

MEDICAL PHYSICS AND CHEMISTRY II**SECTION I: MULTIPLE CHOICE QUESTIONS (20 MARKS)**

1. Up to what intensity of radiation is used for mammography?
 - A. < 10keV
 - B. < 70keV
 - C. < 30keV
 - D. < 40keV
2. Radioactive emissions have different ability to penetrate materials. Alpha particles are,
 - A. Relatively big and heavy in atomic terms and a highly ionizing form of radiation able to penetrate the skin
 - B. Relatively big and heavy in atomic terms and a highly ionising form of radiation but not able to penetrate the skin
 - C. Relatively small and light but able to penetrate the skin
 - D. Relatively small and light but unable to penetrate skin.
3. Which of the following statement is false about X-rays?
 - A. Most X-rays have a wavelength ranging from 10^{-8}m to 10^{-4}m ,
 - B. Most X-rays have frequencies in the range of $3 \times 10^{16}\text{ Hz}$ to $3 \times 10^{19}\text{ Hz}$
 - C. Most X-rays have energies in the range of 124 eV to 124 keV.
 - D. Most X-rays have frequencies in the range of 30 petahertz to 30 exahertz
4. The following are conditions necessary for X-ray to be produced except?
 - A. Exposure factors have to be selected.
 - B. The anode has to rotate to full speed
 - C. Electricity has to travel to the anode and cathode filament.
 - D. Electrons have to be boiled off in the filament and are streaming across the anode at tremendous speed.
5. Which of the following statements is true about x-ray beam quantity
 - A. Beam quantity varies inversely as the square of the ratio of change in kVp.
 - B. Beam quantity varies directly as the square of distance.
 - C. The use of filtration decreases x-ray beam quantity to an extent that it depends on other factors
 - D. Beam quantity is inversely directly proportional to mAs.
6. An interaction with matter that occur throughout the diagnostic range involving moderate energy X-ray photons is known as:
 - A. Classical Interactions
 - B. Pair production
 - C. Photodisintegration interactions
 - D. Compton Interactions
7. The statements below describe the application of an electromagnetic waves.
 - i. Used to produce images of hot objects through the colours
 - ii. Produced by the amount of heat dissipated by an object.
 - iii. They are used in hospitals to detect illnesses (diagnosis)
 - iv. Used in warfare missiles and burglar alarm systems

Identify the type of wave whose application is described above.

- A. Infra-red radiation
- B. Visible spectrum
- C. X-Rays
- D. Gamma rays

8. In order to obtain a higher-energy x-rays, one needs to change?
 - A. Tube current
 - B. Exposure time
 - C. Tube voltage
 - D. Filament voltage
9. Which of the following statements is true about non ionizing radiation?
 - A. Deposits energy in the materials through which it passes.
 - B. They have sufficient energy to break molecular bonds or remove electrons from atoms.
 - C. Example include of non-ionizing radiation include; visible light, heat, beta, microwaves, and radio waves
 - D. They are able to cause ionization
10. For X-ray to be produced, the following conditions have to be met except
 - A. Exposure factors have to be selected.
 - B. Electricity has to travel to the anode, cathode and filament.
 - C. Electrons have to be boiled off in the filament and are streaming across the anode at tremendous speed.
 - D. The X-ray tube window has to be opened
11. During the process of X-ray production, the filament electrons penetrate the face of the target to a depth of approximately how many millimeters?
 - A. 0.5 millimeters
 - B. 0.2 millimeters
 - C. 0.1 millimeters
 - D. 0.3 millimeters
12. During x-ray production, what is the shortest binding energy of K-shell electrons in tungsten
 - A. 40 Kev
 - B. 20 Kev
 - C. 70 Kev
 - D. 10 Kev
13. A filament electron has 50 KeV of kinetic energy and strikes a Tungsten K-shell electron. What would be the result of this type of interaction?
 - A. K characteristic
 - B. L characteristic
 - C. No Interaction
 - D. No X-ray produced
14. During x-ray production, in which interaction does the filament electron misses all the orbital electrons and interacts with the nucleus of the target atom.
 - A. Characteristic interactions
 - B. Bremsstrahlung interactions
 - C. Compton interactions
 - D. Classical interactions

15. Which one of the following is a major source of occupational exposure
 - A. Photodisintegration
 - B. Pair production
 - C. Photoelectric interactions
 - D. Compton interaction
16. The filtration of an atomic beam has the effect of
 - A. Improving the quality of the transmitted X-ray beam
 - B. Increasing the quantity of the transmitted X-ray beam
 - C. Reducing the quantity and decreasing quality of the transmitted X-ray beam
 - D. Improving the quality and increasing quantity of the transmitted X-ray beam
17. A specific combination of protons and neutrons in a nucleus is called
 - A. Nucleus
 - B. Nuclide
 - C. Neutrino
 - D. Nucleolus
18. A photon of 10Mev colliding with a nuclear will likely result in which type of interaction
 - A. Photoelectric
 - B. Photodisintegration
 - C. Thompson
 - D. Compton
19. Ultrasound is sound with frequency greater than
 - A. 2 Hz
 - B. 15 Hz
 - C. 20,000 Hz
 - D. 1540 Hz
20. Which of the following statement is NOT true about beam of x-rays?
 - A. Beam of x-ray pass through body tissue unaffected
 - B. Beam of x-ray may transfer all energy to matter and do not pass through the patient to the film
 - C. Beam of x-ray may be diverted with or without energy loss
 - D. Beam of x-ray is monoenergetic

SECTION 2: SHORT ANSWER QUESTIONS- 40MKS

21. With an aid of well labeled diagram, describe the process of coherent scattering (5mks)
22. State five (5) common properties of electromagnetic waves (5mks)
23. The half-life of a sample of a radioactive substance is 98 minutes. How long does it take for the activity of the sample to reduce to $1/32$ of its original value (5mks)
24. With an aid of a graph explain half-life (5 mks)
25. Define the following terminologies as used in radiation dosimetry
- Absorbed dose
 - Threshold dose
 - Exposure dose
 - Maximum permissible dose (5mks)
 - Skin dose (5mks)
26. State five (5) properties of gamma particles
27. State five (5) characteristics of Tungsten that makes it a material of choice for target of the x-ray tube (5mks)
28. Define half value layer, and briefly describe how it can be determined (5mks)

SECTION 3: LONG ANSWER QUESTIONS (40MKS)

- 29.
- Explain 5 applications of radioactivity $\rightarrow \rightarrow \rightarrow \rightarrow \rightarrow$ (10mks)
 - Describe the principles of Geiger Muller tube (10mks)
30. Discuss the principal factors influencing the shape of an x-ray spectrum (20 mks)