-: Modern physics:-

Chapters: - 1. Nuclear physics, 2. Radioactivity, 3. Solid state electronics, 4. Digital electronics, 5. Elementary particles & 6. Soft-condensed matter physics.

01. The number of protons and neutrons present in $_{92}U^{236}$ are,

1) 236 & 328 2) 92 & 144

3) 92 & 92 4) 236 & 92

02. Assuming the effective radius to be 1.2 fermi, the mass no. of a nucleus with radius 6 fermi, is

1) 125 2) 5

3) 25 4) 225

03. The charge on the nucleus of an atom is 12.8×10^{-19}C. Its atomic no. is

1) 8 2) 4
3) 2 4) 6

04. If the masses of proton and neutron are taken approximately equal, the ratio of the rest masses of $_3Li^7$ and $_5B^{10}$ is

1) 10:7 2) 7:10

3) 3:5 4) 5:3

05. Nuclear force is

a) Charge dependent, b) spin independent,

c) Strongly attractive & d) exchange type.

1) a) and b) are wrong 2) b) and c) are wrong

3) b) and d) are wrong 4) c) and d) are wrong

06. If Avogadro's number is 6×10^{23}, then the numbers of protons, neutrons and electrons in 4 gm of $_2He^4$ are

1) $12x\ 10^{23}$, $12x\ 10^{23}$ & $12x\ 10^{23}$ 2) $24x10^{23}$, $24x10^{23}$ & $24x10^{23}$

3) $24x10^{23}$, $12x10^{23}$ & $24x10^{23}$ 4) $12x10^{23}$, $24x10^{23}$ & $12x10^{23}$

07. The binding energy per nucleon of C-12 is 7.68MeV and that of C-13 is 7.47 MeV. The energy required to remove a neutron from C-13 is

1) 0.21 MeV 2) 2.52 MeV 3) 4.95 MeV
4) 2.75 MeV

08. The specific binding energies of deuteron ($_1D^2$) and helium ($_2He^4$) are 1.1 MeV and 7 MeV respectively. If two deuterons combine to form a helium, an energy of

1) 23.6 MeV is released 2) 8.1 MeV is released 3) 23.6 MeV is absorbed 4) 8.1 MeV is absorbed

09. When an atom of U^{235} undergoes fission after capturing a slow neutron, the average energy released and the numbers of fresh neutrons produced are respectively

1) 200 MeV & 3-4 2)100 MeV & 3-4

3) 200 MeV & 2-3 4)100 MeV & 2-3

10. In a nuclear reactor, $_{92}U^{235}$ captures a thermal neutron and undergoes fission to release about 200MeV of energy. If $2.5x10^{15}$ atoms of $_{92}U^{235}$ are used up in 10 milli sec, the power output of the reactor is

1) 8MW 2) 4MW 3) 16MW
4) 6MW

11. The nuclide 'A' is converted into 'C', via the following reaction:

$A \rightarrow B + {}_2He^4$, $B \rightarrow C + 2\ {}_{-1}e^0$, then

1) A & C are isotopes 2) A & C are isobars

3) A & B are isobars 4) A & B are isotopes

12. When $_{92}U^{238}$ nucleus at rest, decays by emitting an α- particle having a speed 'u', the recoil speed of the residual nucleus is

1) -4u/238 2) +4u/238 3) -4u/234
4) +4u/234

13. When $_{92}u^{238}$ decays into $_{82}Pb^{206}$ during its activity, the number of α-particles and β- particles emitted are

1) 6 and 8 2) 8 and 6
3) 8 and 4 4) 4 and 8

14. The slope of the straight line graph obtained when logA (where A- activity) is plotted versus time gives

1) Decay constant 2) Half -life 3) Mean -life
4) Activity

15. The activity of a freshly prepared radioactive sample is 10^{10}disintegrations per second, whose mean life is 10^9s.
The mass of an atom of this radioisotope is 10^{-25} kg. The mass (in mg) of the radioactive sample is

