1. Revise the chapters taught.
2. Do NCERT back exercises.
3. Do assignment given on the website.
4. Make a project on a suitable topic should be investigatory, experimental or model based. Project report should be preferably of 10 or more pages. As instructed by the teacher and as per CBSE guidelines.

Chapter - 1

THE SOLID STATE

QUESTIONS

VSA QUESTIONS (1 - MARK QUESTIONS)

5. What are anistropic substances.
6. Why are amorphous solids isotropic in nature?
7. Why glass is regarded as an amorphous solid?
8. Define the term 'crystal lattice.'
8. Define the term voids.
9. What type of stochiometric defect is shown by (i) ZnS and (ii) CsCl?

   [**Hint. :** (i) Frenkel defect (ii) Schottky defect]

*10. If the formula of a compound is A_2B, which sites would be occupied by A ions?

   [**Hint. :** Number of A ions is double to B ions, so ions will occupy tetrahedral voids]

11. What is the coordination number for

   (a) an octahedral void

   (b) a tetrahedral void.

   [**Hint. :** (a) 6; (b) 4]

*12. How many octahedral voids are there in 1 mole of a compound having cubic closed packed structure? [**Ans. :** 1 mole]

13. Arrange simple cubic, bcc and fcc lattice in decreasing order of the fraction of the unoccupied space.

   [**Hint. :** fcc < bcc < sc]

14. How much space is empty in a hexagonal closed packed solid?

15. An element crystallises separately both in hcp and ccp structure. Will the two structures have the same density? Justify your answer.

    [**Hint :** Both crystal structures have same density because the percentage of occupied space is same.]

16. In NaCl crystal, Cl^- ions form the cubic close packing. What sites are occupied by Na^+ ions.

17. In Corundum, O^{2-} ions from hcp and Al^{3+} occupy two third of octahedral voids. Determine the formula of corundum. [**Ans. :** Al_2O_3]

18. Why is Frenkel defect not found in pure alkali metal halides?

19. Which point defect is observed in a crystal when a vacancy is created by an atom missing from a lattice site.

20. Define the term ‘doping’.

21. Why does conductivity of silicon increase with the rise in temperature.

22. Name the crystal defect which lowers the density of an ionic crystal.

    [**Ans. :** Schottky defect]

23. What makes the crystal of KCl sometimes appear violet?

    [**Hint :** F-Centre]

24. Which point defect in ionic crystal does not alter the density of the relevant solid?

25. Name one solid in which both Frenkel and Schottky defects occur.

26. Which type of defects are known as thermodynamic defects?

    [**Ans. :** Stoichiometric defects]

27. In a p-type semiconductor the current is said to move through holes. Explain.

28. Solid A is very hard, electrical insulator in solid as well as in molten state and melts at extremely high temperature. What type of solid is it?

    [**Hint :** Covalent solid]

SA (I) TYPE QUESTIONS (2 - MARK QUESTIONS)

1. List four distinctions between crystalline and amorphous solids with one example of each.
2. Give suitable reason for the following–
   (a) Ionic solids are hard and brittle.
   (b) Copper is malleable and ductile.
3. Define F–centre. Mention its one consequence.
4. What is packing efficiency. Calculate the packing efficiency in body-centered cubic crystal.
5. Explain :
   (a) List two differences between metallic and ionic crystals.
   (b) Sodium chloride is hard but sodium metal is soft.
6. Account for the following :
   (a) Glass objects from ancient civilizations are found to become milky in appearance.
   (b) Window glass panes of old buildings are thicker at the bottom than at the top.
7. Why is graphite soft lubricant and good conductor of electricity?
8. What do you understand by the following types of stacking sequences :
   (a) AB AB ..... (b) A B CABC .....
   What kind of lattices do these sequences lead to?
9. Derive the formula for the density of a crystal whose length of the edge of the unit cell is known?

   *Hint : $d = \frac{zm}{a^3 n_A}$

10. Explain how much portion of an atom is located at (a) corner (b) body centre (c) face-centre and (d) edge centre of a cubic unit cell.

