glucose from pyruvate
- B) To generate ATP directly
- C) To oxidize acetyl-CoA to CO_2 and generate NADH and FADH_2
- D) To synthesize fatty acids

Correct Answer: C) To oxidize acetyl-CoA to CO_2 and generate NADH and FADH_2

Reasoning: The citric acid cycle oxidizes acetyl-CoA to CO_2 , generating high-energy electron carriers NADH and FADH_2 , which are used in the electron transport chain to produce ATP.

MCAT Biology Question 13

In the context of enzyme kinetics, which of the following describes the effect of a competitive inhibitor?

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- A) It decreases V_{\max} and K_m .
- B) It decreases V_{\max} and increases K_m .
- C) It increases V_{\max} and K_m .
- D) It does not change V_{\max} but increases K_m .

Correct Answer: D) It does not change V_{\max} but increases K_m .

Reasoning: A competitive inhibitor binds to the active site of the enzyme, increasing K_m (the substrate concentration needed to reach half V_{\max}), but does not affect V_{\max} as the inhibition can be overcome by increasing substrate concentration.

MCAT Biology Question 14

Which of the following structures is involved in the initiation of translation in eukaryotic cells?

- A) 5' cap
- B) Poly-A tail
- C) TATA box
- D) Introns

Correct Answer: A) 5' cap

Reasoning: The 5' cap is a modified guanine nucleotide added to the 5' end of eukaryotic mRNA that helps initiate translation by binding to the ribosome.

MCAT Biology Question 15

Which of the following processes occurs in the mitochondria?

- A) Glycolysis
- B) Electron transport chain
- C) Fermentation
- D) Calvin cycle

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Reasoning: The electron transport chain occurs in the inner mitochondrial membrane and is crucial for ATP production through oxidative phosphorylation.

MCAT Biology Question 16

During which stage of meiosis do homologous chromosomes undergo crossing over?

- A) Prophase I
- B) Metaphase I
- C) Anaphase I
- D) Telophase I

Correct Answer: A) Prophase I

Reasoning: Crossing over, the exchange of genetic material between homologous chromosomes, occurs during Prophase I of meiosis, increasing genetic diversity.

MCAT Biology Question 17

Which type of mutation results in the substitution of a single nucleotide that changes an amino acid codon to a stop codon?

- A) Silent mutation
- B) Missense mutation
- C) Nonsense mutation
- D) Frameshift mutation

Correct Answer: C) Nonsense mutation

Reasoning: A nonsense mutation changes an amino acid codon into a stop codon, resulting in the premature termination of protein synthesis.

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MCAT Biology Question 18

What role does the hormone erythropoietin play in the body?

- A) It stimulates glucose uptake in cells.
- B) It promotes water reabsorption in the kidneys.
- C) It stimulates red blood cell production.
- D) It regulates calcium levels in the blood.

Correct Answer: C) It stimulates red blood cell production.

Reasoning: Erythropoietin, produced by the kidneys, stimulates the production of red blood cells in the bone marrow in response to low oxygen levels in the blood.

MCAT Biology Question 19

Which of the following processes directly uses ATP during muscle contraction?

- A) Binding of myosin to actin
- B) Release of calcium from the sarcoplasmic reticulum
- C) Detachment of myosin from actin
- D) Generation of action potentials in muscle fibers

Correct Answer: C) Detachment of myosin from actin

Reasoning: ATP binds to myosin, causing it to detach from actin, which is a crucial step in the muscle contraction cycle, allowing the muscle to relax.

MCAT Biology Question 20

Which of the following is a characteristic of the innate immune system?

- A) Production of antibodies
- B) Memory response to specific antigens

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- C) Rapid response to a wide range of pathogens
- D) Specificity for particular pathogens

Correct Answer: C) Rapid response to a wide range of pathogens

Reasoning: The innate immune system provides a rapid, nonspecific defense against a wide variety of pathogens, unlike the adaptive immune system, which is slower and specific.

MCAT Biology Question 21

Which of the following best describes the role of chaperone proteins in the cell?

- A) They assist in the correct folding of nascent polypeptides.
- B) They degrade misfolded proteins.
- C) They modify proteins by adding phosphate groups.
- D) They transport proteins across the nuclear membrane.

Correct Answer: A) They assist in the correct folding of nascent polypeptides.

Reasoning: Chaperone proteins help newly synthesized polypeptides fold into their correct three-dimensional structures, preventing misfolding and aggregation.

MCAT Biology Question 22

Which of the following best explains the function of topoisomerase during DNA replication?

- A) It synthesizes the RNA primer.
- B) It unwinds the DNA double helix.
- C) It relieves the tension ahead of the replication fork.
- D) It joins Okazaki fragments together.

Correct Answer: C) It relieves the tension ahead of the replication fork.

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Reasoning: Topoisomerase alleviates the torsional strain generated ahead of the replication fork by introducing temporary nicks in the DNA molecule.

MCAT Biology Question 23

In signal transduction pathways, what is the role of a second messenger?

- A) To bind to extracellular ligands.
- B) To relay signals from the cell surface to target molecules inside the cell.
- C) To phosphorylate proteins.
- D) To degrade signal molecules.

Correct Answer: B) To relay signals from the cell surface to target molecules inside the cell.

Reasoning: Second messengers, such as cAMP and calcium ions, are intracellular molecules that relay signals from receptors on the cell surface to target molecules, amplifying the signal.

MCAT Biology Question 24

Which of the following is the major function of the ribosomal RNA (rRNA) in the cell?

- A) To carry genetic information from DNA to the ribosome.
- B) To catalyze peptide bond formation during protein synthesis.
- C) To transport amino acids to the ribosome.
- D) To regulate gene expression.

Correct Answer: B) To catalyze peptide bond formation during protein synthesis.

Reasoning: rRNA is a key component of ribosomes and plays a crucial role in catalyzing the formation of peptide bonds between amino acids during protein synthesis.

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MCAT Biology Question 25

Which of the following best describes the process of autophagy?

