## PART 13 — PHYSICS AND MATERIAL SCIENCE

### (Answer ALL questions)

76. Materials exhibiting different properties along different directions are called

    1. isotropic
    2. amorphous
    3. anisotropic
    4. crystalline

77. The coordination number of BCC structure is

    1. 6
    2. 8
    3. 12
    4. 4

78. Effective number of atoms belonging to the unit cell of FCC structure is

    1. 14
    2. 8
    3. 4
    4. 2

79. If 0.28 nm is the interatomic distance of $NaCl$ crystal, the lattice parameter is

    1. 0.14 nm
    2. 0.42 nm
    3. 0.56 nm
    4. None of the above

80. In a crystal cell, $a$, b and c represent unit translational vectors along x, y and $z$ axes. A plane makes intercepts 2a, 3b along $x$ and y axes and runs parallel to $z$ axis. Miller indices corresponding to this plane is

    1. $(2\ 3\ \infty)$
    2. $2\ 3\ 0$
    3. $(3\ 0\ 2)$
    4. $(3\ 2\ 0)$

81. If the lattice parameter of cubic crystal is 1 nm and the distance between two parallel planes is $1/\sqrt{3}$ nm, the Miller indices of the planes are

    1. $(1\ \bar{1}\ 0)$
    2. $(1\ 0\ \bar{1})$
    3. $(0\ 0\ \bar{1})$
    4. $(1\ \bar{1}\ 1)$

82. The plastic deformation of a crystal is due to the presence of

    1. Schottky defect
    2. Point defects
    3. Frenkel defect
    4. Dislocations which move

83. A plate carrying charge of 0.5 coulomb is accelerated through a potential of 2000 volts. It attains a kinetic energy equal to

    1. 1000 kilowatt hours
    2. 1000 Joules
    3. 900 ergs
    4. 1500 ergs

84. There are two charges $+1$ coulomb and $+5$ coulomb interacting among themselves. The ratio of forces acting on them will be

    1. $1:25$
    2. $5:1$
    3. $1:1$
    4. $1:5$

85. There are 10 condensers each of capacity 5 $\mu F$. The ratio between maximum and minimum capacity obtained from these condensers will be

1. $100 : 1$
2. $60 : 9$
3. $1 : 100$
4. $1 : 5$

86. Two bulbs, one of 50 watts and another of 25 watts are connected in series to the mains. The current

1. through the 25 watt bulb is more
2. through the 50 watt bulb is more
3. is different in different bulbs
4. is the same in both the bulbs

87. A bar magnet is cut exactly at the middle of its length. The pole strength of the resulting magnets

1. reduces to half its original value
2. increases twice to its original value
3. reduces to one fourth of its initial value
4. remains the same

88. The magnetic field at a distance d from a short bar magnet in longitudinal and transverse position are in the ratio

1. $1 : 4$
2. $2 : 1$
3. $3 : 2$
4. $5 : 4$

89. If E is the kinetic energy of the material particle of mass m, then the de Broglie wavelength is given by

1. $h/\sqrt{2mE}$
2. $\sqrt{2mE}/h$
3. $h\sqrt{2mE}$
4. $h/2mE$

90. Existence of matter wave was experimentally first demonstrated by

1. Newton
2. Planck
3. Davission and Germer
4. deBroglie

91. When an electron is accelerated, if deBroglie wavelength is $1\,\text{Å}$, then the applied voltage is nearly equal to

1. 15 Volts
2. 12 Volts
3. 500 Volts
4. 150 Volts

92. When the potential difference between the electrodes of an X–ray tube is increased, it results in an increase in

1. intensity
2. frequency
3. wavelength
4. speed of X – rays

**93.** T. Maiman invented

1. He–Ne laser

2. $CO_2$ laser

3. Ruby laser

4. Nd: YAG laser

**94.** We observe colours in thin films only because

1. thick films absorb light

2. reflection is possible only in thin films

3. interference condition is satisfied only in thin films

4. dispersion is possible only in thin films

**95.** An alpha particle of energy $5$ MeV is scattered through $180°$ by a fixed uranium nucleus. The distance of closest approach is of the order of