*11. In a fcc arrangement of A and B atoms A are present at the corners of the unit cell and B are present at the face centres. If one atom of A is missing from its position at the corner, what is the formula of the compound?

[**Ans. :** A_7B_{24}]

*12. A compound made up of elements 'A' and 'B' crystallises in a cubic close packed structure. Atoms A are present on the corners as well as face centres, whereas atoms B are present on the edge-centres as well as body centre. What is the formula of the compound? [**Ans.** AB]

13. Explain the terms :

(a) Intrinsic semiconductor

(b) Extrinsic semiconductor.

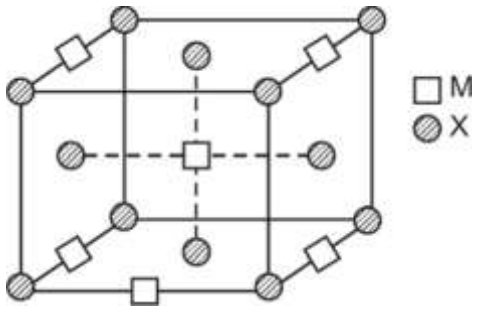
14. Explain how vacancies are introduced in a solid NaCl crystal when divalent cations are added to it.

15. What is meant by non-stoichiometric defect? Ionic solids which have anionic vacancies due to metal excess defect develop colour. Explain with the help of suitable example.

16. Define the term **'point defects'** Mention the main difference between stoichiometric and non-stoichiometric point defects.

THE SOLID STATE (2 - MARK QUESTIONS)

17. A compound M_pX_q has cubic close packing (ccp) arrangement of X. Its unit cell structure is show below :



Determine the empirical formula of the compound. [**Ans :** MX_2]

18. The concentration of cation vacancies in NaCl crystal doped with $CdCl_2$ is found to be 6.02×10^{16} mol^{-1}. What is the concentration of $CdCl_2$ added to it? [**Ans :** 10^{-5} mol% $CdCl_2$]

19. Iron changes its crystal structure from body contred to cubic close backed structure when heated to 916°C. Calculate the ratio of the density of the BCC crystal to that of CCP crystal. Assume that the metallic radius of the atom does not change. [**Ans :** 1]

SA (II) TYPE QUESTIONS (3 - MARK QUESTIONS)

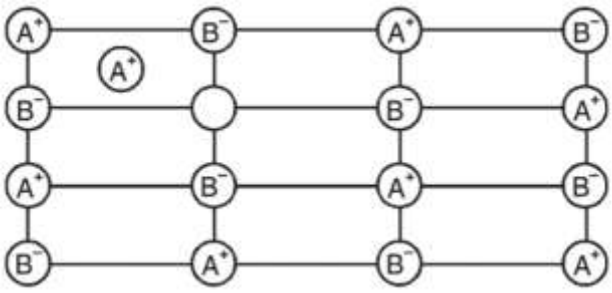
1. Write the relationship between atomic radius (r) and edge length (a) of cubic unit cell for
   (a) Simple cubic unit cell
   (b) Body-centred cubic unit cell
   (c) Face-centred cubic unit cell

   ***Hint :** (a) $a = 2r$ (b) $a = \frac{4}{\sqrt{3}}r$ (c) $a = 2\sqrt{2}r$

2. Define a semiconductor? Describe the two main types of semiconductors when it is doped with
   (a) group 13 element, (b) group 15 element.

3. Explain the following terms with one example each :
   (a) Ferrimagnetism (b) Antiferromagnetism
   (c) 13-15 compounds

*4. Examine the defective crystal lattice given below and answer the following questions :



   (a) Name the crystal defect present in ionic solid.
   (b) Out of AgCl and NaCl, which is most likely to show this type of defect and why?
   (c) Why this defect is also known as dislocation defect?

5. Tungsten crystallizes in body centred cubic unit cell. If the edge of the unit cell is 316. 5pm, calculate the radius of tungsten atom?

6. Iron has a body centred cubic unit cell with a cell dimension of 286.65 pm. The density of iron is 7.874 g cm^{-3}. Use this information to calculate Arogadro number.

