SHIKSHA CLASSES

Subject : Chemistry **BOARD ANSWER PAPER** **Total Marks : 20**

Class : XII **Topic: 1. Solid State**

Q.1 : A)Select and write the most appropriate answer from given alternatives in each sub-question. [4]

i) In close pack array of N spheres, the number of tetrahedral holes are ..... .

Ans: c) 2N

ii) The packing efficiency in simple cubic unit cell is

Ans: a) 52.4 %

iii) In the unit cell of NaCl lattice there are

Ans: d) 4 NaCl units

iv) Schottky defect is notice in

Ans: d) All of these

Q.1 : B) Very short answer type Question. [2]

i) What is unit cell?

Ans. : The smallest group of atom which has the overall symmetry of crystal and from which the entire lattice can be build up by repetition in three diamention is called as unit cell.

ii) How many tetrahedral voids present in crystal containing 'N' atoms?

Ans. : There are 2N tetrahedral voids present in crystal containing 'N' atoms.

Q.2 : Answer the following question. (Any three) [6]

i) Explain molecular solid with example.

Ans: Molecular Solids:

The solids in which molecules are the constituent particles are called molecular solids.

1) They are further classified as
   a) Non polar molecular solids
   b) Polar molecular solids
   c) Hydrogen bonded molecular solid.
2) In molecular solids molecules held together by non covalent forces of attraction, dipole-dipole interaction or H-bonding.
3) They are non conductor of electricity
4) Ex Ice, I_2, Cl_2 H_2 , NH_3 SO_2

ii) Explain properties of metallic crystal?

Ans: i) Metals are malleable, that is, they can be hammered into the sheets.

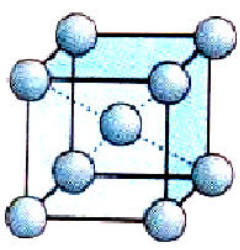
ii) Metals are ductile, that is they can be drawn into wires.

iii) Metals have good electrical and thermal conductivity.

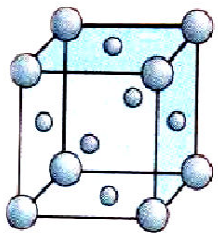
e.g . metals such as Na, K, Ka, Li, Fe, Au, Ag, Co, etc.

iii) Draw the diagram of body centered cubic lattice and face centered cubic lattice.

Ans:



Body-centred cubic lattice



Face centered cubic lattice

iv) Explain conduction band and valence band?

Ans: Conduction band : The highest energy band containing electron in the conduction band. it is form by inter-reaction of outermost energy level of closely spaced atom in a solid. Electron in a conduction band are mobile and delocalised over entire solid. They conduct electricity when

electric potential is applied.

Valence band : The band having lower energy than conduction band is the valence band. The electron in a valence band is not free to move because they are tightly band to nuclei.

Q.3 : Answer the following question.

(Any one) **[3]**

i) Predict the number of atoms per unit cell in face centered cubic lattice and simple cubic lattice.

Ans: Face centred cubic lattice :

In fcc crystal eight atoms present at eight other unit cells. six atoms present at centre of six faces each atom share with two unit cells.

$$\text{No of atoms per unit cell} = 8 \times \frac{1}{8} + 6 \times \frac{1}{2}$$
$$= 4$$

Four atoms present pre unit cell

Simple cubic lattice :

In SCL crystal eight atoms present at eight corners and each share with eight unit cells.

$$\text{No. of atoms per unit cell} = 8 \times \frac{1}{8} = 1$$

one atom present per unit cell.

ii) Explain number of partical in cubic unit cell.

Ans: A simple cubic cell has a partical at its eight corner. When these unit cell are stacked together partical at each corner of a given unit cell is share with seven other neighbouring cube that comes together at that corner as a result the corner partical contribute its $1/8^{th}$ part of given unit cell.

Simple cubic cell has $1/8 \times 8 = 1$ partical per unit cell.

