

1. What is the number of atoms per unit cell in a body centered cubic structure?
2. Find out the number of atoms per unit cell in a face-centered cubic structure having only single atoms at its lattice points.
3. A cubic solid is made of two elements X and Y. Atoms Y are at the corners of the cube and X at the body center. What is the formula of the compound?
4. Name the non-stoichiometric point defect responsible for color in alkali halides.
5. What makes the crystal of KCl appear sometimes violet?
6. Name the crystal defect which lowers the density of an ionic crystal.
7. What is the effect of Schottky and Frenkel defects on the density of crystalline solids?
8. Give reasons for the following:  
Copper is conducting as such while copper sulphate is conducting only in molten state or in aqueous solution.
9. What is the maximum possible coordination number of an atom in an hcp crystal structure of an element?
10. What is the nature of crystal defect produced when sodium chloride is doped with  $MgCl_2$ ?
11. Why is potassium chloride sometimes violet instead of pure white?
12. Name a substance which on addition to  $AgCl$  causes cation vacancy in it.
13. What makes alkali metal halides sometimes colored, which are otherwise colorless?
14. Define the term 'amorphous'.
15. Which point defect lowers the density of a crystal?
16. Why is common salt sometimes yellow instead of being pure white?
17. What happens when ferromagnetic  $Fe_3O_4$  is heated at 850 K and why?
18. Mention one property which is caused due to the presence of F- centre in a solid.
19. What is the difference between glass and quartz, though both contain  $SiO_4^{4-}$  units?
20. What is the effect of Frenkel defect on electrical conductivity of the solid?
21. What is Curie temperature?
22. What is the difference between ferromagnetic and ferroelectric substances?
23. How many atoms are there in a unit cell of a metal crystallizing in fcc structure?
24. Why does pure silicon, which is an insulator behave as a semiconductor on heating?
25. A cubic solid is made of two elements 'P' and 'Q'. Atoms 'Q' are at the corners of the cube and 'P' at the body center. What is the formula of the compound? What are coordination numbers 'P' and 'Q'?
26. Explain each of the following with a suitable example:
  - a. Paramagnetism
  - b. Frenkel defect in crystals
  - c. A n-type semiconductor.
27. An element occurs in bcc structure with cell edge 300 pm. The density of the element is  $5.2\text{gcm}^{-3}$ . How many atoms of the element does 200 g of the element contain?

28. The density of chromium metal is  $7.2\text{gcm}^{-3}$ . If the unit cell has edge length of 289 pm, determine the type of unit cell. [Atomic mass of chromium is 52 u;  $N_A = 6.02 \times 10^{23}\text{mol}^{-1}$ ]
29. State the difference between Schottky and Frenkel defects. Which of the two changes the density of the solid?
30. Lithium metal crystal has body centered cubic structure. Its density is  $0.53\text{gcm}^{-3}$  and its molar mass is  $6.94\text{gmol}^{-1}$ . Calculate the volume of a unit cell of lithium metal. [ $N_A = 6.023 \times 10^{23}$ ]
31. If NaCl crystals are doped with  $2 \times 10^{-3}$  mol percent of  $\text{SrCl}_2$ , calculate the cation vacancies per mole. [ $N_A = 6.023 \times 10^{23}$ ]
32. Unit cell of an element (atomic mass 108 u and density  $10.5\text{gcm}^{-3}$ ) has an edge length 409 pm. Deduce the type of crystal lattice. [ $N_A = 6.023 \times 10^{23}$ ]
33. An element exists in bcc structure with a cell edge of 288 pm. If the density of the element is  $7.2\text{gcm}^{-3}$  what is atomic mass of the element? [ $N_A = 6.023 \times 10^{23}$ ]
34. Determine the type of cubic lattice of which the iron crystal belongs if its cell has an edge length of 268 pm and the density of iron crystal is  $7.86\text{gcm}^{-3}$ . [At. Wt. of Fe = 56  $\text{gmol}^{-1}$ ,  $N_A = 6.023 \times 10^{23}$ ]
35. Copper crystallizes in face-centered cubic lattice and has a density of  $8.930\text{gcm}^{-3}$  at 293K. Calculate the radius of copper atom. [At. Mass of Cu = 63.55 u,  $N_A = 6.023 \times 10^{23}$ ]
36. Assign the reasons for the following
- Phosphorus doped silicon is a semiconductor.
  - Schottky defect lowers the density of a solid.
  - Some of the very old glass objects appear slightly milky instead of being transparent.
37. a. With reference to crystal structure, what is meant by coordination number?  
b. What is the coordination number of atoms?
- In a cubic close packed structure,
  - In a body centered cubic structure?
38. What is a semiconductor? Describe two main types of semiconductors, giving examples and their distinctive features.
39. a. Determine the type of cubic lattice to which a given crystal belongs if it has edge length of 290 pm and density is  $7.80\text{g cm}^{-3}$ . (Molecular mass =  $56\text{ g mol}^{-1}$ )  
b. Why does zinc oxide exhibit enhanced electrical conductivity on heating?
40. Calculate the efficiency (percentage of volume occupied and unoccupied) of packing in case of a metal crystal for simple cubic.
41. Aluminium crystallizes in a cubic close-packed structure. Its metallic radius is 125 pm.
- What is the length of the side of the unit cell?
  - How many unit cells are there in  $1.00\text{ cm}^3$  of Aluminium?