

**Ph. D. Entrance Test – 2015****Subject: Medical Physics****Paper – I**

**Important:** Please consult your Admit Card/Roll No. slip before filling your Roll Number on the Test Booklet and Answer Sheet.

Roll No.

*In Figure**In Words*

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O.M.R. Answer Sheet Serial No.

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Signature of Candidate: \_\_\_\_\_

Signature of Invigilator: \_\_\_\_\_

**Time: 60 Minutes****Number of Questions: 50****Maximum Marks: 50****DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO.****INSTRUCTIONS:**

1. Write your Roll No. on the Questions Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Question Booklet Serial No. on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point/Black Gel Pen**.
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. Please check that this Question Booklet contains **50** Questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of Test.
5. Each question has four alternative answer (A,B,C,D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point/Black Gel Pen**. **There shall be no negative marking for wrong answers.**
6. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Booklet. No marks will be deducted in such cases.
7. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the question given in the Question Booklet.
8. If you want to change an already marked answer, erase the shade in the darkened bubble completely.
9. For rough work only the blank sheet at the end of the Question Booklet be used.
10. The Answer Sheet is designed for computer evaluation. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e. not following the instructions completely, shall be of the candidate only.**
11. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
12. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so would be expelled from the examination.
13. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistant or found giving or receiving assistant or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
14. **Communication equipment such as mobile phones, pager, wireless set, scanner, camera or any electronic/digital gadget etc., is not permitted inside the examination hall. Use of calculators is not allowed.**
15. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

1. Frequency curve is obtained by smoothing
  - A. Bar Diagram
  - B. Histogram
  - C. Frequency polygon
  - D. Ogive
  
2. The harmonic Mean of the set 2, 4, 8 is:
  - A.  $7/8$
  - B.  $1/14$
  - C. 3.4
  - D.  $3/8$
  
3. Standard error is due to:
  - A. Observer error
  - B. Instrumental error
  - C. Sampling error
  - D. Conceptual error
  
4. The peakedness of a frequency distribution curve is known as:
  - A. Mode
  - B. Kurtosis
  - C. Skewness
  - D. None of the above
  
5. Add two binary numbers (111, 110):
  - A. 1101
  - B. 1110
  - C. 1111
  - D. 1001
  
6. Radioactivity is a phenomenon associated with:
  - A. Electron emission from atoms
  - B. Transformation of nuclei
  - C. Fission of nuclei
  - D. None of the above
  
7. What is the approximate range of beta particle of energy 1 MeV in air:
  - A. 10 cm
  - B. 20 cm
  - C. 30 cm
  - D. 40 cm
  
8. What is the approximate range of alpha particle of energy 5 MeV in air:
  - A. 10 cm
  - B. 2 cm
  - C. 3 mm
  - D. 4 cm
  
9. Photoelectric absorption coefficient varies approximately as
  - A. The first power of the atomic number of the absorber ( $Z$ )
  - B. The second power of the atomic number of the absorber ( $Z^2$ )
  - C. The third power of the atomic number of the absorber ( $Z^3$ )
  - D. None of the above



10. How much exposure of whole body may lead to reduction of lymphocyte and granulocyte counts?
- 0.5 Gy
  - 1 Gy
  - 1.5 Gy
  - 2 Gy
11. One gram of a radioactive substance takes 50 seconds to lose 1 centigram. Half-life of radioactive substance is approximately [Given  $\text{Log}_e(0.99) = -0.01005$ ]
- 45 mins.
  - 57 mins.
  - 63 mins.
  - 40 mins.
12. The neutrino hypothesis was put forward by:
- Einstein
  - Rutherford
  - Pauli
  - Fermi
13. The energy of thermal neutrons is of the order of
- 25 meV
  - 10 eV
  - 10 keV
  - 1 MeV
14. Which of the following is incorrect statement about a photon of frequency ' $\nu$ '?
- Photon rest mass is zero
  - Photon momentum is  $c/h\nu$
  - Photon energy is  $h\nu$
  - Photon exert pressure
15. To get high resolution and low noise background, semi-conductor detector be kept at:
- Low temperature
  - High temperature
  - Any temperature
  - Variable temperature
16. The binary number representation of 24.5 decimal number is :
- $(11000.1)_2$
  - $(1101.01)_2$
  - $(11100.1)_2$
  - $(10100.1)_2$
17. What would be the radiation level at 10 cm distance from a 10 MBq of  $^{57}\text{Co}$ ? Specific gamma ray constant for  $^{57}\text{Co} = 0.2 \text{ mGy/h}$  (k-factor) at 1 cm distance.
- 0.01 mGy/h
  - 0.02 mGy/h
  - 0.03 mGy/h
  - 0.04 mGy/h

