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CLASS XII : CHEMISTRY

SOLID STATE

1. Copper crystal has a face centered cubic lattice structure .its edge length is 540pm. What is the distance of the closest approach for two copper atoms .
   Ans. 381.83 pm

2. A metal crystallizes into two cubic phases,FCC and BCC whose unit cell lengths are 350 and 300pm respectively calculate the ratio of densities of FCC and BCC.
   Ans 1.26

3. In a crystalline solid oxide ions are arranged in cubic close packing . cations A aare equally distributed between octahedral and tetrahedral voids . if all the octahedral voids are occupied what is the formulae of the solid
   Ans A_2O

4. Metaliic gold crystallizes in fcc lattice and has a density of 19.3 g/ cm^3 . calculate the radius of gold atom.   (Au = 197u)
   Ans   144pm

5. It can be seen now that both fcc and Hexagonal Primitive Structure have the same packing fraction. Moreover this is also the highest packing fraction of all the possible unit cells with one type of atom with empty voids. Can you explain this?

6. The radius of a calcium ion is 94 pm and of an oxide ion is 146 pm. Predict the crystal structure of calcium oxide.   (NaCl structure)

7. The unit cell of silver iodide (AgI) has 4 iodine atoms in it. How many silver atoms must be there in the unit cell.   (4)

8. The co-ordination number of the barium ions, Ba^{2+}, in barium chloride (BaF_2) is 8. What must be the co-ordination number of the fluoride ions?

   (4)

9. In corundum, oxide ions are arranged in hcp array and the aluminium ions occupy two thirds of octahedral voids. What is the formula of corundum?
   (Al_2O_3)

10. Calculate the ratio of the alkali metal bromides on the basis of the data given below and predict the form of the crystal structure in each case. Ionic radii (in pm) are given below

    $Li^+ = 74$, $Na^+ = 102$, $K^+ = 138$

    $Rb^+ = 148$, $Cs^+ = 170$, $Br^- = 195$

11. NH_4Cl crystallizes in a body centered cubic lattice, with a unit cell distance of 387 pm. Calculate (a) the distance between the oppositely charged ions in the lattice, and (b) the radius of the NH_4^+ ion if the radius of the Cl^- ion is 181 pm. (335.15PM, 154.15PM)

12. Copper has the fcc crystal structure. Assuming an atomic radius of 130pm for copper atom (Cu = 63.54):
    I.   What is the length of unit cell of Cu?
    II. What is the volume of the unit cell?
    III. How many atoms belong to the unit cell?
    IV. Find the density of Cu.

(367.64PM, 4.968 X 10^{-23}cm^{-3}, 4 , 8.54gm cm^{-3})

13. The density of CaO is 3.35 gm/cm^3. The oxide crystallises in one of the cubic systems with an edge length of 4.80 Å. How many Ca^{++} ions and O^{-2} ions belong to each unit cell, and which type of cubic system is present? (4,4 , fcc)

14. Copper crystal has a face centred cubic structure. Atomic radius of copper atom is 128 pm. What is the density of copper metal? Atomic mass of copper is 63.5. (8.9gm/cm^3)

15. X- rays of wavelength equal to 0.134 nm give a first order diffraction from the surface of a crystal when the value of θ is 10.5°. Calculate the distance between the planes in the crystal parallel to the surface examined. (3.68A^0)

16. What is the difference in the semiconductors obtained by doping silicon with Al or with P? (p-type, n-type)

17. Non stoichiometric cuprous oxide, Cu_2O can be prepared in the laboratory. In this oxide, copper to oxygen ratio is slightly less than 2:1 can you account of the fact that this substance is a p – type semiconductor (p- type semiconductor)

18. Classify each of the following as being either a p – type or n – type semiconductor.
    I. Ge doped with In
    II. B doped with Si

(p-type, n-type)

19. If NaCl is doped with 10^{-3} mole% $SrCl_2$ what is the concentration of cation vacancies? (6x 10^{18} moles)

20. In LiI Crystal, I– ions form a cubical closest packed arrangement and Li+ ions occupy octahedral holes. What is the relationship between the edge-length of the unit cells and the radii of the I– ions? Calculate the limiting ionic radii of Li+ and I–- if a= 600pm.
    (87.84 pm)