1) 3 2) 2

3) 1 4) 0

16. In a radioactive decay process, radioactive nucleus emits four α- particles and six β-particles. The ratio of number of neutrons to that of protons is

1) [(A-Z)-16]/ (Z-8) 2) [(A-Z)-10]/ (Z-2) 3) [(A-Z)-14]/ (Z-2) 4) [(A-Z)-8]/ (Z-2)

17. The radius of a nucleus with mass number 16 is $3x10^{-15}$m. The radius of a nucleus of mass number 128 is

1) $3x10^{-15}$m 2) $1.5x10^{-15}$m 3) $6x10^{-15}$m
4) $4.5x10^{-15}$m

18. The masses of proton, neutron and deuteron are 1.00893, 1.00813 and 2.01473 (amu) respectively. The packing fraction of the deuteron(in amu)is

1) $11.65x10^{-4}$ 2) $23.5x10^{-4}$ 3) $33.5x10^{-4}$ 4) $47.14x10^{-4}$

19. In carbon-nitrogen cycle, the number of protons fused and the number of positrons released in the process are respectively,

1) 4 & 4 2) 4 & 2 3) 2 & 4
4) 4 & 6

20. A radioactive sample with a half-life of one month has the label “Activity=2μci on 1-08-2011”. What was its activity three months earlier?

1) 1 μci 2) 8 μci 3) 16 μci
4) 0.5 μci

21. The activity of a radioactive sample diminishes from 1024 to 128 in 2 minutes. In 6 minutes, the activity diminishes to

1) 16 2) 8 3) 4
4) 2

22. A radioactive element X with a half-life of 2 hours decays giving a stable element Y. After a time‘t’ the ratio of X and Y atoms is 1:7, then‘t’ is

1) 6 hours 2) 4 hours 3) 5 hours
4) 14 hours

23. There are three lumps of a given radioactive substance. Their activity is in the ratio of 1:2:3 now. What will be the ratio of their activity at any further date?

1) 1:2:3 2) 3:2:1 3) 2:1:3
4) 2:3:1

24. The radioactivity of a sample is A_1 at time t_1 and A_2 at time t_2. If the mean life of the sample is T, the number of atoms that have disintegrated in the time interval of (t_1-t_2) is

1) $(A_1- A_2)$ 2) $(A_1- A_2)/T$ 3) $(A_1- A_2)$ T
4) $(A_1t_1- A_2 t_2)$

25. A piece of copper and a piece of germanium are cooled from room temperature to 80K. The resistance of

1) Each of them increases

2) Each of them decrease

3) Copper increases and germanium decreases

4) Copper decreases and germanium increases

26. In the classification of solids into conductors, insulators and semiconductors, band theory considers the relative positions of

1) Any valence band and any conduction band

2) Highest valence band and lowest conduction band

3) Lowest valence band and highest conduction band

4) Highest valence band and highest conduction band

27. Reverse biasing the p-n junction

1) Decreases the width of junction barrier

2) Increases the width of junction barrier

3) Increases the majority charge carriers

4) Decreases the minority charge carriers

28. If a metal wire is connected between the two ends of a p-n junction, then through the wire there will be

1) A weak steady current from n-side to p-side

2) A weak steady current from p-side to n-side

3) Not be any steady current

4) A varying current

29. A rectifier is an electronic circuit which converts

1) A.C into D.C

2) D.C into A.C

3) A.C into pulsating D.C

4) High A.C voltage into low A.C voltage

30. The three regions of a transistor in the decreasing order of doping concentration are

1) Base, emitter, collector 2) Base, collector, emitter

3) Emitter, base, collector 4) Emitter, collector, base

31. In the ascending order of their magnitudes, the three currents in a transistor circuit are

1) I_B , I_C , I_E 2) I_E , I_C , I_B

3) I_E , I_B , I_C 4) I_B , I_E , I_C

32. When a transistor is used as an amplifier,

1) Both the junctions are forward biased

2) Both the junctions are reverse biased

3) Emitter-base junction is forward biased and collector- base junction is reverse biased