- A) The process by which cells undergo programmed cell death.
- B) The degradation and recycling of cellular components within lysosomes.
- C) The transport of substances across the cell membrane.
- D) The fusion of vesicles with the cell membrane.

Correct Answer: B) The degradation and recycling of cellular components within lysosomes.

Reasoning: Autophagy is the process by which cells degrade and recycle their own components within lysosomes, helping to maintain cellular homeostasis.

MCAT Biology Question 26

In a eukaryotic cell, which of the following processes occurs in the nucleus?

- A) Translation
- B) Glycolysis
- C) Transcription
- D) Electron transport chain

Correct Answer: C) Transcription

Reasoning: Transcription, the synthesis of RNA from a DNA template, occurs in the nucleus of eukaryotic cells, whereas translation occurs in the cytoplasm.

MCAT Biology Question 27

Which of the following describes the main function of the enzyme ribonucleotide reductase?

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- A) It synthesizes RNA primers during DNA replication.
- B) It converts ribonucleotides to deoxyribonucleotides.
- C) It degrades RNA molecules.
- D) It joins Okazaki fragments together.

Correct Answer: B) It converts ribonucleotides to deoxyribonucleotides.

Reasoning: Ribonucleotide reductase is the enzyme responsible for converting ribonucleotides (RNA building blocks) into deoxyribonucleotides (DNA building blocks), which is crucial for DNA synthesis.

MCAT Biology Question 28

Which of the following correctly describes a characteristic of prions?

- A) They are composed of nucleic acids.
- B) They are infectious proteins that cause neurodegenerative diseases.
- C) They contain both DNA and RNA.
- D) They can be destroyed by standard autoclaving procedures.

Correct Answer: B) They are infectious proteins that cause neurodegenerative diseases.

Reasoning: Prions are misfolded proteins that can induce other normally folded proteins to adopt the misfolded prion form, leading to neurodegenerative diseases. They are resistant to standard autoclaving procedures.

MCAT Biology Question 29

Which of the following best explains the mechanism by which steroid hormones exert their effects on target cells?

- A) They bind to cell surface receptors and activate second messenger pathways.
- B) They enter the target cell and bind to intracellular receptors, influencing gene

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expression.

- C) They induce rapid changes in ion channel permeability.
- D) They are degraded by lysosomes upon entry into the cell.

Correct Answer: B) They enter the target cell and bind to intracellular receptors, influencing gene expression.

Reasoning: Steroid hormones are lipid-soluble and can pass through the cell membrane to bind to intracellular receptors, which then directly affect gene expression in the nucleus.

MCAT Biology Question 30

What is the primary function of the TATA box in eukaryotic promoters?

- A) It is the binding site for ribosomes during translation initiation.
- B) It serves as the termination signal for transcription.
- C) It is the binding site for transcription factors and RNA polymerase II.
- D) It codes for the amino acid methionine.

Correct Answer: C) It is the binding site for transcription factors and RNA polymerase II.

Reasoning: The TATA box is a DNA sequence found in the promoter region of many genes and is recognized and bound by transcription factors and RNA polymerase II, facilitating the initiation of transcription.

MCAT Biology Question 31

Which of the following molecules acts as the final electron acceptor in the electron transport chain?

- A) NAD⁺
- B) FAD

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- C) Oxygen
- D) Carbon dioxide

Correct Answer: C) Oxygen

Reasoning: Oxygen is the final electron acceptor in the electron transport chain, combining with electrons and protons to form water, which is crucial for maintaining the flow of electrons through the chain.

MCAT Biology Question 32

Which of the following best describes the role of microRNAs (miRNAs) in gene expression?

- A) They bind to mRNA and block translation.
- B) They enhance the transcription of specific genes.
- C) They act as templates for protein synthesis.
- D) They modify the structure of chromatin.

Correct Answer: A) They bind to mRNA and block translation.

Reasoning: miRNAs are small non-coding RNAs that regulate gene expression by binding to complementary sequences on target mRNAs, resulting in the inhibition of translation or degradation of the mRNA.

MCAT Biology Question 33

Which of the following structures is directly involved in the production of ATP through chemiosmosis?

- A) Thylakoid membrane
- B) Inner mitochondrial membrane
- C) Cytoplasmic membrane
- D) Nuclear membrane

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Reasoning: The inner mitochondrial membrane houses the electron transport chain and ATP synthase, which together create a proton gradient that drives ATP production through chemiosmosis.

MCAT Biology Question 34

Which of the following processes is directly inhibited by cyanide poisoning?

- A) Glycolysis
- B) Citric acid cycle
- C) Electron transport chain
- D) Fermentation

Correct Answer: C) Electron transport chain

Reasoning: Cyanide inhibits cytochrome c oxidase, a key enzyme in the electron transport chain, preventing the transfer of electrons to oxygen and thereby halting ATP production via oxidative phosphorylation.

MCAT Biology Question 35

Which of the following best explains the concept of pleiotropy in genetics?

- A) A single gene influences multiple phenotypic traits.
- B) Multiple genes influence a single phenotypic trait.
- C) Environmental factors affect the expression of genes.
- D) Genes located close together on a chromosome are inherited together.

Correct Answer: A) A single gene influences multiple phenotypic traits.

Reasoning: Pleiotropy occurs when one gene affects multiple, seemingly unrelated phenotypic traits, highlighting the interconnectedness of genetic pathways.

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MCAT Biology Question 36

What is the primary function of peroxisomes in eukaryotic cells?

- A) To produce ATP through oxidative phosphorylation.
- B) To degrade misfolded proteins.
- C) To break down fatty acids and detoxify harmful substances.
- D) To synthesize ribosomal RNA.

Correct Answer: C) To break down fatty acids and detoxify harmful substances.

Reasoning: Peroxisomes contain enzymes that catalyze the breakdown of fatty acids and the detoxification of hydrogen peroxide and other harmful substances.