Q.4 : Answer the following question.

(Any one) **[5]**

i) a) Atoms C and D form FCC crystalline structure. Atom C is present at corners of cube in which one atom missing from its position and D is at face centered of cube. What is formula of cube?

Ans: Atom 'C' present at corner and D is present at face center, one atom C is missing from its position

$\therefore$ No of 'C' atoms per unit cell

$$= (8 - 1) \times \frac{1}{8} = \frac{7}{8}$$

$\therefore$ No of D atoms per unit cell $= 6 \times \frac{1}{2} = 3$

$\therefore$ Molecular formula is $C_{7/8}D_3$.

b) Calculate percentage of space occupied and voids in body centered unit cell.

Ans: For bcc edge length of unit cell $a = \frac{4}{\sqrt{3}}r$

No. of atoms per unit cell = 2

Volume of unit cell

$$= a^3 = \left(\frac{4}{\sqrt{3}}r\right)^3 = \frac{64}{3\sqrt{3}}r^3$$

Volume of one atoms: $= \frac{4}{3}\pi r^3$.

$\therefore$ Percentage of space occupied

$$= \frac{\text{No. of atoms} \times \text{volume of one atom}}{\text{volume of unit cell}} \text{x}100$$

$$= \frac{2 \times \frac{4}{3}\pi \times r^3}{\frac{64}{3\sqrt{3}}r^3} \text{x}100 = \frac{8\sqrt{3}}{64}\pi \times 100$$

$= 68.04\ \%$

$\therefore$ Volume unoccupied i.e.

Voids = 100 – 68.00% = 32%.

ii) a) A compound is forms by two element A and B. The atom of element B form ccp structure. The atom of A occupy of tetrahedral voids. What is the formula of compound?

Ans: a) The atom of element B form ccp structure. The number of tetrahedral voids generated is twice the number of B atoms.

The number of tetrahedral voids = 28

The atom A occupy $1/3^{rd}$ of these tetrahedral voids hence.

Number of A atoms = 2 B × $\frac{1}{3}$

Ratio of A and B atoms $\frac{2}{3}$B : 1B = $\boxed{2:3}$

Formula of compound = A_2B_3.

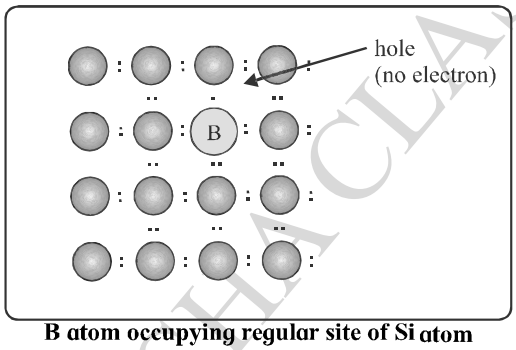
b) What are semiconductors ? How p-type semiconductors are develop?

Ans: Semiconductors are poor conductors of electricity and which conduct electricity at high temperature. A substance containing completely filled bond with electrons and completely empty bond behaves as semiconductors.

P type semiconductor :

Si or Ge doped with electron deficient impurity of group 13 elements like B or Al called P- type semi conductor.

A p-type semiconductor is produced by doping a pure semiconductor material (Si or Ge) with an impurity of group 13 elements. These elements contain less number of valence electrons than that of the pure semiconductor. Consider, for example, pure Si doped with boron. The B atoms occupy normal positions of some of the Si atoms in the lattice as shown in Fig. Boron atom has only three valence electrons. It does not have enough electrons to form bonds with its four Si neighbours.



B atom occupying regular site of Si atom

B atom forms bonds with three Si atoms only. The missing fourth electron creates an electron vacancy. It is called a hole. Fig. shows the holes in the valence band of p-type semiconductor.

A hole has a tendency to accept electron from its close vicinity. Thus, a hole behaves as if it has a positive charge. The electrons in partially filled valence band move under the influence of an applied potential. The holes move in the opposite direction.

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