4) Emitter-base junction is forward biased and collector- base junction is not biased

33. In a half-wave rectifier, load current flows for a time interval equal to

1) The complete cycle of input A.C

2) Only half the cycle of input A.C

3) More than half the cycle of input A.C

4) Less than half the cycle of input A.C

34. Y=A+B is the Boolean expression for

1) NOT gate 2) OR gate 3) AND gate 4) NOR gate

35. The universal gates are

1) OR and AND 2) NOR and NAND 3) OR and NOT 4) NOT and AND

36. In a given n-p-n transistor, it is found that the collector current is 90% of the emitter current. The base current is

1) 10% of emitter current
2) 10% of collector current
3) 90% of emitter current
4) 90% of collector current

37. The elementary particles which participate in weak interaction are called

1) Hadrons 2) Leptons 3) Photons 4) Gravitons

38. The composition of 'proton' on the basis of quark model is

1) uud 2) usd 3) udd 4) uss

39. An example of water in oil type of emulsion is

1) Milk 2) Butter

3) Ice-cream 4) Cold-cream

40. The liquid crystalline phase normally used in LCD is

1) Smectic 2) Cholesteric 3) Twisted nematic 4) Lyotropic

41. The nuclear radius of an atomic nucleus ${}_{Z}X^{A}$, varies as

1) $Z^{1/2}$ 2) $A^{1/2}$ 3) $Z^{1/3}$ 4) $A^{1/3}$

42. The ratio of the radii of two nuclei with mass numbers 8 and 64, is

1) 1:2 2) 1:8 3) 2:3 4) 2:1

43. The number of nucleons present in the nucleus of an atom of atomic no.Z and mass no. A, is

1) A-Z 2) A+Z 3) A 4) Z

44. The density of a nucleus of mass no. A, is proportional to,

1) A^3 2) A^2

3) A^1 4) A^0

45. The charge on the nucleus of atomic number Z and mass number A, is (e-charge on a proton)

1) Ae 2) Ze 3) (A+Z) e
4) (A-Z) e

46. The ratio of the charges on the nuclei of hydrogen and helium is,

1) 1:2 2) 2:1 3) 1:4
4) 4:1

47. Nuclear mass of an atom of atomic number Z and mass number A is given by

1) Zm_p+ (A-Z) m_n 2) Am_p+ (A-Z) m_n 3) Zm_p+ (A+Z) m_n 4) Z m_n + (A-Z) m_p

48.The packing fraction of an atomic nucleus of atomic number Z, mass number A and rest mass M, is

1) (A-M)/Z 2) (M-A)/A 3) A/(M-A)
4) Z/(A-M)

49. The packing fraction of a certain nucleus is negative. It shows that, the nucleus is

1) Unstable 2) Fissionable 3) Stable 4) Radioactive

50. The packing fraction of an atomic nucleus is

1) Mass-defect per nucleon 2) Mass-defect per proton 3) Mass-defect per neutron 4) Mass-defect per electron

51. In the nuclear reaction given by ${}_7N^{14} + {}_2He^4 = {}_mX^n + {}_1H^1$, what is the nucleus ${}_mX^n$?

1) Oxygen of mass number 18

2) Nitrogen of mass number 18

3) Oxygen of mass number 16

4) Oxygen of mass number 17

52. In a typical fission reaction, a U^{235} nucleus absorbs a slow neutron and becomes a compound nucleus U^{236} in a highly excited state. U^{236} then undergoes fission, producing two fission fragments (Xe^{140} and Sr^{94}) and two neutrons. Typically what should be the energy of the slow neutron that initiates the fission reaction in U^{235} nucleus?

1) 25 Mev 2) 2.5 KeV

3) 250 eV 4) 0.025 eV

53. Which of the following is/are the energy source of the Sun?

1) Cold fusion of helium nucleus 2) Solar wind
3) Fission of helium nucleus 4) Fusion of hydrogen nuclei

54. Fusion is difficult to achieve. What is the reason?

1) The nucleus will collapse together.
2) The nuclei will repel each other.
3) The presence of electrons hinders the fusion.
4) There is a lack of hydrogen atom.