1. $10^{-12}$ cm

2. $10^{-10}$ cm

3. $10^{-15}$ cm

4. $10^{-8}$ cm

**96.** The ratio of Rydberg constant for helium to the Rydberg constant for hydrogen is

1. $2 . 3$

2. $3 . 2$

3. $4 : 1$

4. $1 : 4$

**97.** What percentage of original radioactive atoms is left five half-lives?

1. $10$

2. $20$

3. $5$

4. $3$

The picture tube screens in television sets operate on

1. thermoluminescence

2. cathodeluminescence

3. electroluminescence

4. photoluminescence

**99.** The rest mass of an electron is $m_0$ when it moves with a velocity $v = 0.6\,C$, then its mass is

1. $\frac{3}{7} m_0$

2. $\frac{3}{5} m_0$

3. $\frac{m_0}{3}$

4. $\frac{5}{4} m_0$

**100.** The relation between three moduli of elasticity is given by

1. $9E = 3N + K$

2. $\frac{E}{9} = \frac{N}{3} + K$

3. $\frac{1}{E} = \frac{1}{N} + \frac{1}{K}$

4. $\frac{9}{E} = \frac{3}{N} + \frac{1}{K}$

**101.** Which is more elastic in nature?

1. Ivory

2. Rubber

3. Aluminium

4. Wax

102. Crystals like diamond and silicon are brittle because

1. they contain no dislocations
2. they are non-crystalline
3. the stress required to move a dislocation is high
4. they contain very few dislocations

103. The energy gap in diamond is

1. $5.4$ eV
2. $2-3$ eV
3. $1.1$ eV
4. $0.08$ eV

104. Pure silicon at OK is an

1. intrinsic semiconductor
2. extrinsic semiconductor
3. metal
4. insulator

105. GaAs has an energy gap of $1.43$ eV. The wavelength of the radiation emitted during an electronic transition in GaAs will be in the

1. visible range
2. ultraviolet range
3. infrared region
4. X-ray range

106. The entropy of mixing of 0.5 mole of Ni atoms and 0.49 mole of Cu atoms on $1$ mole of sites in J/mol/K is

1. 5.76
2. 5.79
3. 5.85
4. 6.17

107. The entropy becomes zero at $0°C$ for a

1. pure element
2. perfect crystal
3. random solid solution
4. none of the above

108. A reaction takes $500$ min in $1$ min respectively at $10°$ C and $80°$ C. The time it would take at $50°$ C is

1. 25 min
2. 15 min
3. 10 min
4. 6 min

109. In a single component system, the maximum number of phases that can coexist in equilibrium is

1. 2
2. 3
3. 4
4. 5

110. Boltzmann distribution law which governs the distribution of atoms among the various energy levels is given as

1. $n_i = n_0 \exp(-\Delta E / kT)$
2. $n_0 = n_i \exp(-\Delta E / kT)$
3. $n_i = n_0 \exp(\Delta E / kT)$
4. $n_i = n_0 \exp(kT)$

111. Choose the correct statement

    1. Thermal conductivity of a metal does not vary with temperature

    2. Thermal conductivity of a metal varies as **a** function of temperature

    3. Thermal expansion coefficients are isotropic for all materials

    4. Thermal vibration of atoms contribute for electronic specific heat

112. The main raw material used for the manufacture of porcelain is

    1. Clay

    2. Alumina

    3. Zirconia

    4. Silicon carbide

113. Rotary kiln is used to produce

    1. Cement clinker

    2. Sanitary ware

    3. Ceramic tiles

    4. Porcelain ware

114. Which of the following material is inorganic graphite?

    1. Aluminium nitride

    2. Silicon nitride

    3. Boron nitride

    4. Silicon carbide

115. Lead oxide is widely used in glass industry to make

    1. Photosensitive glass

    2. Translucent glass

    3. Opaque glass

    4. Radiation shield glass

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