MCAT Biology Question 37

Which of the following accurately describes the difference between euchromatin and heterochromatin?

- A) Euchromatin is transcriptionally inactive, while heterochromatin is transcriptionally active.
- B) Euchromatin is densely packed, while heterochromatin is loosely packed.
- C) Euchromatin is transcriptionally active, while heterochromatin is transcriptionally inactive.
- D) Euchromatin contains repetitive DNA sequences, while heterochromatin contains unique DNA sequences.

Correct Answer: C) Euchromatin is transcriptionally active, while heterochromatin is transcriptionally inactive.

Reasoning: Euchromatin is loosely packed and accessible for transcription, while heterochromatin is densely packed and typically transcriptionally silent.

MCAT Biology Question 38

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In which phase of the cell cycle does the cell check for DNA damage before proceeding to mitosis?

- A) G1 phase
- B) S phase
- C) G2 phase
- D) M phase

Correct Answer: C) G2 phase

Reasoning: During the G2 phase, the cell checks for DNA damage and ensures that all DNA is properly replicated before entering mitosis, preventing the propagation of errors.

MCAT Biology Question 39

Which of the following correctly describes the process of somatic hypermutation in B cells?

- A) It occurs during the development of B cells in the bone marrow.
- B) It introduces random mutations in the variable region of antibody genes to increase antibody diversity.
- C) It is a process that increases the number of B cells in response to an antigen.
- D) It involves the rearrangement of V(D)J gene segments.

Correct Answer: B) It introduces random mutations in the variable region of antibody genes to increase antibody diversity.

Reasoning: Somatic hypermutation occurs in activated B cells and introduces mutations in the variable regions of immunoglobulin genes, enhancing the affinity of antibodies for their specific antigens.

MCAT Biology Question 40

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Which of the following statements best describes the function of the sarcoplasmic reticulum in muscle cells?

- A) It synthesizes ATP for muscle contraction.
- B) It stores and releases calcium ions to regulate muscle contraction.
- C) It generates action potentials to initiate muscle contraction.
- D) It transports oxygen to muscle fibers.

Correct Answer: B) It stores and releases calcium ions to regulate muscle contraction.

Reasoning: The sarcoplasmic reticulum is a specialized type of endoplasmic reticulum in muscle cells that stores calcium ions and releases them during muscle contraction, enabling the interaction of actin and myosin.

MCAT Biology Question 41

Which of the following best describes the process of alternative splicing?

- A) The removal of introns from pre-mRNA.
- B) The addition of a poly-A tail to the mRNA.
- C) The production of different mRNAs from the same primary transcript by including or excluding certain exons.
- D) The degradation of mRNA by ribonucleases.

Correct Answer: C) The production of different mRNAs from the same primary transcript by including or excluding certain exons.

Reasoning: Alternative splicing allows a single gene to produce multiple proteins by varying the inclusion of exons in the final mRNA, increasing protein diversity.

MCAT Biology Question 42

Which of the following is a function of the enzyme telomerase?

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- A) It shortens telomeres after each round of DNA replication.
- B) It synthesizes the RNA primer required for DNA replication.
- C) It adds repetitive nucleotide sequences to the ends of chromosomes to prevent degradation.
- D) It unwinds the DNA double helix during replication.

Correct Answer: C) It adds repetitive nucleotide sequences to the ends of chromosomes to prevent degradation.

Reasoning: Telomerase extends the telomeres, which are repetitive nucleotide sequences at the ends of chromosomes, preventing their shortening during DNA replication.

MCAT Biology Question 43

Which of the following best explains the concept of genetic linkage?

- A) Genes located on the same chromosome that are inherited together.
- B) Genes located on different chromosomes that are inherited independently.
- C) Genes that influence the same phenotypic trait.
- D) Genes that undergo independent assortment during meiosis.

Correct Answer: A) Genes located on the same chromosome that are inherited together.

Reasoning: Genetic linkage refers to the tendency of genes located close to each other on the same chromosome to be inherited together because they are less likely to be separated during recombination.

MCAT Biology Question 44

Which of the following correctly describes a primary function of the liver in glucose metabolism?

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- A) It stores glucose as glycogen and releases it during fasting.
- B) It produces insulin to regulate blood glucose levels.
- C) It absorbs glucose from the gastrointestinal tract.
- D) It converts glucose to fatty acids for storage.

Correct Answer: A) It stores glucose as glycogen and releases it during fasting.

Reasoning: The liver stores excess glucose as glycogen during periods of high blood glucose levels and breaks down glycogen to release glucose into the bloodstream during fasting or low blood glucose levels.

MCAT Biology Question 45

Which of the following correctly describes the Bohr effect on hemoglobin?

- A) It describes the binding of oxygen to hemoglobin in the lungs.
- B) It describes the increased affinity of hemoglobin for oxygen at low pH.
- C) It describes the decreased affinity of hemoglobin for oxygen at low pH.
- D) It describes the increased production of hemoglobin at high altitude.

Correct Answer: C) It describes the decreased affinity of hemoglobin for oxygen at low pH.

Reasoning: The Bohr effect refers to the phenomenon where a decrease in pH (increase in hydrogen ion concentration) reduces the affinity of hemoglobin for oxygen, facilitating oxygen release in tissues with high metabolic activity.

MCAT Biology Question 46

Which of the following best describes the role of the spleen in the immune system?

- A) It produces antibodies to fight infections.
- B) It filters and removes old or damaged red blood cells.

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- C) It synthesizes clotting factors.
- D) It stores and releases white blood cells during infection.

Correct Answer: B) It filters and removes old or damaged red blood cells.

Reasoning: The spleen functions as a blood filter, removing old or damaged red blood cells and recycling their components. It also plays a role in immune surveillance and response.

MCAT Biology Question 47

Which of the following describes the mechanism by which acetylcholine is removed from the synaptic cleft?

- A) It is taken up by postsynaptic receptors.
- B) It diffuses away from the synaptic cleft.
- C) It is degraded by the enzyme acetylcholinesterase.
- D) It is taken up by presynaptic vesicles.

