PG - TRB - PHYSICS
TEST No.1 (19PCT01)
UNIT IX – NUCLEAR PHYSICS

Time: 2 Hrs. **Marks: 100**

1. The weakest of four fundamental interactions
   (A) gravitational (B) electromagnetic (C) strong (D) weak
2. The isotope of an element all has the same
   (A) atomic number (B) mass number (C) binding energy (D) half-life
3. Nuclear fusion and Nuclear fission reactions give off energy because
   (A) binding energy per nucleon is least for nuclei of intermediate size
   (B) they liberate neutron
   (C) binding energy per nucleon is most for nuclei of intermediate size
   (D) they liberate protons
4. Nuclear forces are
   (A) spin dependent (B) exchange forces
   (C) extremely short range forces (D) all of the above
5. Source of stellar energy
   (A) chemical reaction (B) fusion reaction (C) fission reaction (D) none of these
6. The process in which heavy nucleus splits into two lighter nuclei is called
   (A) α –decay (B) β - decay (C) nuclear fission (D) nuclear fusion
7. A nuclear reaction is called exoergic if Q value is
   (A) negative (B) positive (C) zero (D) none of these
8. What is the nature of force exerted by a neutron on a proton?
   (A) electromagnetic B) nuclear C) electromotive D) none of these
9. Isotones have
   (A) same number of protons (B) same number of neutrons
   (C) same atomic masses (D) none of these
10. The number of atoms in 235g of U^{235} is
    (A) as same in 233g of U^{233} (B) 239g of U^{239} (C) Avogadro's number (D) all are true
11. Using dimensional analysis check which expression is valid for the radius of Bohr first orbit
    (A) $\frac{4\pi\epsilon_0 m}{\hbar^2 e^2}$ (B) $\frac{\hbar^2 e^2}{4\pi\epsilon_0 m}$ (C) $\frac{4\pi\epsilon_0 \hbar^2}{me^2}$ D) none are true
12. For $^{238}_{92}U$ the radius of the nucleus is approximately
    (A) 5.4 fm (B) 7.5 fm (C) 7.5Å (D) 6.3 fm
13. Which of the set or subset given are magic numbers?
    (A) 2, 8, 18, 32 (B) 50, 82, 126 (C) 2, 8, 20, 50 (D) 2, 8, 20, 50, 82, 126
14. A reaction that releases more energy than is put into it is called
    (A) endothermic (B) exothermic (C) nuclear (D) chemical
15. Isobars have
    (A) same number of protons (B) same number of neutrons
    (C) same atomic masses (D) none of these
16. A 100 g sample of a radioactive element has a half-life of 5 days. How many grams of radioactive material will remain after 15 days?
    (A) 100g (B) 50g (C) 12.5g (D) 25g
17. What type of radiation is stopped by a sheet of paper?
    (A) alpha particle (B) beta particle (C) gamma ray (D) X-ray