18. The total activity of all radioactive waste discharge into sanitary sewage in one year should not exceed:
- A. 2.7 GBq
  - B. 37 GBq
  - C. 170 GBq
  - D. 75 GBq
19. Which of the following is in correct order of increasing wavelengths
- A. Radio waves, visible photons, microwaves, Ultraviolet and X-rays
  - B. Microwaves, Infrared, visible photons, Ultraviolet, Radio waves
  - C. X-rays, Ultraviolet, Infrared, Microwaves, Radio waves
  - D. Radio waves, visible photons, microwaves, Ultraviolet and X-rays
20. The density of nucleus is of the order of:
- A.  $10^5 \text{ kg/m}^3$
  - B.  $10^{12} \text{ kg/m}^3$
  - C.  $10^{17} \text{ kg/m}^3$
  - D.  $10^{27} \text{ kg/m}^3$
21. Ge and Si semiconductors, both P-type and N-type are produced by:
- A. Ionic solids
  - B. Covalent solids
  - C. Metallic solids
  - D. Molecular solids
22. The exposure rate at the surface of a package to be shipped is 50 mrem/hr. What label is required?
- A. DOT Radioactive White I
  - B. DOT Radioactive Yellow II
  - C. DOT Radioactive Yellow III
  - D. no radioactive label is required
23. The most radiosensitive phase of a cell cycle is :
- A. S phase
  - B. M phase
  - C. G1 phase
  - D. G<sup>0</sup> Phase
24. A typical *in vitro* mammalian cell survival curve for low-LET radiations is characterised by :
- A. Exponential curve
  - B. Continuously curving survival curve
  - C. Initial shoulder followed by an exponential part
  - D. Bell curve
25. Radiation induced chromosome type aberrations does not include :
- A. Interstitial deletions
  - B. Dicentric
  - C. Achromatic lesions
  - D. Translocations



26. Which is the correct order of cellular radiosensitivity
- Erythroblasts > Intestinal crypt cells > spermatids > chondrocytes
  - Intestinal crypt cells > spermatids > Erythroblasts > chondrocytes
  - spermatids > Erythroblasts > chondrocytes > Intestinal crypt cells
  - spermatids > Erythroblasts > Intestinal crypt cells > chondrocytes
27. The tissue weighing factor for brain is
- 0.12
  - 0.08
  - 0.04
  - 0.01
28. The local irradiation dose for causing temporary sterility in testes is
- 0.15 Gy
  - 1.5 Gy
  - 3 Gy
  - 5 Gy
29. The prescribed limit for handling group III radionuclide (on the basis of radiotoxicity per unit activity) in a Type III radioisotope laboratory is
- >185 MBq
  - >1.85 GBq
  - >18.5 GBq
  - <18.5GBq
30. You want to know if a culture of cells is in the process of DNA synthesis. You incubate your cells in the presence of radioactive thymidine to see if it is being incorporated into the DNA. What is the best technique to detect the labeled deoxynucleotide in nuclear DNA?
- autoradiography
  - polyacrylamide gel electrophoresis
  - agarose gel electrophoresis
  - two-dimensional gel electrophoresis
31. Oncogenes are the cancer causing genes in the cells but they do not express usually. This is because of the presence of
- Preprotooncogenes
  - Protooncogenes
  - Tumor suppressor genes
  - Transposons