55. In a nuclear pressurized water reactor, water acts as both a heat transfer agent and a moderator. Being a moderator, what is the function of the water?

a) It slows down the neutrons in order to increase the probability of nuclear interaction.
b) It absorbs the neutrons and hence decreases the reaction rate.
c) It prevents a chain reaction from occurring.

1) (a) only 2) (b) only
3) (a) and (b) only 4) (b) and (c) only

56. The binding energy per nucleon for the parent nucleus is E_1 and that for the daughter nuclei is E_2. Then

1) $E_1 = 2\,E_2$ 2) $E_2 = 2\,E_1$

3) $E_1 > E_2$ 4) $E_2 > E_1$

57. In an atom bomb, the reaction which occurs is

1) Thermo nuclear 2) Uncontrolled fission

3) Controlled fission 4) Nuclear Fusion

58. According to Yukava, the nuclear forces arise as a result of exchange of certain particles between the nucleons. These particles are

1) Positrons 2) Neutrinos 3) Mesons
4) Leptons

59. Two isolated neutrons are placed 150nm apart. If F_N is the nuclear force and F_E is the electrical force between them, then

1) $F_N = 0$ and $F_E = 0$ 2) $F_N \neq 0$ and $F_E = 0$

3) $F_N = 0$ and $F_E \neq 0$ 4) $F_N \neq 0$ and $F_E \neq 0$

60. When the nucleus of a radioactive sample ${}_ZX^A$ emits an α- particle and then a β- particle, the result is

1) Z decreases by 2 & A decreases by 4

2) Z increases by 1 & A decreases by 4

3) Z decreases by 1 & A decreases by 4

4) Z increases by 2 & A increases by 4

61. A radioactive element emits a Gamma ray photon. As a result its atomic number and mass number

1) Both decrease by 2 2) Both decrease by 4 3) Both remain the same 4) Both become zero

62. A radioactive sample has a half-life of 1600 years. The time required for 75% of the atoms in the sample to disintegrate is