18. When a nucleus is divided into its constituents, energy is
    (A) absorbed by the nucleus which then breaks it apart
    (B) transformed into visible light
    (C) none of these
19. When nucleons form a stable nucleus, binding energy is
    (A) created from nothing (B) destroyed into nothing
    (C) released as high energy photon as particle (D) none
20. What force is responsible for the radioactive decay of nucleus?
    (A) Gravitational force (B) weak nuclear force
    (C) strong nuclear force (D) electromagnetic force
21. What law did Ernest Rutherford use to estimate the size of the nucleus?
    (A) conservation of charge (B) conservation of linear momentum
    (C) conservation of energy (D) none of these
22. Why are nuclear energy levels more complex than electron energy levels?
    (A) Nuclear energy levels depend on attractive and repulsive forces.
    (B) Nuclear energy levels are an order of one hundred times as great as electron energy levels
    (C) Electron energy levels depend on the interaction between neutrons and electrons.
    (D) Electron energy levels have greater energy than the nuclear energy levels
23. Which of the following about the nuclear force is true?
    (A) It is an attractive force between electrons and protons in an atom.
    (B) It is a strong, short-range, attractive force between the nucleons.
    (C) It is an attractive force between electrons and neutrons in an atom.
    (D) it is much weaker than the gravitational force
24. Binding energy is
    (A) the amount of energy required to break a nucleus apart into protons and neutrons.
    (B) the amount of energy required to break a nucleus apart into protons and neutrons.
    (C) the amount of energy required to break a nucleus apart into protons and neutrons.
    (D) none of these
25. If m_H is the atomic mass of Hydrogen, m_n is the mass of a neutron, and M is the atomic mass of the atom, which of the following is the mass defect formula?
    (A) $\Delta m = (Zm_H + Nm_n) - M$ (B) $\Delta m = Zm_H + Nm_n + M$
    (C) $\Delta m = Zm_H - Nm_n - M$ (D) $\Delta m = Zm_H - Nm_n + M$
26. Why do heavier nuclei have a greater ratio of neutrons to protons than lighter nuclei?
    (A) to add more nucleons so that the binding energy is greater
    (B) to provide a greater weak nuclear force.
    (C) to provide more attractive electromagnetic force.
    (D) to provide more attractive strong nuclear force to balance the repulsive electromagnetic force.
27. Which of the following is the alpha particle?
    (A) ${}^{0}_{+1}e$ (B) ${}^{0}_{-1}e$ (C) ${}^{1}_{0}e$ (D) ${}^{4}_{2}He$
28. Which of the following about the gamma ray is true?
    (A) It carries a positive charge. (B) It has zero rest mass and a neutral charge
    (C) It can be deflected by a magnetic field. (D) none of these
29. What is the missing element from the following equation
    ${}^{226}Ra_{\ 88} \rightarrow$ ---------- $+ {}^{4}He_{\ 2}$?
    (A) ${}^{230}Rn_{86}$ (B) ${}^{220}Rn_{86}$ (C) ${}^{228}Rn_{86}$ (D) ${}^{222}Rn_{86}$

30. What is the missing element from the following equation $^{14}C_{6} \rightarrow$ ---------- $+ {}^{0}e_{-1}$?
    (A) $^{13}N_7$ (B) $^{12}C_6$ (C) $^{17}O_8$ (D) $^{14}N_7$
31. Gamma rays have the same basic nature as
    (A) alpha particle (B) positiron (C) electron (D) X-rays
32. The following reaction: $^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + 3\,{}^{1}_{0}n$ is called
    (A) fusion (B) fission (C) alpha decay (D) beta decay
33. The following reaction: $^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{2}_{4}He + {}^{1}_{0}n$ is called
    (A) fusion (B) fission (C) alpha decay (D) beta decay
34. An unknown chemical element is presented by the following formula: $^{Z}X_{A}$. What is the name of index Z ?
    (A) atomic mass number (B) atomic number
    (C) principal quantum number (D) orbital quantum number
35. The atomic number is equivalent to number of ---------- in the atom.
    (A) proton (B) proton (C) nucleon (D) none of these
36. Which of the following particles has the smallest mass?
    (A) proton (B) electron (C) nuetron (D) nucleus
37. Which of the following is correct for the number of neutrons in the nucleus?
    (A) N = A - Z (B) N = Z - A (C) N = A + Z (D) N = Z
38. How many nucleons are in the $^{10}Ne_{20}$ atom?
    (A) 12 (B) 30 (D) 18 (D) 20
39. How many neutrons are in the $^{11}Na_{23}$ atom?
    (A) 12 (B) 11 (C) 18 (D) none of these
40. An isotope with a high Binding Energy per nucleon
    (A) will decay in short period of time (B) is very unstable
    (C) is very stable (D) has more proton than neutron
41. The ratio of nuclear density to the density of mercury is about
    (A) 1.3×10^{10} (B) 1.3 (C) 1.3×10^{13} (D) 1.3×10^{4}
42. The binding energy of $_{26}Fe^{56}$ nucleus is ----------.
    (A) 8.8 Mev (B) 88 Mev (C) 493 Mev (D) 413 Mev
43. The half life period of N^{13} is 10.1 minute. Its life time is
    (A) 5.05 minutes (B) 20.2 minutes (C) $\frac{10.1}{0.6931}$ minutes (D) infinity
44. The time taken by the radioactive element to reduce to (1/e) times is
    (A) half life (B) mean life (C) $\frac{half\ life}{2}$ (D) twice the mean life
45. In β-decay
    (A) atomic number decreases by one (B) mass number decreases by one
    (C) proton number remains the same (D) neutron number decreases by one
46. In the nuclear reaction $_{80}Hg^{198} + X \rightarrow {}_{79}Au^{198}\ 1H^{1}$, X – stand for
    (A) proton (B) electron (C) neutron (D) deutron
47. Anaemia can be diagnosed by
    (A) $_{15}P^{31}$ (B) $_{15}P^{32}$ (C) $_{26}Fe^{56}$ (D) $_{11}Na^{24}$
48. The explosion of atom bomb is based on the principle of
    (A) uncontrolled fission reaction (B) controlled fission reaction
    (C) fusion reaction (D) thermonuclear reaction
49. The average energy released per fission is
    (A) 200eV (B) 200MeV (C) 200meV (D) 200 GeV