32. Blastoma is a cancer involving which tissue
- A. Bone
  - B. Connective tissue
  - C. Epithelial tissue
  - D. Embryonic tissue
33. Which one of the following does not form a solid neoplasm?
- A. Leukemia
  - B. Lymphoma
  - C. Lipoma
  - D. Sarcoma
34. The LD<sub>50/60</sub> dose for humans is approximately equal to
- A. 1 Gy
  - B. 4 Gy
  - C. 10Gy
  - D. 12Gy
35. The gastrointestinal syndrome is induced by a total body absorbed dose of
- A.  $\geq 100$  Gy of gamma rays
  - B.  $\geq 10$  Gy of gamma rays
  - C.  $<10$ Gy of gamma rays
  - D. 5 -10 Gy of gamma rays
36. Primary legislation to regulate the use of ionizing radiations in India is
- A. Radiation Protection Rules, 1971
  - B. Atomic Energy Rules, 2004
  - C. Atomic Energy Regulation board, 1983
  - D. Atomic Energy Act ,1902
37. Who among the following are responsible for health surveillance of Radiation workers as specified under rule 25 of Radiation Protection Rule, 2004 ?
- A. Competent Authority Of India.
  - B. Licancee
  - C. Radiation Safety Office
  - D. Employee
38. Lead apran used during various X rays diagnostic procedures should have recommended a lead equivalent thickness of
- A. 0.25 – 0.5 mm
  - B. 0.5 – 1 mm
  - C. 1 – 2 mm
  - D. 1.5 – 2 mm
39. What is the unit of Nominal Standard Dose?
- A. Rad
  - B. Ren
  - C. Rets
  - D. Roentgen



40. The generalized equivalent dose (gEUD) is given by the formula  $gEUD = \left[ \sum_i v_i (D_i)^a \right]^{\frac{1}{a}}$ . What happens to its value if 'a' tends to minus infinity
- gEUD approaches to minimum dose
  - gEUD equal to arithmetic mean
  - gEUD equals to geometric mean
  - gEUD approaches maximum dose
41. In FBX dosimeter, presence of benzoic acid
- Decreases  $G(Fe^{3+})$
  - Increases  $G(Fe^{3+})$
  - Has no effect on  $G(Fe^{3+})$
  - Will increase or decrease depending upon the concentration of benzoic acid
42. Ceric-Sulphate Dosimeter is made insensitive to organic impurity by adding
- Benzoic acid
  - Sodium chloride
  - Cerrous ions
  - Xylenol Orange
43. Which chemical dosimeter is best suited for dosimetry of large scale irradiation
- FDX
  - Fricke
  - Ceric-Cerous Sulphate
  - Polyvinyl Chloride
44. During spectrophometric measurement of Fricke dosimeter requires a temperature correction of
- 0.13 % per degree Celsius
  - 0.7 % per degree Celsius
  - 0.15 % per degree Celsius
  - Nil
45. Electrochemical Etching required to magnify the tracks created by neutrons in CR-39 SSNTD is done in
- Only applying potential of 1.5 kV at 3.5 kHz.
  - 7N KOH at 60 degree Celsius applying a potential of 1.5 kV at 3.5 kHz
  - No etching is required as tracks produce and in CR-39 SSNTD are easily viewed under microscope
  - 7N KOH at 120 degree Celsius
46. The helical winding of cathode filament in x-ray Machine facilitate
- Decrease heating due to joule's effect.
  - Larger surface area for electron emission.
  - Decrease resistance and hence increases cathode current.
  - Decrease surface area for electron emission.
47. A transistor acts like a diode and a
- Voltage source
  - Current source
  - Resistance
  - Transformer

48. Which of the following particle is not stable:

- A. Proton
- B. Neutron
- C. Neutrino
- D. Alpha-particle

49. Junction Field Effect Transistors (JFET) contain how many diodes?

- A. Four
- B. Three
- C. Two
- D. One

50. What does a Hall effect sensor sense?

- A. pressure
- B. temperature
- C. moisture
- D. magnetic field

x-x-x