Correct Answer: C) It is degraded by the enzyme acetylcholinesterase.

Reasoning: Acetylcholine is rapidly broken down by the enzyme acetylcholinesterase in the synaptic cleft, terminating the signal transmission.

MCAT Biology Question 48

Which of the following processes is directly inhibited by non-competitive inhibitors?

- A) Substrate binding to the active site.
- B) Enzyme synthesis.
- C) Product formation by binding to a site other than the active site.
- D) Allosteric activation.

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Correct Answer: C) Product formation by binding to a site other than the active site.

Reasoning: Non-competitive inhibitors bind to an enzyme at a site other than the active site, causing a conformational change that reduces the enzyme's activity regardless of substrate concentration.

MCAT Biology Question 49

In the context of the lac operon, which of the following conditions must be met for maximal expression of the operon?

- A) High glucose levels and low lactose levels.
- B) Low glucose levels and high lactose levels.
- C) High glucose levels and high lactose levels.
- D) Low glucose levels and low lactose levels.

Correct Answer: B) Low glucose levels and high lactose levels.

Reasoning: For maximal expression of the lac operon, low glucose levels increase cAMP levels, which activate CAP (catabolite activator protein) to enhance transcription, while high lactose levels inactivate the repressor by binding to it.

MCAT Biology Question 50

Which of the following correctly describes the function of myosin in muscle contraction?

- A) It binds to actin filaments and pulls them to cause muscle shortening.
- B) It releases calcium ions to trigger muscle contraction.
- C) It hydrolyzes ATP to ADP and phosphate to provide energy for muscle contraction.
- D) It binds to tropomyosin to expose binding sites on actin filaments.

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Correct Answer: A) It binds to actin filaments and pulls them to cause muscle shortening.

Reasoning: Myosin heads bind to actin filaments and, through a power stroke driven by ATP hydrolysis, pull the actin filaments toward the center of the sarcomere, causing muscle contraction.

MCAT Biology Question 51

Which of the following best describes the role of the spliceosome in eukaryotic cells?

- A) It synthesizes mRNA from a DNA template.
- B) It translates mRNA into a polypeptide.
- C) It removes introns and joins exons in pre-mRNA.
- D) It attaches amino acids to tRNA molecules.

Correct Answer: C) It removes introns and joins exons in pre-mRNA.

Reasoning: The spliceosome is a complex of small nuclear RNAs and proteins that splices pre-mRNA by removing introns and ligating exons to produce mature mRNA.

MCAT Biology Question 52

Which of the following best describes the function of tight junctions in epithelial tissues?

- A) They allow the passage of small molecules between adjacent cells.
- B) They anchor epithelial cells to the basement membrane.
- C) They prevent the leakage of molecules between adjacent cells.
- D) They enable communication between adjacent cells.

Correct Answer: C) They prevent the leakage of molecules between adjacent cells.

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Reasoning: Tight junctions create a seal between adjacent epithelial cells, preventing the passage of molecules and ions through the space between cells, thus maintaining distinct compartments within tissues.

MCAT Biology Question 53

In eukaryotic cells, which organelle is primarily involved in the modification, sorting, and packaging of proteins?

- A) Endoplasmic reticulum
- B) Golgi apparatus
- C) Lysosome
- D) Mitochondrion

Correct Answer: B) Golgi apparatus

Reasoning: The Golgi apparatus processes, modifies, sorts, and packages proteins and lipids for secretion or delivery to other organelles.

MCAT Biology Question 54

Which of the following mechanisms is primarily responsible for generating genetic diversity during meiosis?

- A) DNA replication
- B) Independent assortment and crossing over
- C) Mitosis
- D) Somatic hypermutation

Correct Answer: B) Independent assortment and crossing over

Reasoning: Genetic diversity in meiosis is generated through independent assortment of chromosomes and crossing over (recombination) between homologous chromosomes during Prophase I.

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MCAT Biology Question 55

Which of the following statements correctly describes the function of the Na⁺/K⁺ ATPase pump?

- A) It transports sodium and potassium ions down their concentration gradients.
- B) It pumps three sodium ions out of the cell and two potassium ions into the cell using ATP.
- C) It generates action potentials in neurons.
- D) It is involved in the passive diffusion of ions across the membrane.

Correct Answer: B) It pumps three sodium ions out of the cell and two potassium ions into the cell using ATP.

Reasoning: The Na⁺/K⁺ ATPase pump actively transports three sodium ions out of the cell and two potassium ions into the cell against their concentration gradients, maintaining the electrochemical gradient essential for various cellular processes.

MCAT Biology Question 56

Which of the following best describes the function of enhancers in gene regulation?

- A) They bind to repressors to inhibit transcription.
- B) They are sequences where RNA polymerase binds to initiate transcription.
- C) They are DNA sequences that increase the rate of transcription when bound by specific proteins.
- D) They encode proteins that act as transcription factors.

Correct Answer: C) They are DNA sequences that increase the rate of transcription when bound by specific proteins.

Reasoning: Enhancers are regulatory DNA sequences that, when bound by transcription factors, enhance the transcription of associated genes by increasing the activity of the promoter.

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MCAT Biology Question 57

Which of the following correctly describes the role of the liver in the urea cycle?

- A) It synthesizes urea from ammonia to detoxify nitrogenous wastes.
- B) It breaks down urea into ammonia and carbon dioxide.
- C) It converts urea into amino acids.
- D) It stores urea until it can be excreted.

Correct Answer: A) It synthesizes urea from ammonia to detoxify nitrogenous wastes.

Reasoning: The liver converts toxic ammonia, produced from amino acid catabolism, into urea, a less toxic compound that can be safely excreted by the kidneys.

MCAT Biology Question 58

Which of the following describes the primary function of microglia in the central nervous system?

- A) They transmit electrical signals between neurons.
- B) They provide structural support to neurons.
- C) They act as the main form of active immune defense.
- D) They produce myelin sheaths around axons.