50. The radio isotope used in agriculture is
(A) ${}_{15}P^{31}$ (B) ${}_{15}P^{32}$ (C) ${}_{11}Na^{23}$ (D) ${}_{11}Na^{24}$

51. The half life period of a certain radioactive element with disintegration constant 0.0693 per day is
(A) 10 days (B) 14 days (C) 140 days (D) 1.4 days

52. The ionization power is maximum for
(A) neutrons (B) α - particle (C) γ - particle (D) β - particle

53. Nuclear fission can be explained by
(A) shell model (B) liquid drop model (C) quark model (D) Bohr atom model

54. The mass defect of a certain nucleus is found to be 0.03 amu. Its binding energy is
(A) 27.93 eV (B) 27.93 KeV (C) 27.93 MeV (D) 27.93 GeV

55. The nuclei ${}_{13}Al^{27}$ and ${}_{14}Si^{28}$ are examples of
(A) isotopes (B) isobars (C) isotones (D) isomers

56. The nuclear radius of ${}_{4}Be^{8}$ nucleus is
(A) 1.3 x 10^{-15} m (B) 2.6 x 10^{-15} m (C) 1.3x10^{-13} m (D) 2.6 x10^{-13} m

57. Mass of a proton is ---------- times as that of an electron.
(A) 1/1836 (B) 1836 (C) 8136 (D) 1/8136

58. If the nucleus radius is 2.6 x 10^{-15}m. The mass number will be
(A) 2 (B) 4 (C) 8 (D) 16

59. Deuterium is isotope of
(A) water (B) hydrogen (C) oxygen (D) boron

60. If R is nucleus radius, A its mass number, then ----------
(A) $R = r_o A^{\frac{1}{3}}$ (B) $R = r_o A^{\frac{-1}{3}}$ (C) $R = \frac{1}{r_o} A^{\frac{1}{3}}$ (D) $(r_o A)^{\frac{1}{3}}$

61. Mass of neutron is ---------- times that of an electron.
(A) 1/1836 (B) 1836 (C) 8136 (D) 1/8136

62. The radius of the nucleus is 5.2F. The number of nucleons in the nucleus is
(A) 52 (B) 104 (C) 64 (D) 128

63. The value of r_o is equal to
(A) 1.3F (B) 1.4F (C) 1.3m (D) 10F

64. 1 fermi is equal to
(A) $10^{-5}m$ (B) $10^{-3}m$ (C) $10^{-6}m$ (D) $10^{-15}m$

65. 1eV =
(A) 1.6 x 10^{19} eV (B) 1.6 x 10^{-19} C (C) 1.6 x 10^{-29} eV (D) 1.6 x 10^{-19} eV

66. 1 amu =
(A) 1.6 x 10^{19} eV (B) 931 MeV (C) $\frac{1}{931}$ MeV (D) 2.7 MeV

67. When mass number increases, nuclear density
(A) increases (B) decreases (C) remains constant (D) may increase or decrease

68. The nuclear force between a proton and another proton inside the nucleus is
(A) zero (B) short range (C) repulsive (D) long range

69. Mass defect appears as ---------- energy of a nucleus.
(A) mass (B) atomic (C) nuclear (D) binding

70. Gravitation force is ---------- times weaker than the nuclear force
(A) 10^{40} (B) 10^{-25} (C) 10^{-40} (D) 10^{-25}

71. Photons are the exchange particles in ---------- interactions.
(A) electromagnetic (B) nuclear (C) gravitational (D) weak

