



KENYA MEDICAL TRAINING COLLEGE
NYERI CAMPUS
DEPARTMENT OF RADIOGRAPHY AND IMAGING

2021/2022 ACADEMIC YEAR **SEMESTER 2**
MID SEMESTER EXAM

CLASS: SEPT 2021
MODULE: MEDICAL PHYSICS AND CHEMISTRY II
DATE: 06/06/2022
TIME: 1400HRS-1600HRS

INSTRUCTIONS

1. You are allowed **TWO HOUR** for answering **ALL** the **FOUR** questions of this paper
2. You should write legibly and avoid irrelevant matters
3. Questions not numbered or wrongly numbered will not be marked
4. You are advised to read the questions carefully and illustrate your answers by diagrams where necessary
5. Marks indicated along side the questions are for your guidance in planning your answers
6. **DO NOT** write your name on any question paper/answer sheet. Instead, write Your College Number.

QUESTION ONE

1. Derive the equation $N = N_0 e^{-\lambda t}$ (6 marks)
2. Differentiate between radiological half-life and biological half-life (4 marks)
3. Discuss X-ray interaction with materials under the following sub heading
(i) Compton scattering (8 marks) (ii) Photoelectric effect (7 marks)

QUESTION TWO

1. Differentiate between excitation and ionization (4 marks)
2. Describe two processes of X-ray production (12 marks)
3. Classify radiation into two classes (4 marks)
4. How long can a radiation worker stay in 15 rem/hr radiation field if we wish to limit his dose to 1000 mrem? (5 marks)

QUESTION THREE

(5 marks)

1. State characteristics of X-rays
2. With well labelled diagrams discuss factors that affect the shape of an X-ray spectrum

(20 marks)

QUESTION FOUR

1. Define radioactivity, nuclear stability and linear energy transfer **(6 marks)**
2. Define the following terms; Exposure, absorbed dose and equivalent dose **(6 marks)**
3. What is Half Value Layer **(2 marks)**
4. Discuss principles of radiation protection **(6 marks)**
5. Describe any three types of radioactive decay emission **(6 marks)**

SECTION 1: MULTIPLE CHOICE QUESTIONS (20 MARKS)

1. Among the following electromagnetic waves which has the highest frequency?
 - A. Radio waves
 - B. X-rays
 - C. Gamma rays
 - D. ultraviolet radiation
2. During X- radiation production what percentage of energy is converted to x-rays?
 - A. 1%
 - B. 99%
 - C. 90%
 - D. 10%
3. The process of addition or removal of electrons from an ion is called
 - A. Disintegration
 - B. Electrification
 - C. Ionization
 - D. Resistivity
4. Which of the following is the largest source of natural environmental radiation?
 - A. Radium
 - B. Radon
 - C. Carbon
 - D. Helium
5. Which of the following is a unit for absorbed dose?
 - A. Rad
 - B. Rem
 - C. Sievert
 - D. Becquerel
6. The following terminologies are applied in radiation dosimetry except?
 - A. Accurate dose
 - B. Total dose
 - C. Skin dose
 - D. Absorbed dose
7. Which component is added to the tungsten used in x-ray tube anode to reduce surface crazing?
 - A. Aluminum
 - B. Rhenium
 - C. Silver
 - D. Molybdenum
8. The following are functions of anode part of the x-ray tube insert except?
 - A. To convert electron energy to x-radiation
 - B. To dissipate the heat created in the process of x-radiation production
 - C. To act as the positive electrode of the valve
 - D. Thermionic emission of electrons
9. Electrons are emitted in the filament coil in the cathode of x-ray tube insert through _____ emission.
 - A. Thermionic emission
 - B. Photoelectric emission
 - C. Secondary emission
 - D. Field emission

10. The space between the housing and tube insert in the xray tube is filled with
A. Vacuum
B. Oil
C. Air
D. Water
11. Deceleration of charged particles results in the emission of electromagnetic field called _____.
A. X-radiation
B. Characteristic radiation
C. bremsstrahlung radiation
D. Gamma radiation
12. When electron change from one atomic shell to another _____ are produced.
A. X-radiation
B. Characteristic radiation
C. Bremsstrahlung radiation
D. Gamma radiation
13. Ultrasound is sound with frequency greater than _____.
A. 2 Hz
B. 15 Hz
C. 20,000 Hz
D. 1540 Hz
14. While frequency of ultrasound in soft tissues increase, the wavelength
A. Weakens
B. Is constant
C. Increases
D. Decreases
15. The following are inherent filters in x-ray tube except?
A. Aluminum
B. Cooling oil
C. Glass envelope
D. Window of the x-ray tube
16. The linear attenuation coefficient is affected by?
A. Atomic number of the medium
B. Material density
C. Photon energy
D. All of the above
17. Which of the following is not a principle which assist in maintaining low radiation dose during radiographic examination?
A. Time
B. Compression band
C. Distance
D. Shielding
18. Which of the following statement best describe stochastic effects of ionizing radiation?

- A. Probability of occurrence and severity are increased with dose
 - B. Probability of occurrence are increased with exposure
 - C. Probability of occurrence increases with dose while its severity is independent of dose.
 - D. Probability of occurrence is increased with exposure while its severity is decreased with dose.
19. Which of the following is not a stochastic effect of ionizing radiation?
- A. Teratogenesis
 - B. Cognitive decline
 - C. Heart disease
 - D. Cataracts
20. Which of the following interactions contributes to most image fog
- A. Classical
 - B. photoelectric
 - C. pair production
 - D. Compton

SECTION 2: SHORT ANSWER QUESTIONS (40 MARKS)

21. State the major properties of ultrasound (5marks)
22. Which qualities of tungsten makes it a metal of choice to use in the making of x-ray tube anode (5marks)
23. Define attenuation as used in diagnostic radiation and state the four processes of attenuation (5 marks)
24. You measure 37 grams of strontium 90 (half-life = 28.8 years). How much was present 2 years before this? (5marks)
25. State the application of radioactivity (5 marks)
26. Name five basic components of ultrasound equipment (5marks)
27. Give five examples of deterministic effects of ionizing radiation (5 marks)
28. Differentiate between excitation and ionization potential as used in atomic theory. (5marks)

SECTION 3: LONG ANSWER QUESTIONS (40 MARKS)

29. Describe the modes of ultrasound (20 Marks)
30. Describe the decay schemes in radioactivity (20 marks)