Correct Answer: C) They act as the main form of active immune defense.

Reasoning: Microglia are specialized macrophages in the central nervous system that provide immune defense by phagocytosing pathogens and clearing cellular debris.

MCAT Biology Question 59

Which of the following mechanisms is used by cells to maintain osmotic balance and cell volume?

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- A) Simple diffusion
- B) Facilitated diffusion
- C) Active transport
- D) Osmosis

Correct Answer: C) Active transport

Reasoning: Active transport mechanisms, such as the Na⁺/K⁺ ATPase pump, help maintain osmotic balance and cell volume by actively moving ions against their concentration gradients, thereby controlling water movement.

MCAT Biology Question 60

Which of the following best explains the function of hemoglobin's cooperative binding?

- A) It ensures hemoglobin releases oxygen in tissues with low pH.
- B) It allows hemoglobin to bind oxygen more tightly at high altitudes.
- C) It enables hemoglobin to increase its affinity for oxygen as more oxygen molecules bind.
- D) It prevents hemoglobin from binding carbon dioxide.

Correct Answer: C) It enables hemoglobin to increase its affinity for oxygen as more oxygen molecules bind.

Reasoning: Cooperative binding in hemoglobin means that the binding of each oxygen molecule increases the affinity of hemoglobin for the next oxygen molecule, allowing efficient oxygen loading in the lungs and unloading in the tissues.

MCAT Biology Question 61

Which of the following best describes the function of the enzyme ribonuclease?

- A) It synthesizes RNA from a DNA template.
- B) It degrades RNA molecules into smaller components.

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- C) It synthesizes DNA from an RNA template.
D) It joins RNA fragments together.

Correct Answer: B) It degrades RNA molecules into smaller components.

Reasoning: Ribonuclease (RNase) is an enzyme that degrades RNA into smaller components, playing a role in RNA processing and turnover.

MCAT Biology Question 62

Which of the following processes is involved in the amplification of a specific DNA segment using polymerase chain reaction (PCR)?

- A) Restriction digestion
B) Ligation
C) Denaturation, annealing, and extension
D) Cloning

Correct Answer: C) Denaturation, annealing, and extension

Reasoning: PCR involves repeated cycles of denaturation (separating DNA strands), annealing (binding primers to DNA), and extension (synthesizing new DNA strands) to amplify a specific DNA segment.

MCAT Biology Question 63

Which of the following statements best describes the function of the protein tubulin?

- A) It forms the structural framework of the cell membrane.
B) It is involved in muscle contraction.
C) It is a key component of microtubules involved in cell division and intracellular transport.
D) It acts as an enzyme in metabolic pathways.

Correct Answer: C) It is a key component of microtubules involved in cell division and intracellular transport.

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Reasoning: Tubulin is the protein that polymerizes to form microtubules, which are crucial for maintaining cell shape, enabling intracellular transport, and segregating chromosomes during cell division.

MCAT Biology Question 64

Which of the following best explains the role of the sigma factor in prokaryotic transcription?

- A) It terminates transcription.
- B) It unwinds the DNA double helix.
- C) It recognizes the promoter region and initiates transcription.
- D) It synthesizes the RNA transcript.

Correct Answer: C) It recognizes the promoter region and initiates transcription.

Reasoning: The sigma factor is a protein that binds to RNA polymerase and directs it to specific promoter regions in the DNA to initiate transcription in prokaryotes.

MCAT Biology Question 65

Which of the following best describes the function of the lymphatic system?

- A) It circulates oxygenated blood throughout the body.
- B) It transports oxygen and carbon dioxide between the lungs and tissues.
- C) It returns excess interstitial fluid to the bloodstream and provides immune defense.
- D) It regulates the body's metabolic rate.

Correct Answer: C) It returns excess interstitial fluid to the bloodstream and provides immune defense.

Reasoning: The lymphatic system collects excess interstitial fluid and returns it to the bloodstream, while also playing a key role in immune defense by transporting lymphocytes and filtering lymph through lymph nodes.

MCAT Biology Question 66

Which of the following correctly describes the mechanism of action of non-steroidal anti-inflammatory drugs (NSAIDs)?

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- A) They block the action of COX enzymes, reducing the synthesis of prostaglandins.
- B) They inhibit the reuptake of serotonin in the brain.
- C) They enhance the production of corticosteroids.
- D) They block acetylcholine receptors at neuromuscular junctions.

Correct Answer: A) They block the action of COX enzymes, reducing the synthesis of prostaglandins.

Reasoning: NSAIDs inhibit cyclooxygenase (COX) enzymes, which are involved in the synthesis of prostaglandins that mediate inflammation, pain, and fever.

MCAT Biology Question 67

Which of the following processes is directly affected by mutations in the p53 gene?

- A) DNA replication
- B) Cell cycle regulation and apoptosis
- C) Protein synthesis
- D) Membrane transport

Correct Answer: B) Cell cycle regulation and apoptosis

Reasoning: The p53 gene encodes a tumor suppressor protein that regulates the cell cycle and promotes apoptosis in response to DNA damage, preventing the proliferation of damaged cells.

MCAT Biology Question 68

Which of the following best describes the function of plasmodesmata in plant cells?

- A) They facilitate the transport of water and nutrients from roots to leaves.
- B) They connect the cytoplasm of adjacent plant cells for communication and transport.
- C) They store pigments and other secondary metabolites.
- D) They regulate gas exchange between the plant and its environment.

Correct Answer: B) They connect the cytoplasm of adjacent plant cells for communication and transport.

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Reasoning: Plasmodesmata are channels that traverse the cell walls of plant cells, allowing direct cytoplasmic exchange and communication between adjacent cells.

MCAT Biology Question 69

Which of the following describes the primary function of the loop of Henle in the nephron?

- A) To filter blood to form urine.
- B) To reabsorb water and solutes from the filtrate.
- C) To secrete waste products into the filtrate.
- D) To regulate blood pressure by releasing renin.

