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University Examinations 2023/2024

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN MEDICAL MICROBIOLOGY

HML 3423: NUCLEAR MEDICINE

DATE: APRIL 2024

TIME: 2 HOURS

INSTRUCTIONS:

- (i) The paper consists of **Three** Sections
 - (ii) Section A: Multiple Choice Questions
 - (iii) Section B: Short Answer Questions
 - (iv) Section C: Long Answer Questions
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SECTION A: ANSWER ALL QUESTIONS

1. Which physical property is characteristic of radioisotopes?
 - a) High electrical conductivity
 - b) High density
 - c) Radioactivity
 - d) Low melting point
 2. Which of the following elements is commonly used in medical imaging due to its emission of positrons?
 - a) Uranium
 - b) Technetium
 - c) Carbon
 - d) Fluorine
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3. Which of the following radioactive isotopes is commonly used in radiotherapy to treat cancer?
- a) Carbon-14
 - b) Technetium-99m
 - c) Iodine-131
 - d) Tritium
4. Which method is commonly used for the production of technetium-99m ?
- a) Nuclear fission
 - b) Nuclear fusion
 - c) Cyclotron bombardment
 - d) Generator separation
5. Which of the following radiation spectra is associated with gamma decay?
- a) Continuous spectrum
 - b) Discrete spectrum
 - c) Absorption spectrum
 - d) Emission spectrum
6. In the event of a spill involving a radioactive specimen, what is the appropriate immediate action for laboratory personnel?
- a) Attempt to clean up the spill immediately using regular cleaning supplies
 - b) Evacuate the area and notify the radiation safety officer or appropriate personnel
 - c) Contain the spill using absorbent materials and continue working as usual
 - d) Ignore the spill if it is small and not visible to others
7. Which of the following techniques is commonly used to determine the concentration of an analyte in a sample using radioisotope dilution?
- a) Spectrophotometry
 - b) Chromatography
 - c) Mass spectrometry
 - d) Gamma scintillation counting
8. What is the primary goal of plesiotherapy in the treatment of breast carcinoma?
- a) To completely eradicate all cancerous cells from the breast
 - b) To minimize radiation exposure to healthy tissues surrounding the tumor site
 - c) To replace surgical intervention entirely in breast cancer treatment

- d) To promote cancer cell proliferation for better treatment response
9. What is the primary purpose of using radiation dosimeters in nuclear medicine?
- a) To measure the activity of radioactive isotopes used in diagnostic and therapeutic procedures
 - b) To monitor the radiation exposure of healthcare personnel and patients
 - c) To shield patients from radiation during imaging procedures
 - d) To regulate the production and distribution of radioactive isotopes
10. Which of the following features is essential for ensuring radiation safety in nuclear medicine facilities within radiology buildings?
- a) Installation of high-efficiency air filtration systems
 - b) Regular use of high-dose radiation equipment
 - c) Minimization of emergency exits for better containment
 - d) Implementation of strict access control measures
11. Where is a film badge typically worn by personnel working in nuclear medicine facilities?
- a) Around the neck
 - b) On the wrist
 - c) Attached to the clothing collar
 - d) In a pocket
12. Which of the following tissues is most sensitive to the effects of ionizing radiation?
- a) Muscle tissue
 - b) Nervous tissue
 - c) Connective tissue
 - d) Hematopoietic tissue
13. What is the primary principle behind the formation of images in single-photon emission computed tomography (SPECT) imaging?
- a) Measurement of the time-of-flight of gamma rays
 - b) Detection of annihilation photons from positron-electron interactions
 - c) Reconstruction of gamma ray emission data from multiple angles
 - d) Analysis of acoustic waves reflected from tissue
14. In radioimmunoassay (RIA), what is the primary function of the radioisotope labeled antigen or antibody?

- a) To serve as a tracer for the antigen or antibody of interest
 - b) To inhibit the binding of the antigen or antibody to its corresponding antibody or antigen
 - c) To directly measure the concentration of the antigen or antibody in the sample
 - d) To neutralize any interfering substances present in the sample
15. In a competitive radioimmunoassay, how does the concentration of the unlabeled analyte in the sample affect the amount of radioactivity detected?
- a) Higher analyte concentration leads to higher radioactivity detected
 - b) Higher analyte concentration leads to lower radioactivity detected
 - c) Analyte concentration does not affect radioactivity detected
 - d) Analyte concentration affects radioactivity detected in a nonlinear manner
16. In hormone radioimmunoassay, which of the following is typically used as the radioactive label for the hormone?
- a) Technetium-99m
 - b) Iodine-131
 - c) Carbon-14
 - d) Fluorine-18
17. In the context of nuclear medicine studies, which statistical measure is commonly used to describe the spread or dispersion of data points around the mean?
- a) Probability density function
 - b) Standard deviation
 - c) Confidence interval
 - d) Regression coefficient
18. Which law governs the random nature of radioactive decay?
- a) Law of Conservation of Energy
 - b) Law of Mass Action
 - c) Law of Exponential Decay
 - d) Law of Universal Gravitation
19. Which type of radiation is typically used in nuclear medicine imaging?
- a) Alpha radiation
 - b) Beta radiation

- c) Gamma radiation
- d) Neutron radiation

20. Which organization provides guidelines and standards for quality assurance in nuclear medicine?

- a) International Atomic Energy Agency (IAEA)
- b) Food and Drug Administration (FDA)
- c) World Health Organization (WHO)
- d) American Medical Association (AMA)

SECTION B: ANSWER ALL QUESTIONS EIGHT QUESTIONS (5 Marks each)

1. Briefly mention the different types of radiotherapy and give an example of a type of diagnosis for each.
2. Explain how radioactivity lead to ionization and excitation in atoms and molecules?
3. Explain how film badges contribute to ensuring safety in the field of nuclear medicine and radiotherapy?
4. Explain the process of energy absorption and radiation-induced chemical changes in tissues exposed to radiation.
5. Explain vital reasons for practicing safe laboratory procedures when working with radioisotopes?
6. Outline the use of Scintillators in Nuclear medicine?
7. State five physical properties of Radioisotopes.
8. Describe the Schilling test and its purpose in nuclear medicine?

SECTION C: ANSWER ANY TWO QUESTIONS

1. What are the key considerations and safety measures that need to be taken when handling radioactive patients and specimens in the field of nuclear medicine? (20marks)
2. Discuss Quality assurance in Nuclear medicine (20marks)
3. Giving examples, explain how Radionuclides are used in medical diagnosis (20marks)