1) 3200years 2)1600years 3) 800years
4) 6400years

63. The ratio of half- life and mean-life of a radioactive element is

1) 0.693 2) 0.707 3) 1.44
4) 2.303

64. The half-life of a radioactive element is 20 milli- sec. Its average-life (in milli- sec) is

1) 28.57 2) 13.57 3) 0.0345
4) 20

65. The radio-isotope used in the treatment of skin deceases is

1) Phosphorous-39 2) Iodine-131 3) Gold-189
4) Carbon-14

66. The radio isotope used in determining the age of an archaeological specimen is

1) Phosphorous-39 2) carbon-14

3) Chromium-51 4) Iodine-131

67. The minimum Gamma ray energy required to produce an electron- positron pair is

1) 1.02 MeV 2) 0.51 MeV

3) 931 MeV 4) 2.04 MeV

68. Which of the following has the highest neutron-proton ratio?

1) ${}_{8}O^{16}$ 2) ${}_{2}He^{4}$ 3) ${}_{26}Fe^{56}$
4) ${}_{92}U^{235}$

69. In the nuclear reaction ${}_{1}H^{2}+{}_{1}H^{1}\rightarrow{}_{2}He^{3}+x$, x is

1) Neutron 2) Proton 3) Positron
4) Photon

70. If 10% of a radioactive material decays in 5days, then the amount of the original material left after 20 days is

1) 60% 2) 65% 3) 70%
4) 75%

71. Percentage of the atoms that disintegrate in a time interval equal to one mean-life is

1) 63 2) 37

3) 50 4) 45

72. A small impurity is added to germanium to get a p-type semiconductor. This impurity atom is

1) Trivalent 2) Pentavalent 3) Bivalent
4) Monovalent

73. In a good conductor, the forbidden energy gap is

1) Zero 2) Wide 3) Narrow
4) Infinite

74. In an insulator, the energy gap between the valence and conduction bands is of the order of

1) 1eV 2) 5eV 3) 1keV
4) 1MeV

75. In the depletion region of an unbiased p-n junction there are

1) Only electrons 2) Only holes 3) Both electrons and holes 4) Only fixed ions

76. The depletion region in a p-n junction is formed due to the

1) Drift of electrons

2) Drift of holes

3) Diffusion of charge carriers

4) Drift of minority charge carriers

77. In intrinsic semiconductor at zero K, the number of electrons and holes are

1) Equal 2) Zero 3) Infinity
4) Unequal

78. Which of the following doping will produce a p-type semiconductor?
1) Germanium with phosphorus 2) Silicon with Germanium
3) Germanium with Antimony 4) Silicon with Indium

79. The dispersion of tiny droplets of one liquid in another liquid is called

1) Froth 2) Emulsion 3) Sol
4) Gel

80. The cleaning action of soaps and detergents is due to

1) Emulsions 2) Sols 3) Foams
4) Gels

81. Cod liver oil is an emulsion in which

1) Fat is dispersed in water 2) Water is dispersed in fat 3) Water is dispersed in oil 4) Oil is dispersed in water

82. The elementary particles which interact through the strong force are called

1) Hadrons 2) Leptons 3) Photons
4) Gravitons

83. The particles not belonging to the category of hadrons and leptons are

1) Electrons 2) Protons 3) Neutrons
4) Photons

84. Particles having zero or integral spins and masses lying between those of electron and proton are

1) Mesons 2) Baryons 3) Leptons
4) Hadrons

85. The particle emitted during β- decay of a radioactive nucleus is

1) Electron 2) Positron 3) Both electron and positron 4) Either electron or positron

86. The ‘Neutrino hypothesis’ was proposed by

1) Einstein 2) Pauli 3) Becquerel
4) Curie

87. The charges of u, d and s quarks are

1) +2e/3, -e/3 & -e/3 2) -2e/3, +e/3 & +e/3 3) +e/3, -e/3 & +e/3 4) +e/3, +e/3 & -2e/3

88. The composition of ‘neutron’ on the basis of quark model is

1) uud 2) usd 3) udd
4) uss

89. The output of a two input AND gate is 1 only when its

1) Either input is 1 2) Either input is 0 3) Both inputs are 1 4) Both inputs are 0

90. According to the rules of addition in binary system 1+1 is equal to

1) 0 2) 1 3) 2
4) 10

91. The following is the truth table of which gate?

1) OR gate 2) NOR gate

3) AND gate 4) NAND gate

A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

92. Soda water contains dissolved

1) Oxygen 2) Carbon dioxide 3) Sodium salt
4) Lime

93. If μ_e and μ_h are the mobility's of electrons and holes respectively, then

1) $\mu_e = \mu_h$ 2) $\mu_e > \mu_h$

3) $\mu_e < \mu_h$ 4) Depends on the semiconductor

94. A p-n junction is used as a

1) Resistor 2) Rectifier

3) Amplifier 4) Voltage source

95. The number of junctions and the number of terminals in a transistor are respectively

1) 2, 2 2) 2, 3 3) 3, 2
4) 1, 2

96. The phase difference (in rad) between the transistor output and the input voltage in a common emitter amplifier is

1) 0 2) π 3) π/2
4) π/4

97. A transistor in common emitter mode has

1) a high input resistance and low output resistance
2) a medium input resistance and high output resistance
3) a very low input resistance and a low output resistance
4) a high input resistance and a high output resistance

98. The relation connecting the three currents in a transistor is

1) $I_E = I_B + I_C$ 2) $I_C = I_E + I_B$

3) $I_B = I_E + I_C$ 4) $I_E = I_C - I_B$

99. A nucleus splits into two nuclear parts having radii in the ratio 1:2. The ratio of their velocities is

1) 7:8 2) 3:4 3) 5:8
4) 1:8

100. Digital circuits can be made by repetitive use of

1) OR gates 2) AND gates 3) NOT gates
4) NOR gates