

# Ankit Gupta Classes



[www.AnkitGuptaClasses.weebly.com](http://www.AnkitGuptaClasses.weebly.com)

[gupta.ankit54@yahoo.com](mailto:gupta.ankit54@yahoo.com)

[ankitgupta.gupta175@gmail.com](mailto:ankitgupta.gupta175@gmail.com)



9899875480.

9541241201

## UNIT-1

### SOLID STATE

#### 1 MARK QUESTIONS

**Q. 1. Name a liquefied metal which expands on solidification.**

**Ans.** Gallium (Ga) is a silvery white metal, liquid at room temp. It expands by 3.1% on solidification.

**Q. 2. How many number of molecules per unit cell which crystallizes in the form of end face centred (monoclinic) lattice with a molecule at each lattice.**

**Ans.** 2.

**Q. 3. What is the coordination number of carbon, in diamond ?**

**Ans.** 4 and its unit cell has 8 atoms.

[The space lattice of diamond is FCC]

**Q. 4. Name the solid which has weakest intermolecular force ?**

**Ans.** Ice

**Q. 5. Arrange the following types of interactions in correct order of their increasing strength :**

**Covalent, hydrogen bonding, Vander Waals, dipole dipole**

**Ans.** Vander Waals < dipole dipole < hydrogen bonding < covalent.

**Q. 6. Give reason for the appearance of colour in alkali metal halides.**

**Ans.** Due to F-centres.

**Q. 7. Which type of defect occur in Ag Br ?**

**The More Goals You Set - The More Goals You Get.**

# Ankit Gupta Classes



[www.AnkitGuptaClasses.weebly.com](http://www.AnkitGuptaClasses.weebly.com)

[gupta.ankit54@yahoo.com](mailto:gupta.ankit54@yahoo.com)

[ankitgupta.gupta175@gmail.com](mailto:ankitgupta.gupta175@gmail.com)



9899875480.

9541241201

**Ans.** Schottky defect and Frenkel defect.

**Q. 8.** Give one example of doping which produces p-type of semi-conductors.

**Ans.** Ge doped with Al.

**Q. 9.** Out of (a) Graphite and (b) Carborundum which one is harder ?

**Ans.** Carborundum.

**Q. 10.** How can a material be made amorphous ?

**Ans.** By melting the material and by cooling it rapidly.

## 2 MARKS QUESTIONS

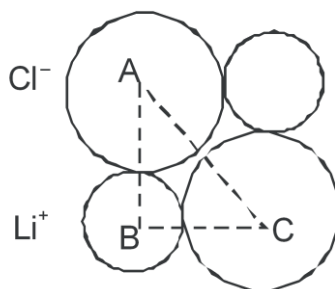
**Q. 1.** Give Reason :

The energy required to vaporize one mol of copper is smaller than that of energy required to vaporize 1 mol of diamond.

**Ans.** Copper is a metallic solid having metallic bonds while diamond is a covalent solid having covalent bonds. Metallic bonds are weaker than covalent bonds and thus less amount of energy is required to break metallic bonds than covalent bonds.

**Q. 2.** The unit cube length for LiCl (NaCl) is  $5.14 \text{ \AA}$ . Assuming anion-anion contact. Calculate the ionic radius for Chloride ion.

**Ans.**



Interionic distance of LiCl =  $5.14 / 2 = 2.57 \text{ \AA}$

$$AC = \sqrt{AB^2 + BC^2}$$

**The More Goals You Set - The More Goals You Get.**

# Ankit Gupta Classes



[www.AnkitGuptaClasses.weebly.com](http://www.AnkitGuptaClasses.weebly.com)

[gupta.ankit54@yahoo.com](mailto:gupta.ankit54@yahoo.com)

[ankitgupta.gupta175@gmail.com](mailto:ankitgupta.gupta175@gmail.com)



9899875480.

9541241201

$$\begin{aligned} &= \sqrt{2.57^2 + 2.57^2} \\ &= 3.63 \end{aligned}$$

therefore, radius of  $\text{Cl}^- = \frac{1}{2} \times 3.63 = 1.81 \text{ \AA}$

**Q. 3. Give reasons :**

- (a) Diamond and rhombic Sulphur are covalent solids, but the latter has lower melting points.
- (b) Among NaCl and CsCl, CsCl is quite stable.

**Ans.** (a) Due to weak Vander Waal's Force in Sulphur molecule.

(b) CsCl coordination number is 8. It is surrounded by 8 anion tightly.

**Q. 4. How many unit cells are present in a cube shaped ideal crystal of NaCl of mass 1 gm ?**

**Ans.** Mass of 1 unit cell = volume  $\times$  density

$$= a^3 \times d$$

$$= \frac{a^3 \times M \times Z}{N^0 a^3}$$

$$= \frac{58.5 \times 4}{6.023 \times 10^{23}}$$

No. of unit cells in 1 gm =  $1/M$

$$= 6.023 \times 10^{23} / 58.5 \times 4$$

$$= 2.57 \times 10^{21}$$

**Q. 5. In the mineral spinel; having the formula  $\text{MgAl}_2\text{O}_4$ . The oxide ions are arranged in CCP,  $\text{Mg}^{2+}$  ions occupy the tetrahedral voids. While  $\text{Al}^{3+}$  ions occupy the octahedral voids.**

(i) What percentage of tetrahedral voids is occupied by  $\text{Mg}^{2+}$  ions ?

