# Speed Test-43

**1.** **(c)**

**2.** **(b)** n-Type, since electron is set free.

**3.** **(a)**

Let radius of the sphere = r

Area occupied by sphere in hexagonal close packing

$$\pi r^2 + 6\times\left(\frac{1}{6}\times\pi r^2\right) = 2\pi r^2$$

$$\text{Area of hexagonal} = 6\times\left[\frac{\sqrt{3}}{4}\times(2r)^2\right]$$

$$= 6\times\frac{\sqrt{3}}{4}\times 4r^2$$

$$= 6\sqrt{3}\times r^2$$

$$\%\text{ occupied by} = \frac{2\pi r^2}{6\times\sqrt{3}\times r^2}\times 100$$

$$= \frac{2\times 3.14}{6\times\sqrt{3}}\times 100 = 60.43\%$$

**4.** **(c)** As per formula,

$$\text{radius ratio} = \frac{\text{radius of cation}}{\text{radius of anion}}$$

$$= \frac{94}{146} = 0.643$$

Since the value is between 0.414 – 0.732 hence the coordination no. will be 6 and geometry will be octahedral.

**5.** **(c)** As CsCl is body-centred, $d = \sqrt{3}a/2$.

**6.** **(b)** It is the property of liquid crystal.

**7.** **(a)** $\frac{r+}{r-}$ ratio is $\frac{60}{136} = 0.441$, Hence LiF has NaCl structure with C.N. = 6.

**8.** **(b)** Molecular solid is the best description of water in the solid phase. For example ice is hydrogen bonded molecular solid.

**9.** **(c)** The hcp arrangement of atoms occupies 74% of the available space and thus has 26% vacant space.

**10.** **(c)** The p.f. for body centred cube = 0.68

**11.** **(d)** When insulators (non metal atoms) interact to form a solid, their atomic orbitals mix to form two bunch of orbitals, separated by a large band gap. Electrons cannot therefore be promoted to an empty level, where they could move freely.

**12.** **(a)** Covalent solids as in case of diamond.

**13.** **(c)**

**14.** **(d)** For octahedral $r^+/r^- = 0.414 - 0.732$.

**15.** **(c)** AgBr exhibits Frenkel defect.

**16.** **(b)** $\rho = \frac{z\,M}{N_A V}$

$$z = \frac{\rho N_A V}{M} = \frac{8.92\times 6.02\times 10^{23}\times(362)^3\times 10^{-30}}{63.55}$$

$$= 4$$

$\therefore$ It has fcc unit cell

**17.** **(a)** $MnO_2$.

**18.** **(c)** Amorphous silicon is used as best photovoltaic material available for conversion of sunlight into electricity.

**19.** **(d)**

**20.** **(c)** $\frac{d_1}{d_2} = \frac{(a_2)^3}{(a_1)^3}\times\frac{z_1}{z_2} = \left(\frac{3}{3.5}\right)^3\times\frac{4}{2} = 1.26$

**21.** **(c)** Glass is amorphous solid.

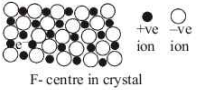
**22.** **(d)** $n\lambda = 2d\sin\theta$ ;

$$2\times 1\text{Å} = 2\times d\sin 60 \Rightarrow d = 1.15\text{Å} \because \left(\sin 60 = \frac{\sqrt{3}}{2}\right)$$

**23.** **(b)**

**24.** **(c)** Solid $CH_4$ is a molecular solid. In this, the constituent molecules are held together by van der Waal's forces.

**25.** **(d)** When electrons are trapped in anion vacancies, these are called F-centre.




F- centre in crystal

**26.** **(b)** Density is given by

$$d = \frac{z\times M}{N_A a^3}\text{ ; where z = number of formula units}$$

present in unit cell, which is 4 for fcc

a = edge length of unit cell. M = Molecular mass

$$2.72 = \frac{4 \times M}{6.02 \times 10^{23} \times \left(404 \times 10^{-10}\right)^3}$$

$(\because\ 1\,pm = 10^{-10}\,cm)$

$$M = \frac{2.72 \times 6.02 \times (404)^3}{4 \times 10^7} = 26.99$$

$$= 27\ g\ mol^{-1}$$

**27. (a)** It is due to movement of energised electrons (KE $\propto$ T).

**28. (c)** $\frac{M^+}{X^-}$ is highest in CsF

$\therefore$ correct choice : (c)

**29. (d)** The electrical resistance of metals depends upon temperature. Electrical resistance decreases with decrease in temperature and becomes zero near the absolute temperature. Material in this state is said to possess super conductivity.

**30. (c)**

**31. (d)** Number of formulas in cube shaped crystals

$$= \frac{1.0}{58.5} \times 6.02 \times 10^{23}$$ since in NaCl type of structure

4 formula units form 'a' cell

$$\therefore \text{units cells} = \frac{1.0 \times 6.02 \times 10^{23}}{58.5 \times 4} = 2.57 \times 10^{21}\ \text{unit cells.}$$

**32. (b)** CsCl has a bcc structure ions touching along body diagonal.

**33. (c)** Rhenium oxide $ReO_3$ is like metallic copper in conductivity.

**34. (d)**

**35. (b)** Among the given crystals, only silicon exists as a covalent solid. It has diamond like structure.

**36. (d)** The addition of one $Sr^{2+}$ replaces $2Na^+$ and one cationic vacancy is created.

No. of cationic vacancy = $2 \times 10^{-3}$ mole % of NaCl

$$= \frac{2 \times 10^{-3}}{100} mol^{-1}\ \text{of NaCl}$$

$$= 2 \times 10^{-5} \times 6.02 \times 10^{23}\ mol^{-1}$$

$$= 12.04 \times 10^{18}\ mol^{-1}\ \text{of NaCl}$$

**37. (d)** In bcc - points are at corners and one in the centre of the unit cell.

Number of atoms per unit cell = $8 \times \frac{1}{8} + 1 = 2$.

In fcc - points are at the corners and also centre of the six faces of each cell.

Number of atoms per unit cell = $8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$.

**38. (b)** For fcc,

$$r = \frac{\sqrt{2}a}{4} = \frac{a}{2\sqrt{2}} = 0.3535a$$

given $a = 361$ pm

$r = 0.3535 \times 361$

$= 128$ pm

**39. (a)**

**40. (a)** Diamond is like ZnS. In diamond cubic unit cell, there are eight corner atoms, six face centered atoms and four more atoms inside the structure.

Number of atoms present in a diamond cubic cell

$$= 8 \times \frac{1}{8} + 6 \times \frac{1}{2} + 4 = 8$$

(corners) (face centered) (inside body)

**41. (b)** Packing fraction is defined as the ratio of the volume of the unit cell that is occupied by the spheres to the total volume of the unit cell.

P.F. for ccp and bcc are 0.74 and 0.68 respectively.

So, the free space in ccp and bcc are 26% and 32% respectively.

**42. (d)** For an Fcc crystal

$$r_{cation} + r_{anion} = \frac{\text{edge length}}{2}$$

$$110 + r_{anion} = \frac{508}{2}$$

$$r_{anion} = 254 - 110 = 144\ pm$$

**43. (b)** $CsI_3$ dissociates as $CsI_3 \rightarrow Cs^+ + I_3^-$

**44. (b)**

**45. (a)** For bcc lattice body diagonal = $a\sqrt{3}$.

The distance between the two oppositely charged ions

$$= \frac{a}{2}\sqrt{3}$$

$$= \frac{387 \times 1.732}{2} = 335\ pm$$