Correct Answer: B) To reabsorb water and solutes from the filtrate.

Reasoning: The loop of Henle creates a concentration gradient in the medulla of the kidney, allowing for the reabsorption of water and solutes from the filtrate, which is crucial for the concentration of urine.

MCAT Biology Question 70

Which of the following processes occurs during the Calvin cycle of photosynthesis?

- A) Oxidation of glucose to produce ATP
- B) Fixation of carbon dioxide into organic molecules
- C) Splitting of water molecules to release oxygen
- D) Conversion of light energy into chemical energy

Correct Answer: B) Fixation of carbon dioxide into organic molecules

Reasoning: The Calvin cycle, also known as the light-independent reactions of photosynthesis, involves the fixation of carbon dioxide into organic molecules like glucose, using ATP and NADPH produced during the light-dependent reactions.

MCAT Biology Question 71

Which of the following best describes the role of the enzyme DNA gyrase in prokaryotic cells?

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- A) It synthesizes RNA primers.
- B) It relieves the torsional strain generated during DNA replication.
- C) It joins Okazaki fragments together.
- D) It unwinds the DNA double helix.

Correct Answer: B) It relieves the torsional strain generated during DNA replication.

Reasoning: DNA gyrase, a type of topoisomerase, introduces negative supercoils into DNA, which relieves the torsional strain generated ahead of the replication fork during DNA replication in prokaryotes.

MCAT Biology Question 72

Which of the following structures is directly involved in the formation of the spindle apparatus during mitosis?

- A) Centrosome
- B) Nucleolus
- C) Endoplasmic reticulum
- D) Golgi apparatus

Correct Answer: A) Centrosome

Reasoning: The centrosome is the major microtubule-organizing center in animal cells and plays a critical role in forming the spindle apparatus, which is essential for the proper segregation of chromosomes during mitosis.

MCAT Biology Question 73

Which of the following best describes the function of histones in eukaryotic cells?

- A) They degrade misfolded proteins.
- B) They bind to DNA and help package it into chromatin.
- C) They synthesize RNA from a DNA template.
- D) They transport proteins across the nuclear membrane.

Correct Answer: B) They bind to DNA and help package it into chromatin.

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Reasoning: Histones are proteins that bind to DNA and help package it into a compact, organized structure called chromatin, facilitating efficient DNA storage and regulation of gene expression.

MCAT Biology Question 74

Which of the following mechanisms is responsible for the majority of ATP production in aerobic respiration?

- A) Substrate-level phosphorylation
- B) Oxidative phosphorylation
- C) Glycolysis
- D) Fermentation

Correct Answer: B) Oxidative phosphorylation

Reasoning: Oxidative phosphorylation, which occurs in the inner mitochondrial membrane, generates the majority of ATP in aerobic respiration through the electron transport chain and chemiosmosis.

MCAT Biology Question 75

Which of the following best describes the function of the sodium-potassium pump in maintaining resting membrane potential?

- A) It allows passive diffusion of sodium and potassium ions across the membrane.
- B) It pumps sodium out of the cell and potassium into the cell against their concentration gradients.
- C) It generates action potentials by rapidly depolarizing the membrane.
- D) It facilitates the diffusion of neurotransmitters across the synaptic cleft.

Correct Answer: B) It pumps sodium out of the cell and potassium into the cell against their concentration gradients.

Reasoning: The sodium-potassium pump actively transports three sodium ions out of the cell and two potassium ions into the cell, maintaining the electrochemical gradients of these ions and the resting membrane potential.

MCAT Biology Question 76

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Which of the following processes leads to the formation of a mature, fully functional mRNA in eukaryotic cells?

- A) Splicing of introns, addition of a 5' cap, and addition of a poly-A tail
- B) Translation of the primary transcript into protein
- C) Methylation of cytosine residues
- D) Degradation of the primary transcript by ribonucleases

Correct Answer: A) Splicing of introns, addition of a 5' cap, and addition of a poly-A tail

Reasoning: The formation of mature mRNA in eukaryotic cells involves the removal of introns through splicing, the addition of a 5' cap, and the addition of a poly-A tail to the 3' end, which are all essential for stability and translation.

MCAT Biology Question 77

Which of the following correctly describes the primary function of the Calvin cycle in photosynthesis?

- A) To produce ATP and NADPH
- B) To fix carbon dioxide into organic molecules
- C) To split water molecules and release oxygen
- D) To capture light energy and convert it to chemical energy

Correct Answer: B) To fix carbon dioxide into organic molecules

Reasoning: The Calvin cycle, also known as the light-independent reactions, fixes carbon dioxide into organic molecules, such as glucose, using the ATP and NADPH generated during the light-dependent reactions of photosynthesis.

MCAT Biology Question 78

Which of the following is a characteristic feature of apoptosis?

- A) Inflammation and swelling of the surrounding tissue
- B) Random cleavage of DNA
- C) Controlled cell death without releasing harmful substances
- D) Rapid cell proliferation

Website : www.tutorSTEM.caMCAT Page : www.tutorSTEM.ca/mcatPhone Number for Tutor STEM's Medical School MCAT Department : [416-795-5000](tel:416-795-5000)**Correct Answer: C) Controlled cell death without releasing harmful substances**

Reasoning: Apoptosis is a programmed and controlled cell death process that avoids triggering inflammation by containing and degrading cellular components in an orderly manner, preventing the release of harmful substances.

MCAT Biology Question 79

Which of the following best explains the role of tight junctions in epithelial tissues?

- A) They allow free passage of ions and small molecules between adjacent cells.
- B) They provide strong adhesion between epithelial cells and the basement membrane.
- C) They form a barrier that prevents the leakage of molecules between adjacent cells.
- D) They facilitate the exchange of nutrients between epithelial cells and the bloodstream.

Correct Answer: C) They form a barrier that prevents the leakage of molecules between adjacent cells.

Reasoning: Tight junctions create a seal between adjacent epithelial cells, preventing the movement of substances through the space between the cells and maintaining distinct tissue compartments.