**The More Goals You Set - The More Goals You Get.**

# Ankit Gupta Classes



[www.AnkitGuptaClasses.weebly.com](http://www.AnkitGuptaClasses.weebly.com)  
[gupta.ankit54@yahoo.com](mailto:gupta.ankit54@yahoo.com)  
[ankitgupta.gupta175@gmail.com](mailto:ankitgupta.gupta175@gmail.com)



9899875480.  
9541241201

(ii) What percentage of octahedral voids is occupied by  $\text{Al}^{3+}$  ions ?

**Ans.** According to the formula,  $\text{MgAl}_2\text{O}_4$ . If there are 4 oxide ions, there will be 1  $\text{Mg}^{2+}$  ions and 2  $\text{Al}^{3+}$ . But if the 4  $\text{O}^{2-}$  ions are ccp in arrangement, there will be 4 octahedral and 8 tetrahedral voids.

(i) Percentage of tetrahedral voids occupied by  $\text{Mg}^{2+} = (1 / 8) \times 100$   
 $= 12.5\%$

(ii) Percentage of octahedral voids occupied by  $\text{Al}^{3+} = (2 / 4) \times 100$   
 $= 50\%$

**Q. 6. Give reasons :**

- (a) Window glass of old building look milky.
- b) Window glass of old building is thick at bottom.
- (c)  $\text{CaCl}_2$  will introduce Schottky defect if added to  $\text{AgCl}$  crystal.

**Ans.** (a) Due to annealing over a number of years glass acquires some crystalline character.  
(b) Glass is not a true solid. But a super-cooled liquid of high viscosity. It has the property to flow.  
(c) 2  $\text{Ag}^+$  will be replaced by 1  $\text{Ca}^{2+}$  ions to maintain electrical neutrality. Thus a hole is created and lattice site for every  $\text{Ca}^{2+}$  ion introduced.

**Q. 7. Analysis shows that nickel oxide has the formula  $\text{NiO}_{.98}\text{O}_{1.00}$ . What fractions of nickel exist as  $\text{Ni}^{2+}$  and  $\text{Ni}^{3+}$  ions ?**

**Ans.**  $\text{NiO}_{.98}\text{O}_{1.00}$

Let  $\text{Ni}^{2+}$  be x and  $\text{Ni}^{3+}$  be  $0.98 - x$

Total charge on compd. is equal to zero.

$$[2 (\text{Ni}^{2+}) + 3 (\text{Ni}^{3+}) - 2 (\text{O}^{2-})] = 0$$

**The More Goals You Set - The More Goals You Get.**

# Ankit Gupta Classes



[www.AnkitGuptaClasses.weebly.com](http://www.AnkitGuptaClasses.weebly.com)  
[gupta.ankit54@yahoo.com](mailto:gupta.ankit54@yahoo.com)  
[ankitgupta.gupta175@gmail.com](mailto:ankitgupta.gupta175@gmail.com)



9899875480.  
9541241201

$$2x + 3(0.98 - x) - 2 = 0$$

$$x = 0.94$$

$$\text{Therefore Ni}^{2+} \% = \frac{0.94}{0.98} \times 100 = 96\%$$

$$\text{Ni}^{3+} = 4\%$$

**Q. 8. What type of defect can arise when a solid is heated ? Which physical property is affected by this and in what way ?**

**Ans.** When a solid is heated vacancy defect arises. This is because on heating some atoms or ions leave the lattice site completely some lattice sites are vacant. As a result of this defect the density of the substance decreases, because some atoms leave the structure completely.

**Q. 9. (a) What happens when a Ferromagnetic or Ferrimagnetic solid is heated ?**

**(b) The ions of MgO and NaF all have the same number of electrons and intermolecular distance are about the same (235 & 215 pm). Why are the melting points are so different (2642 °C & 992 °C ?**

**Ans. (a)** It changes into paramagnetic at high temperature due to randomization of spins.

**(b)** The ions in MgO carry two unit charges. In NaCl only one unit charge. Hence electrostatic forces of attraction in MgO are stronger.

**Q. 10. (a) If the radius of the Br ion is 0.182 nm, how large a cation can fit in each of the tetrahedral hole.**

**(b) AgI crystallizes in a cubic closed packed ZnS structure. What fraction of tetrahedral site is occupied by Ag ion ?**

**(c) At what temp. range, most of the metals becomes super conductors ?**

**Ans. (a)** For a tetrahedron the limiting ratio is 0.225 – 0.414

For largest cation highest value 0.414 would be considered.

**The More Goals You Set - The More Goals You Get.**

# Ankit Gupta Classes



[www.AnkitGuptaClasses.weebly.com](http://www.AnkitGuptaClasses.weebly.com)

[gupta.ankit54@yahoo.com](mailto:gupta.ankit54@yahoo.com)

[ankitgupta.gupta175@gmail.com](mailto:ankitgupta.gupta175@gmail.com)



9899875480.

9541241201

$$r^+ / r^- = 0.414$$

$$r^+ = 0.414 \times 0.182 = 0.075 \text{ nm.}$$

- (b) In FCC there are 8 tetrahedral voids. Out of this  $\frac{1}{2}$  is occupied by Ag cation.
- (c) 2 k – 5 k.

The More Goals You Set - The More Goals You Get.