72. Average energy of thermal neutrons is
(A) 0.025eV (B) 0.25 eV (C) 2.5 eV (D) 25 eV
73. An element zX^A successively undergoes three α decays and four β decays and get converted inot element. The mass number and atomic number of the element Y are respectivley
(A) A-12, Z-2 (B) A-12, Z+2 (C) A-12, Z+4 (D) A-8, Z+2
74. The unit of decay constant or disintegration constant is
(A) no unit (B) second (C) second $^{-1}$ (D) curie
75. The fuel used in Kaminin reactor
(A) $_{92}U^{238}$ (B) $_{92}U^{233}$ (C) $_{92}U^{239}$ (D) low enriched uranium
76. The mean life τ and half-life $T_{½}$ of a radioactive element are related as
(A) $\tau = 2\ T_{½}$ (B) $\tau = \frac{T_{½}}{0.6931}$ (C) $\tau = 0.693\ T_{½}$ (D) $\tau = \frac{T_{½}}{2}$
77. Roentgen (R) is the unit to measure
(A) X-ray strength (B) number of holes produced by X-rays (C) radiation exposure (D) number of cancer cells
78. ---------- is used to measure the intensity of radioactive radiation.
(A) GM counter (B) velocity selector (C) CRO (D) electron gun
79. On an average ---- neutrons per fission are released
(A) 2 (B) 3 (C) 2.5 (D) 5
80. A fuel bundle consists of ---------- fuel rods.
(A) 5 (B) 11 (C) 19 (D) 31
81. Which of the following is not a moderator?
(A) liquid sodium (B) ordinary water (C) graphite (D) heavy water
82. BARC is situated at
(A) Trombay (B) Kalpakkam (C) Trivandrum (D) Thumba
83. Gieger Muller Counter is used to detect
(A) proton (B) neutron (C) photon (D) none of these
84. A free neutron is
(A) stable (B) unstable (C) is lighter than a proton (D) none of these
85. Stability of nuclei requires the ratio of neutron to proton to be around -------- for heavy nuclei.
(A) 1:1 (B) 3:2 (C) 2:3 (D none of these
86. ---------- part of the binding energy curve is considered as evidence of atom-like shell structure in nuclei.
(A) Smooth (B) Varying (C) Peaks (D) none of these
87. The nature of binding energy curve shows that --------- nuclear reactions are possible.
(A) stable (B) unstable (C) exothermic (D) endothermic
88. Scintillation counter depends upon
(A) inoisation property (B) photographic effect (C) fluoresecence (D) none of these
89. GM counters works at ---------- region.
(A) low voltage (B) high voltage C) none of these (D) both A & B
90. In GM counter region pulse height is ---------- to the initial number of ions and their energy.
(A) dependent (B) independent (C) proportional (D) none of these
91. Scintillation counter is used for the detection and measurement of ------ of atomic radiation.
(A) charge (B) energy (C) none of these

92. In a bubble chamber ---------- is formed in super heated liquid.
(A) liquid drop (B) vapour bubble (C) none of these

93. The energy to which a particle can be accelerated in a cyclotron is limited due to change in ---- with velocity.
(A) position (B) momentum (C) Mass (D) none of these

94. The basic cyclotron resonance equation is
(A) $f = \frac{Be}{2\pi m}$ (B) $f = \frac{2\pi m}{Be}$ (C) $T = \frac{Be}{2\pi m}$ (D) none of these

95. A machine in which magnetic field is kept constant and the frequency of the applied electric field is varied is
(A) synchrotron (B) frequency modulated cyclotron
(C) synchro-cylotron (D) Both B & C

96. ---------------- provides the highest energy particle of all the particle accelerators.
(A) cyclotron (B) synco-cyclotron (C) proton cyclotron (D) betatron

97. The physical quantity that is not conserved in nuclear reactions are
(A) spin (B) energy (C) mass number (D) magnetic dipole moment

98. The nuclear reactor is said to be subcritical when the multiplication factor , k is
(A) greater than 1 (B) equal to 1 (C) lesser than 1 (D) none of these

99. The nucleus of the greatest stability is found in the isotopes of the element
(A) aluminium (B) iron (C) hydrogen (D) lead

100. The decay rate of a radioactive isotope can be increased by increasing the
(A) temperature (B) pressure (C) size of the sample (D) none of these