   (At. Mass of Fe = 55.845u).

NUMERICALS

1. Sodium crystallises in a bcc unit cell. What is the approximate number of unit cells in 4.6 g of sodium? Given that the atomic mass of sodium is 23 g mol^{-1}. [**Ans. :** 6.022×10^{22}]

*2. In a crystalline solid anions 'C' are arranged in cubic close packing, cations 'A' occupy 50% of tetrahedral voids and cations 'B' occupy 50% of octanedral voids. What is the formula of the solid? [**Ans. :** A_2BC_2]

*3. Magnetite, a magnetic oxide of iron used on recording tapes, crystallises with iron atoms occupying $\frac{1}{8}$ of the tetrahedral holes and $\frac{1}{2}$ of the octahedral holes in a closed packed array of oxides ions. What is the formula of magnetite? [**Ans. :** Fe_3O_4]

4. A metal crystalises into two cubic lattices fcc and bcc, whose edge length are 3.5Å and 3.0Å respectively. Calculate the ratio of the densities of fcc and bcc lattices.

5. An element of atomic mass 98.5 g mol^{-1} occurs in fcc structure. If its unit cell edge length is 500 pm and its density is 5.22 g cm^{-3}. Calculate the value of Avogadro constant. [**Ans. :** 6.03×10^{23} mol^{-1}]

6. An element crystallises in a cubic close packed structure having a fcc unit cell of an edge 200 pm. Calculate the density if 200 g of this element contain 24×10^{23} atoms. [**Ans. :** 41.6 g cm^{-3}]

7. Analysis shows that a metal oxide has a empirical formula $M_{0.96}O$. Calculate the percentage of M^{2+} and M^{3+} ions in this crystal. [**Ans. :** M^{2+} = 91.7%, M^{3+} = 8.3%]

8. AgCl is doped with 10^{-2} mol% of $CdCl_2$, find the concentration of cation vacancies. [**Ans. :** 10^{-4} mol]

9. A metallic element has a body centered cubic lattice. Edge length of unit cell is 2.88×10^{-8} cm. The density of the metal is 7.20 gcm^{-3}. Calculate
   (a) The volume of unit cell.
   (b) Mass of unit cell.
   (c) Number of atoms in 100 g of metal.

   [**Ans. :** (a) 2.39×10^{-23} cm^3 (b) 1.72×10^{-22} g, (c) 1.162×10^{24} atoms]

10. Molybednum has atomic mass 96 g mol^{-1} with density 10.3 g/cm^3. The

edge length of unit cell is 314 pm. Determine lattice structure whether simple cubic, bcc or fcc.

(Given $N_A = 6.022 \times 10^{23}$ mol^{-1}) [**Ans. :** Z = 2, bcc type]

*13. The density of copper metal is 8.95 g cm^{-3}. If the radius of copper atom is 127 pm, is the copper unit cell a simple cubic, a body-centred cubic or a face centred cubic structure?

(Given at. mass of Cu = 63.54 g mol^{-1} and $N_A = 6.02 \times 10^{23}$ mol^{-1}]

[**Ans. :** Z = 4, fcc type]

[**Hint :** $d = \frac{ZM}{a^3 \times N_A}$ calculate Z/a^3 by putting the values given in the question.

Calculate packing efficiency by $\frac{z \times \frac{4}{3}\pi r^3 \times 100}{a^3}$ using value of Z/a^3,which is 74%. This shows that Z = 4

14. The well known mineral fluorite is chemically calcium fluoride. It is known that in one unit cell of this mineral there are 4 Ca^{2+} ions and 8F^- ions and that Ca^{2+} ions are arranged in a fcc lattice. The F^- ions fill all the tetrahedral holes in the fcc lattice of Ca^{2+} ions. The edge of the unit cell is 5.46×10^{-8} cm in length. The density of the solid is 3.18 g cm^{-3}. Use this information to calculate Avogadro's number (Molar mass of CaF_2 = 78.08 g mol^{-1}]

[**Ans. :** 6.02×10^{23} mol^{-1}]