



Appendix 3 – Part 1 Sample Questions and Answers

Part 1A – Radiation Physics and Imaging Techniques (RPIT)

Which property of x-radiation increases attenuation?

- Increased velocity
- Decreased velocity.
- Increased wavelength
- Decreased wavelength.

Which of the following is the effect of altering kV on image density and image contrast?

- Increasing kV decreases radiographic density and increases contrast.
- Increasing kV increases radiographic density and decreases contrast.
- Decreasing kV decreases radiographic density and decreases contrast.
- Decreasing kV increases radiographic density and increases contrast.

Radionuclides used for nuclear medicine imaging must include one of the following emissions:

- Electrons
- Alpha particles
- Gamma rays
- Protons

Which of the following represents the latent image in a phosphor plate?

- Silver ions in a valence band.
- Bromide in the meta-stable state.
- Electrons in the meta-stable state.
- Iodide in a valence band.

If a panoramic imaging is performed at 80 kVp, which of the following interactions will be the predominant interaction with bone?

- Coherent scattering
- Compton scattering
- Photoelectric effect
- Pair production.

Which of the following scanning parameters decreases CBCT scan time with the least amount of image degradation?

- Increasing the detector frame rate
- Increasing the voxel size
- Reducing the number of projections
- Reducing the scan arc

What system element affects spatial resolution in direct radiography flat panel detector systems?

- Phosphor thickness
- Detector element size
- Laser spot size
- Field of view

An increase in what parameter can improve visibility of low-contrast structures in a CT image without increasing radiation dose to the patient?

- Tube current.
- Rotation time
- Slice thickness.
- Increase kV.

Which of the following tissues appears dark in a T2-weighted image? Tissues with a

- short spin-lattice relaxation time.
- long spin-lattice relaxation time.
- short spin-spin relaxation time.
- long spin-spin relaxation time



Describe what happens at the atomic level with exposure and processing of a photostimulable phosphor plate (PSP) used in dentistry (Essay - 4 points).

- The PSP material used for radiographic imaging is “europium-doped” barium fluorohalide on a flexible plastic backing support **(1/2 point)**.
- When exposed to a radiation, valence electrons in europium absorb energy and move into the conduction band **(1/2 point)**.
- These electrons migrate to nearby halogen vacancies in the fluorohalide lattice and may become trapped there in a metastable state **(1/2 point)**.
- The number of trapped electrons is proportional to x-ray exposure and represents a latent image **(1/2 point)**.
- When stimulated by red light of around 600 nm, the barium fluorohalide releases trapped electrons to the conduction band. When an electron returns to the Eu^{+3} ion, energy is released as light in the green spectrum **(1/2 point)**.
- Fiber optics conduct the light from the PSP plate to a photomultiplier tube which converts the light into electrical energy **(1/2 point)**.
- A red filter at the photomultiplier tube selectively removes the stimulating laser light and the remaining green light is detected and converted to a varying voltage **(1/2 point)**.
- The voltage signal is quantified by an analogue to digital convertor and stored and displayed as a digital image **(1/2 point)**.

Part 1B - Radiation Biology, Protection, and Safety (RBPS)

In which phase of the reproductive cycle are cells most sensitive to the damaging effects of radiation?

- G1 phase
- S phase
- G2 phase
- M phase

What is the most radiosensitive organ in young women?

- Breast
- Brain
- Gonads
- Skin

Which of the following interactions is primarily responsible for patient dose in the low diagnostic energy range?

- Coherent scattering
- Compton scattering
- Photoelectric effect
- Pair production.

Which quantity provides a single index that relates to the overall stochastic risk (at diagnostic radiation dose levels) when multiple organs are irradiated?

- Absorbed dose.
- Equivalent dose
- Effective dose
- Air kerma

Which of the following organizations is an advisory body?

- U.S. Nuclear Regulatory Commission (NRC)
- Food and Drug Administration (FDA)
- National Council on Radiation Protection and Measurement (NCRP)
- U.S. Department of Transportation (DOT)



According to the NCRP 145, radiation monitoring of personnel is mandated when the recommended annual dose limit is exceeded by:

- 1%
- 5%
- 10%
- 25%

Late effects of radiation therapy in slowly proliferating tissues arise from which of the following?

- parenchymal hypertrophy and neoplasia.
- vascular and parenchymal damage.
- osteoclastic damage.
- epithelial damage

Which of the following is an effect of sub-lethal damage?

- Delayed cellular apoptosis.
- Maturation of the surviving fraction of cells
- Radio resistance due to oncogene activation
- Repopulation of the surviving fraction of cells

What is the yearly effective dose limit for radiologists under current regulations?

- 10 mSv
- 50 mSv
- 100 mSv
- 0.5 mSv

In communicating the risk of ionizing radiation to the patient, which of the following comparisons is most valid?

- Number of cigarettes smoked.
- Number of hours/days in the sun
- Number of miles traveled in an airplane.
- Number of hours/days of equivalent background radiation

How is the development of radiation-induced cataracts affected by a high dose versus a low dose of radiation?

- The higher dose will increase the probability and the severity will remain the same.
- The higher dose will increase the severity and the probability will remain the same.
- The higher dose will result in a shorter latent period.
- The higher dose will result in longer latent period.

Identify four (4) practical guidelines for protecting occupationally exposed operators in Dentistry from unnecessary radiation exposure. Include any considerations for hand-held dental x-ray units (Essay - 4 points).

- Operators of dental x-ray equipment are not permitted to hold patients, image receptors or the dental x-ray tube head during exposure **(1 point)**
- During the exposure, operators should stand at least 6 feet away from the patient **(1/2 point)** and not in the path of the primary x-ray beam. **(1/2 point)**
- If the operator is unable to comply with this, then they should stand behind a protective barrier. **(1/2 point)**
- For handheld dental x-ray units, operators should be within the zone of occupancy such that the device is perpendicular to the operator **(1/2 point)**, the backscatter shield is positioned at the end of the beam indicating device **(1/2 point)** and the beam indicating device is held against the patient's skin surface **(1/2 point)**

