

## Multiple Choice Questions

Time Allowed : One Hour

Max Marks : 50

- Which one of the following bonds produces a solid that reflects light in the visible region and whose electrical conductivity decreases with temperature and has high melting point?  
A) Metallic bonding  
B) Van der Wall's bonding  
C) Ionic bonding  
D) Covalent bonding
- In semiconductors, at room temperature, the  
A) Conduction band is completely empty  
B) Valence band is partially empty and conduction band is completely filled  
C) Valence band is partially empty and the conduction band is partially filled  
D) Valence band is completely filled
- A piece of copper and other of germanium are cooled from room temperature to 80K, then,  
A) Resistance of each will increase  
B) Resistance of copper will decrease  
C) Resistance of copper will increase while that of germanium will decrease  
D) Resistance of copper will decrease while that of germanium will increase
- Choose the only false statement from the following  
A) In conductors, the valence and conduction bands may overlap  
B) Substances with energy gap of the order of 10eV are insulators  
C) The resistivity of semiconductor increases with increase in temperature  
D) The conductivity of semiconductor increases with increase in temperature
- The forbidden energy band gap in conductors, semiconductors and insulators are  $E_{g_1}$ ,  $E_{g_2}$  and  $E_{g_3}$  respectively. The relation among them is  
A)  $E_{g_1} = E_{g_2} = E_{g_3}$   
B)  $E_{g_1} < E_{g_2} < E_{g_3}$   
C)  $E_{g_1} > E_{g_2} > E_{g_3}$   
D)  $E_{g_1} < E_{g_2} > E_{g_3}$
- Which of the following statement is not true about  $NaCl$  structure?  
A) Each unit cell contains four  $NaCl$  molecules  
B)  $Cl^-$  ions has coordination number six  
C)  $Na^+$  ions has coordination number four  
D)  $Cl^-$  ions are in  $fcc$  arrangement
- Total volume of atoms present in face centred cubic unit cell of metal is (  $r$  is atomic radius)  
A)  $(20/3)\pi r^3$   
B)  $(24/3)\pi r^3$   
C)  $(12/3)\pi r^3$   
D)  $(16/3)\pi r^3$
- How many number of atoms are present in  $fcc$  unit cell ?  
A) 4  
B) 3  
C) 2  
D) 1
- Bragg's law is given by equation  
A)  $n\lambda = 2\theta \sin\theta$   
B)  $n\lambda = 2d \sin\theta$   
C)  $2n\lambda = d \sin\theta$   
D)  $n\lambda = (d/2) \sin\theta$
- A crystalline solid has  
A) Disordered arrangement  
B) Long range order  
C) Short range order  
D) None of these

11. **Assertion:** Crystalline solids can cause X-ray to diffract  
**Reason:** Inter atomic distance in crystalline solids is of the order of 0.1 nm
- A) Both the assertion and reason are true and reason explains the assertion.  
 B) Both the assertion and reason are true but reason does not explain the assertion  
 C) Assertion is true but reason is false  
 D) Assertion is false but reason is true.
12. The second order Bragg diffraction of X-rays with  $\lambda=1.0\text{\AA}$  from a set of parallel planes in a metal occurs at an angle  $60^\circ$ . The distance between the scattering planes in the crystal is  
 A) 1.155  $\text{\AA}$       B) 1.0  $\text{\AA}$       C) 2.0  $\text{\AA}$       D) 1.7  $\text{\AA}$
13. The crystal lattice is a lattice in real ordinary space but the reciprocal lattice is a lattice in  
 A) Gaussian space      B) Laplacian space  
 C) Fourier space      D) Hypothetical space
14. If the number density of a free electron gas in three dimensions is increased eight times, its Fermi temperature will  
 A) Increase by a factor of 4      B) Decrease by a factor of 4  
 C) Increase by a factor of 8      D) Decrease by a factor of 8
15. If  $k$  is the wave vector of incident light such that  $|\vec{k}| = \frac{2\pi}{\lambda}$  ( $\lambda$  is the wavelength of light) and  $\vec{G}$  is a reciprocal lattice vector, then the Bragg's law can be written as:  
 A)  $\vec{k} + \vec{G} = 0$       B)  $2\vec{k} \cdot \vec{G} + G^2 = 0$       C)  $2\vec{k} \cdot \vec{G} + k^2 = 0$       D)  $\vec{k} \cdot \vec{G} = 0$
16. A transistor has  $\alpha=0.95$ . If emitter current changes by 100 milliampere, then the change in the collector is  
 A) 95 mA      B) 99.05 mA      C) 100.95 mA      D) 100 mA  $I_c = \alpha I_e$
17. The depletion layer in the p-n junction region is caused by  
 A) Drift of holes      B) Diffusion of charge carriers  
 C) Migration of impurity ions      D) Drift of electrons
18. When n-type semiconductor is heated  
 A) Number of electrons increases while that of holes decreases  
 B) Number of holes increases while that of electrons decreases  
 C) Number of electrons and holes remain same  
 D) Number of electrons and holes increases equally
19. If a full wave rectifier circuit is operating from 50Hz mains, the fundamental frequency in the ripple will be  
 A) 100 Hz      B) 25 Hz      C) 50 KHz      D) 70.7Hz
20. The voltage gain of an amplifier with 9 negative feedback is 10. The voltage gain without feedback will be  
 A) 90      B) 10      C) 1.25      D) 100
21. Reverse bias applied to a junction diode  
 A) Increases the minority carrier current  
 B) Lowers the potential barrier  
 C) Raises the potential barrier  
 D) Increases the majority carrier current