MCAT Biology Question 80

Which of the following correctly describes the role of myosin in muscle contraction?

- A) It binds to tropomyosin, exposing binding sites on actin filaments.
- B) It hydrolyzes ATP, providing energy for the power stroke.
- C) It releases calcium ions from the sarcoplasmic reticulum.
- D) It depolarizes the muscle cell membrane to initiate contraction.

Correct Answer: B) It hydrolyzes ATP, providing energy for the power stroke.

Reasoning: Myosin heads hydrolyze ATP to provide the energy needed for the power stroke, pulling actin filaments toward the center of the sarcomere and resulting in muscle contraction.

MCAT Biology Question 81

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Which of the following best describes the role of the lac repressor in the lac operon system of *E. coli*?

- A) It enhances the transcription of the lac operon genes.
- B) It binds to the promoter region to initiate transcription.
- C) It binds to the operator region to inhibit transcription.
- D) It degrades lactose into glucose and galactose.

Correct Answer: C) It binds to the operator region to inhibit transcription.

Reasoning: The lac repressor binds to the operator region of the lac operon, preventing RNA polymerase from transcribing the downstream genes involved in lactose metabolism. In the presence of lactose, the repressor is inactivated, allowing transcription.

MCAT Biology Question 82

Which of the following processes is directly responsible for the reduction of chromosome number during meiosis?

- A) DNA replication
- B) Separation of sister chromatids
- C) Separation of homologous chromosomes
- D) Crossing over

Correct Answer: C) Separation of homologous chromosomes

Reasoning: The reduction of chromosome number in meiosis is achieved during Meiosis I, where homologous chromosomes are separated into two different cells, reducing the chromosome number by half.

MCAT Biology Question 83

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Which of the following molecules acts as a coenzyme in the citric acid cycle and is essential for the production of ATP?

- A) Coenzyme A
- B) NAD⁺
- C) FAD
- D) ATP synthase

Correct Answer: B) NAD⁺

Reasoning: NAD⁺ acts as a coenzyme in the citric acid cycle, accepting electrons and becoming reduced to NADH, which then donates electrons to the electron transport chain for ATP production.

MCAT Biology Question 84

Which of the following best describes the function of the enzyme reverse transcriptase?

- A) It synthesizes DNA from an RNA template.
- B) It synthesizes RNA from a DNA template.
- C) It degrades RNA molecules.
- D) It ligates DNA fragments together.

Correct Answer: A) It synthesizes DNA from an RNA template.

Reasoning: Reverse transcriptase is an enzyme used by retroviruses to synthesize DNA from their RNA genome, allowing integration into the host's genome.

MCAT Biology Question 85

Which of the following best describes the process of clathrin-mediated endocytosis?

- A) The uptake of fluids and dissolved substances into vesicles.
- B) The engulfment of large particles or cells.

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- C) The selective uptake of molecules bound to receptors on the cell surface, facilitated by clathrin-coated vesicles.
- D) The export of substances from the cell via vesicles.

Correct Answer: C) The selective uptake of molecules bound to receptors on the cell surface, facilitated by clathrin-coated vesicles.

Reasoning: Clathrin-mediated endocytosis is a process where specific molecules bound to cell surface receptors are internalized into clathrin-coated vesicles for transport into the cell.

MCAT Biology Question 86

Which of the following best explains the function of telomeres in eukaryotic chromosomes?

- A) They encode essential genes for cell division.
- B) They prevent the ends of chromosomes from being degraded and from fusing with other chromosomes.
- C) They serve as origins of replication for DNA synthesis.
- D) They act as binding sites for RNA polymerase during transcription.

Correct Answer: B) They prevent the ends of chromosomes from being degraded and from fusing with other chromosomes.

Reasoning: Telomeres are repetitive nucleotide sequences at the ends of chromosomes that protect the chromosome ends from degradation and prevent them from fusing with other chromosomes.

MCAT Biology Question 87

Which of the following best describes the mechanism by which allosteric enzymes are regulated?

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- A) Binding of a molecule at the active site inhibits the enzyme's activity.
- B) Phosphorylation of the enzyme changes its activity.
- C) Binding of an effector molecule at a site other than the active site changes the enzyme's conformation and activity.
- D) Cleavage of the enzyme activates it.

Correct Answer: C) Binding of an effector molecule at a site other than the active site changes the enzyme's conformation and activity.

Reasoning: Allosteric regulation involves the binding of effector molecules at sites other than the active site, inducing conformational changes that alter the enzyme's activity.

MCAT Biology Question 88

Which of the following best describes the role of the enzyme ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO) in photosynthesis?

- A) It captures light energy and converts it into chemical energy.
- B) It synthesizes ATP and NADPH in the chloroplast.
- C) It catalyzes the fixation of carbon dioxide into organic molecules during the Calvin cycle.
- D) It transports electrons in the electron transport chain of the chloroplast.

Correct Answer: C) It catalyzes the fixation of carbon dioxide into organic molecules during the Calvin cycle.

Reasoning: RuBisCO is the enzyme responsible for catalyzing the first step of carbon fixation in the Calvin cycle, incorporating carbon dioxide into ribulose-1,5-bisphosphate to form 3-phosphoglycerate.

MCAT Biology Question 89

Which of the following processes occurs in the mitochondria of eukaryotic cells?

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- A) Glycolysis
- B) Calvin cycle
- C) Citric acid cycle (Krebs cycle)
- D) Transcription

Correct Answer: C) Citric acid cycle (Krebs cycle)

Reasoning: The citric acid cycle occurs in the mitochondrial matrix of eukaryotic cells, where acetyl-CoA is oxidized to produce NADH, FADH₂, and ATP.

MCAT Biology Question 90

Which of the following best describes the function of the Wnt signaling pathway in embryonic development?

- A) It regulates cell proliferation, differentiation, and migration.
- B) It induces apoptosis in developing tissues.
- C) It controls the synthesis of ribosomal RNA.
- D) It mediates the transport of nutrients across the placenta.

