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**JOMO KENYATTA UNIVERSITY**

**OF AGRICULTURE AND TECHNOLOGY**

**University Examinations 2012/2013**

**YEAR I SEMESTER II EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MEDICAL LABORATORY SCIENCE**

**MLS 2103: MEDICAL DIAGNOSTIC IMAGING SCIENCES**

## DATE: AUGUST 2012 TIME: 2 HOURS

**INSTRUCTIONS:**

* **ANSWER ALL QUESTIONS IN SECTION A AND B AND ONLY ONE QUESTION IN SECTION C.**
* **A WRONG ANSWER OR GUESS WORK WILL RESULT IN A PENALTY OF 0.5 MARKS**
* The following constants may be useful; C = 3.0 x 108, H = 6.62 x 10-34 JS, 1eV = 1.6 x 10-19J, velocity of sound in air = 3.30m/s

**SECTION A - ANSWER ALL QUESTIONS**

1. A diagnostic radiation is marked to have energy 2.0MeV. What is this energy in Joules.

a) 3.2 x 10-13J

b) 2 x 106J

c) 3.2 x 106J

d) 4.2 x 10-10J

2. Radiation energy used in diagnostic radiology is said to suffer attenuation when:

a) Its energy is absorbed and scattered

b) Its energy is hafived

c) Its energy penetrates matter

d) Its energy is detectable

3. The most preffered material for use in the ultrasound probe is:

a) Lead

b) Lead aluminate titanate

c) Zirconate lead titanate

d) Lead Zirconate magnatate

4. The minimum ionization energy required for an ion pair to be produced in gas is:

a) 45Kev

b) 30eV

c) 1MeV

d) 45eV

5. A radiodiagnostic technique for the examination of breast cancer is:

a) CT scan

b) Mammography

c) MRI

d) Radiography

6. A mode of ultrasonic examination where a linear array of transducer probes is used is known as:

a) A- mode

b) B – mode

c) Doppler

d) M- mode

7. The exit dose measured from a bone tissue of length 20cm was found to be 20KeV.

Determine the HVL of the bone tissue if the X-ray source of intensity 140KeV was used.

a) 20cm

b) 7.12cm

c) 14.3cm

d) 0.0123

8. The mass attenuation co-efficient if the bone tissue is its density was 4.3g/cm3

a) 0.0973

b) 0.0223

c) 4.3

` d) 0.0123

9. After the development of the latent image of the radiographic film, it is then placed in ‘a’:

a) Developer solution

b) Fixer solution

c) Water

d) Drier

10. Which of the factors listed affects the attenuation of an incident x-ray radiation inversely.

a) Atomic number

b) Intensity

c) Thickness

d) Density

11. The shorter the wavelength of a radiation the higher the penetration of an

ionizing radiation. This is so because;

a) Wavelength reduced intensity

b) Wavelength increases the energy

c) Wavelength reduces glare

d) Wavelength increases the plank’s constant

12. Which is the main property that makes ultrasound suitable for obstetric sonography

a) Inaudible

b) Non-Ionizing

c) Focused easily

d) Has high frequency

13. Tomography in a CT scan radiology technique refers to:

a) Pixels

b) Gradients

c) Images

d) X-rays used

14. Half Value Layer (HVL) is related to the absorption co-efficient (K) by the relation:

a) K = 

b) -K = 

c) K = HVL ln ½

d) I = Io 

15. A unit of ray dose that measures the amount of exposure caused during diagnosis in known as:

a) Coulombs/kg

b) Gray

c) Sieverts

d) Rad

16. The photographic effect of ionizing radiations has been used in:

a) Radiation personnel monitoring

b) Radiation biological effects

c) Cancer treatment

d) Dose calibration

17. What is the main aim of administering a barium meal during fluoroscopic examination:

a) To protect the patient

b) To minimize dose used

c) To improve contrast

d) To allow for ingestion

18. An ultrasonographer intends to examine a deep seated tissue: If she is on axial

resolution, what must she reduce to achieve her objective:

a) The frequency

b) Scan motion

c) Separation distance

d) Velocity of sound

19. An ionizing radiation interaction where an atom within a tissue is left in an exited

state is known as:

a) Photoelectric effect

b) Piezzoelectric effect

c) Comptom effect

d) Moussbaur effect

20. What would be the effect of reducing the fuse current during the production of diagnostic x-rays:

a) Increases the intensity of x-ray produced

b) Increases the patients dose absorbed

c) Decreased the heating of the target

d) Decreases the exposure time

**SECTION B – ANSWER ALL QUESTIONS**

21. Fluoroscopy is a medical imaging technique that results in the production of real

time images. State any six main applications. (6 marks)

22. Explain the effectiveness of mammography in the early diagnosis of breast cancer.(6 marks)

23. Show that for a soft tissue of length cm having an absorption co-efficient, k, of

ultrasonic waves; the intensity of ultrasonic waves at any distance in the tissues is given by:

I = Io (6 marks)

24. Explain three main factors that effect the quality and quantity of X-rays produced

for medical diagnosis. (6 marks)

25. Describe the production of ultrasonic waves for use in carotid sonography. (6 marks)

**SECTION C – ANSWER ONLY ONE QUESTION**

26. a) Explain the role of radiation detectors in ensuring quality radio-diagnostic

medical imaging in x-ray departments. (6 marks)

b) Describe the principle and operation of scintillation detector. (14 marks)

27. a) Differentiate in principle and practice between ionizing and non-ionizing

radiation imaging techniques. (8 marks)

b) Discuss the production of a radiograph of a bone fractures for an accident

victim referred to a diagnostic medical imaging department. (12 marks)

28. Ionizing radiation use in medical diagnostic imaging is a necessary evil. Discuss. (20 marks)