22. The peak voltage in the output of half-wave diode rectifier feed with a sinusoidal signal without filter is 10V. The d.c component of the output voltage is,  
 A)  $(20/\pi)$  V      B)  $(10/\sqrt{2})$  V      C)  $(10/\pi)$  V      D) 10 V
23. A p-n photodiode is fabricated from a semiconductor with a band gap of 2.5eV. It can detect a signal of wavelength  
 A) 4000 nm      B) 6000 nm      C) 4000Å      D) 6000Å
24. A semi-conducting device is connected in a series circuit with some resistance. A current is found to pass through the circuit. If the polarity of the battery is reversed, the current drops to almost zero. The device may be  
 A) A p-n junction      B) An intrinsic semi-conductor  
 C) A p-type semi-conductor      D) An n-type semiconductor
25. In a p-type material the Fermi level is 0.3 eV above valence band. The concentration of acceptor atoms is increased. The new position of Fermi level is likely to be  
 A) 0.5 eV above valence band      B) 0.28 eV above valence band  
 C) 0.1 eV above valence band      D) below the valence band
26. Liquid drop model of a nucleus cannot explain  
 A) Nuclear fission      B) Nuclear fusion  
 C) Spin and magnetic moment of nuclei      D) None of the above
27. The mass of a nucleus is  
 A) Always greater than the mass of its constituent particles  
 B) Always less than the mass of its constituent particles  
 C) Always equal to the mass of its constituent particles  
 D) Can be any of the above depending on how stable the nucleus is
28. An atomic mass unit is approximately equal to the mass of  $1.66 \times 10^{-27}$  kg  
 A) Electron      B) Positron      C) Proton      D) Photon
29. 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 electrons.  
 C) The amount of energy required to break a nucleus apart into electrons and neutrons.  
 D) The amount of energy released when neutrons change energy levels.
30. The average binding energy per nucleon of a nucleus is of the order of  
 A) 8 eV      B) 8 keV      C) 8 MeV      D) 8 GeV
31. An isotope with a high binding energy per nucleon  
 A) will decay in a short period of time      B) is very unstable  
 C) has more protons than neutrons      D) is very stable
32. If  $M$  is the atomic mass,  $A$  is mass number, then  $(M-A)/A$  is called  
 A) Packing fraction      B) Mass defect  
 C) Fermi energy      D) Binding energy
33. In the Bethe-Weizsäcker semi-empirical mass formula the Coulomb repulsion term is  
 A)  $a_v A$       B)  $a_s A^{2/3}$       C)  $Z(Z-1)A^{-1/3}$       D)  $(N-Z)^2 A^{-1}$
34. Which nuclear model is used to describe the excited states of nuclei?  
 A) Liquid drop model      B) Shell model  
 C) Collective model      D) Atomic model

35. In the nuclear shell model, the shells are closed for  
 A) 2, 8, 20, 28, 50, 82, and 126 nucleons  
 B) 2, 8, 20, 28, 52, 82, and 126 nucleons  
 C) 2, 8, 20, 28, 50, 84, and 126 nucleons  
 D) 2, 8, 20, 28, 50, 82, and 128 nucleons
36. Nuclei with magic number of neutrons or protons are spherical and have.....  
 quadrupole moment  
 A) Positive                      B) Negative                      C) Zero                      D) Infinity
37. The ground state of any even-even nucleus has spin and parity  
 A)  $0^+$                       B)  $0^-$                       C)  $2^+$                       D)  $2^-$
38. The neutron capture cross sections at the magic numbers are  
 A) Very low                      B) Very high                      C) zero                      D) Infinity
39. A nuclide with a half-life of 2 days is tested after 6 days. What fraction of the sample has  
 decayed?  
 A)  $1/8$                       B)  $1/4$                       C)  $1/2$                       D)  $7/8$
40.  $1 \mu\text{Ci}$  is  
 A)  $1.4 \times 10^4$  decays/second                      B)  $2.5 \times 10^4$  decays/second  
 C)  $3.7 \times 10^4$  decays/second                      D)  $3.7 \times 10^6$  decays/second
41. When a fast charged particle traverses a dielectric medium at a velocity exceeding the  
 velocity of light in that medium, radiation is emitted. This radiation is known as  
 A) Gamma radiation                      B) Cherenkov radiation  
 C) Synchrotron radiation                      D) Bremsstrahlung
43. Which of the following gives the correct order of the penetrating power of radiation?  
 A)  $\alpha > \beta > \gamma$                       B)  $\beta > \alpha > \gamma$                       C)  $\beta > \gamma > \alpha$                       D)  $\gamma > \beta > \alpha$
44. The intensity of a beam of  $\gamma$ -photons, emitted by a point source, is  
 A) Proportional to the squared distance                      B) Proportional to the distance.  
 C) Inversely proportional to the distance  
 D) Inversely proportional to the squared distance
45. The nuclear reaction  $X \rightarrow Y + Z$  occurs spontaneously. If  $M_X$ ,  $M_Y$ , and  $M_Z$  are the masses  
 of the three particles. Which of the following relationships is true?  
 A)  $M_X < M_Y - M_Z$                       B)  $M_X < M_Y + M_Z$                       C)  $M_X > M_Y + M_Z$                       D)  $M_X - M_Y < M_Z$
46. An ideal scintillation material should have  
 A) High scintillation efficiency                      B) Linear conversion  
 C) High stopping power for gamma radiation                      D) All the above
47. In which of the following radiation detectors is a phosphor used?  
 A) G-M counter                      B) Proportional counter  
 C) Scintillation counter                      D) All of these
48. Which of the following particle does not have distinct antiparticle?  
 A) p                      B) Kaons                      C)  $\gamma$                       D)  $\pi^+$
49. According to the quark model, a proton consists of quarks represented as  
 A) uud                      B) dud                      C) udd                      D) cud
50. The gluon is the force carrier for  
 A) Weak force                      B) Gravity                      C) Strong force                      D) EM Force