Correct Answer: A) It regulates cell proliferation, differentiation, and migration.

Reasoning: The Wnt signaling pathway plays a crucial role in regulating cell proliferation, differentiation, and migration during embryonic development, affecting the formation of various tissues and organs.

MCAT Biology Question 91

Which of the following best describes the primary function of ubiquitin in cells?

- A) It marks proteins for degradation by the proteasome.
- B) It transports proteins across the cell membrane.
- C) It acts as a molecular chaperone for protein folding.
- D) It regulates gene expression by binding to DNA.

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Website : www.tutorSTEM.caMCAT Page : www.tutorSTEM.ca/mcatPhone Number for Tutor STEM's Medical School MCAT Department : [416-795-5000](tel:416-795-5000)**Correct Answer: A) It marks proteins for degradation by the proteasome.**

Reasoning: Ubiquitin is a small protein that attaches to other proteins to mark them for degradation by the proteasome, thus regulating protein levels and quality control within the cell.

MCAT Biology Question 92

Which of the following correctly describes the role of cytochrome c in cellular respiration?

- A) It carries electrons from Complex I to Complex III in the electron transport chain.
- B) It acts as the final electron acceptor in the electron transport chain.
- C) It is involved in the formation of ATP by ATP synthase.
- D) It transfers electrons between Complex III and Complex IV in the electron transport chain.

Correct Answer: D) It transfers electrons between Complex III and Complex IV in the electron transport chain.

Reasoning: Cytochrome c is a component of the electron transport chain that transfers electrons from Complex III to Complex IV, playing a crucial role in oxidative phosphorylation.

MCAT Biology Question 93

Which of the following best explains the concept of incomplete dominance in genetics?

- A) Both alleles contribute equally and independently to the phenotype.
- B) One allele completely masks the effect of the other allele.
- C) The heterozygous phenotype is an intermediate between the two homozygous phenotypes.
- D) The phenotype is determined by multiple genes.

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Correct Answer: C) The heterozygous phenotype is an intermediate between the two homozygous phenotypes.

Reasoning: In incomplete dominance, the heterozygous phenotype is a blend or intermediate of the two homozygous phenotypes, rather than one allele being completely dominant over the other.

MCAT Biology Question 94

Which of the following mechanisms is primarily responsible for generating antibody diversity?

- A) Somatic hypermutation
- B) V(D)J recombination
- C) Class switching
- D) Alternative splicing

Correct Answer: B) V(D)J recombination

Reasoning: V(D)J recombination is the process of rearranging variable (V), diversity (D), and joining (J) gene segments in B cells to generate a diverse repertoire of antibodies.

MCAT Biology Question 95

Which of the following correctly describes the role of the enzyme helicase during DNA replication?

- A) It synthesizes RNA primers.
- B) It joins Okazaki fragments together.
- C) It unwinds the DNA double helix.
- D) It relieves the torsional strain generated ahead of the replication fork.

Correct Answer: C) It unwinds the DNA double helix.

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Reasoning: Helicase unwinds the DNA double helix, separating the two strands to allow the replication machinery to access the template strands.

MCAT Biology Question 96

Which of the following best explains the process of genetic drift?

- A) It is a change in allele frequencies due to selective pressures.
- B) It is a change in allele frequencies due to random sampling effects.
- C) It results from gene flow between populations.
- D) It involves changes in the genetic code due to mutations.

Correct Answer: B) It is a change in allele frequencies due to random sampling effects.

Reasoning: Genetic drift is the random fluctuation of allele frequencies in a population due to chance events, which can have a significant impact, especially in small populations.

MCAT Biology Question 97

Which of the following best describes the function of the enzyme pyruvate dehydrogenase?

- A) It converts pyruvate to lactate under anaerobic conditions.
- B) It catalyzes the oxidative decarboxylation of pyruvate to acetyl-CoA.
- C) It phosphorylates glucose during glycolysis.
- D) It converts acetyl-CoA to citrate in the citric acid cycle.

Correct Answer: B) It catalyzes the oxidative decarboxylation of pyruvate to acetyl-CoA.

Reasoning: Pyruvate dehydrogenase converts pyruvate to acetyl-CoA, a crucial step linking glycolysis to the citric acid cycle under aerobic conditions.

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MCAT Biology Question 98

Which of the following best describes the role of T-tubules in muscle contraction?

- A) They store calcium ions.
- B) They conduct action potentials from the sarcolemma to the sarcoplasmic reticulum.
- C) They generate ATP for muscle contraction.
- D) They attach to actin filaments to initiate contraction.

Correct Answer: B) They conduct action potentials from the sarcolemma to the sarcoplasmic reticulum.

Reasoning: T-tubules (transverse tubules) transmit action potentials deep into muscle fibers, ensuring that the sarcoplasmic reticulum releases calcium ions uniformly throughout the muscle, facilitating contraction.

MCAT Biology Question 99

Which of the following is a primary function of the smooth endoplasmic reticulum?

- A) Protein synthesis
- B) Lipid synthesis and detoxification of drugs
- C) DNA replication
- D) Synthesis of ribosomal RNA

Correct Answer: B) Lipid synthesis and detoxification of drugs

Reasoning: The smooth endoplasmic reticulum is involved in the synthesis of lipids, metabolism of carbohydrates, and detoxification of drugs and poisons, contributing to cellular homeostasis.

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MCAT Biology Question 100

Which of the following best describes the function of the enzyme ribonucleotide reductase?

- A) It synthesizes RNA from a DNA template.
- B) It converts ribonucleotides to deoxyribonucleotides.
- C) It degrades RNA molecules.
- D) It ligates RNA fragments together.

Correct Answer: B) It converts ribonucleotides to deoxyribonucleotides.

Reasoning: Ribonucleotide reductase catalyzes the conversion of ribonucleotides to deoxyribonucleotides, providing the building blocks necessary for DNA synthesis.

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