

CHAPTER-1-SOLID STATE

Assignment

- Q1. Potassium iodide has cubic unit cell with cell edge of 705 pm. The density of KI is 3.12 g cm^{-3} . How many K^+ and I^- ions are contained in the unit cell?
- Q2. A body centred cubic elements of density 10.3 g cm^{-3} has a cell edge of 314 pm. Calculate the atomic mass of the element.
- Q3. The unit of an elements of atomic mass 96 and density 10.3 g cm^{-3} is a cube with edge length 314 pm. Find the structure of the crystal lattice.
- Q4. Rubidium(atomic number 85.5) Crystallizes in a body centred cubic lattice with density of 1.51 g cm^{-3} . If the radius of rubidium atom is 248 pm, calculate Avogadro number.
- Q5. The density of a face centred cubic element (Atomic mass = 60.2 a.m.u) is 6.25 g cm^{-3} . Calculate the length of the unit cell.
- Q6. A metallic elements 'X' exists as a cubic lattice. Each edge of the unit cell is 2.90 \AA and density of metal is 7.20 g cm^{-3} . How many unit cells will be present in 100g of the metals?
- Q7. Lithium metals has a body centred cubic structure. Its density is 0.53 g cm^{-3} and its molar mass is 6.94 g mol^{-1} . Calculate the volume of a unit cell of lithium metals.
- Q8. A compound is formed by two elements X and Y. Atoms of the element Y (as anions) make *ccp* and those of the element X (as cations) occupy all the octahedral voids. What is the formula of the compound?
- Q9. Atoms of element B form *hcp* lattice and those of the element A occupy $\frac{2}{3}$ rd of tetrahedral voids. What is the formula of the compound formed by the elements A and B?
- Q10. An element has a body-centred cubic (*bcc*) structure with a cell edge of 288 pm. The density of the element is 7.2 g/cm^3 . How many atoms are present in 208 g of the element?
- Q11. X-ray diffraction studies show that copper crystallises in an *fcc* unit cell with cell edge of $3.608 \times 10^{-8} \text{ cm}$. In a separate experiment, copper is determined to have a density of 8.92 g/cm^3 , calculate the atomic mass of copper.
- Q12. Silver forms *ccp* lattice and X-ray studies of its crystals show that the edge length of its unit cell is 408.6 pm. Calculate the density of silver (Atomic mass = 107.9 u).
- Q13. A compound forms *hexagonal close-packed* structure. What is the total number of voids in 0.5 mol of it? How many of these are tetrahedral voids?
- Q14. A compound is formed by two elements M and N. The element N forms *ccp* and atoms of M occupy $\frac{1}{3}$ rd of tetrahedral voids. What is the formula of the compound?
- Q15. An element with molar mass $2.7 \times 10^{-2} \text{ kg mol}^{-1}$ forms a cubic unit cell with edge length 405 pm. If its density is $2.7 \times 10^3 \text{ kg m}^{-3}$, what is the nature of the cubic unit cell?
- Q16. Niobium crystallises in body-centred cubic structure. If density is 8.55 g cm^{-3} , calculate atomic radius of niobium using its atomic mass 93 u.

Q17. Silver crystallises in fcc lattice. If edge length of the cell is 4.07×10^{-8} cm and density is 10.5 g cm^{-3} , calculate the atomic mass of silver.

Q18. Copper crystallises into a fcc lattice with edge length 3.61×10^{-8} cm. Show that the calculated density is in agreement with its measured value of 8.92 g cm^{-3} .

Q19. Analysis shows that nickel oxide has the formula $\text{Ni}_{0.98}\text{O}_{1.00}$. What fractions of nickel exist as Ni^{2+} and Ni^{3+} ions?

Q20. Aluminium crystallises in a cubic close-packed structure. Its metallic radius is 125 pm.

(i) What is the length of the side of the unit cell?

(ii) How many unit cells are there in 1.00 cm^3 of aluminium?

Q21. If NaCl is doped with 10^{-3} mol % of SrCl_2 , what is the concentration of cation vacancies?

Q22. Gold (atomic radius = 0.144 nm) crystallises in a face-centred unit cell. What is the length of a side of the cell?