

# **CBSE & State Boards**

## **UNSOLVED PAPERS**

# **CHEMISTRY**

### **CHAPTER WISE**

### **& SUB- TOPICWISE**

## **Question Bank**

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# Syllabus

## Unit II: Solutions

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, Raoult's law, colligative properties - relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Van't Hoff factor.

## Unit III: Electrochemistry

Redox reactions, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, Relation between Gibbs energy change and EMF of a cell, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and law of electrolysis (elementary idea), dry cell-electrolytic cells and Galvanic cells, lead accumulator, fuel cells, corrosion. CLASS XII (2024-25) (THEORY)

## Unit IV: Chemical Kinetics

Rate of a reaction (Average and instantaneous), factors affecting rate of reaction: concentration, temperature, catalyst; order and molecularity of a reaction, rate law and specific rate constant, integrated rate equations and half-life (only for zero and first order reactions), concept of collision theory (elementary idea, no mathematical treatment), activation energy, Arrhenius equation.

## Unit VIII: d and f Block Elements

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals – metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation, preparation and properties of  $K_2Cr_2O_7$  and  $KMnO_4$ . Lanthanoids - Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences. Actinoids - Electronic configuration, oxidation states and comparison with lanthanoids.

## Unit IX: Coordination Compounds

Coordination compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's theory, VBT, and CFT; structure and stereoisomerism, importance of coordination compounds (in qualitative analysis, extraction of metals and biological system).

## Unit X: Haloalkanes and Haloarenes.

Haloalkanes: Nomenclature, nature of C–X bond, physical and chemical properties, optical rotation mechanism of substitution reactions. Haloarenes: Nature of C–X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only). Uses and environmental effects of - dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

## Unit XI: Alcohols, Phenols and Ethers

Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration, uses with special reference to methanol and ethanol. Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols. Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.

## Unit XII: Aldehydes, Ketones and Carboxylic Acids

Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes, uses. Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

## Unit XIII: Amines

Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines. Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

## Unit XIV: Biomolecules

Carbohydrates - Classification (aldoses and ketoses), monosaccharides (glucose and fructose), D-L configuration oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); Importance of carbohydrates. Proteins -Elementary idea of - amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins; enzymes. Hormones - Elementary idea excluding structure. Vitamins - Classification and functions. Nucleic Acids: DNA and RNA.

## A. General Characteristics of Solid State

### Section-A : Multiple Choice Questions

1. Which of the following statement about the interstitial compound is INCORRECT?
- They retain metallic conductivity
  - They are chemically reactive
  - They are much harder than the pure metal.
  - They have higher melting points than the pure metal.

Manipur Board-2018

Ans. (b)

2. Which type of solid is carborundum?
- Ionic solid
  - Metallic solid
  - Molecular solid
  - Network solid

Gujarat Board-2019

Ans. (c)

3. H<sub>2</sub>O (ice) is an example of
- Polar molecular solid
  - Hydrogen bonded molecular solid
  - Ionic solid
  - None of these

Jharkhand Board-2019

Ans. (b)

4. Graphite is a good conductor of electricity due to the presence of:
- Lone pair of electron
  - Free valence electron
  - Cations
  - Anions

Haryana Board-2017

Ans. (b)

5. Which of the following exists as covalent crystal in solid state?
- Phosphorus
  - Iodine
  - Silicon
  - Sulphur

Haryana Board-2017

Ans. (c)

6. Which of the following is a molecular solid?
- Diamond
  - Graphite
  - Ice
  - Quartz

Kerala Board-2016

Ans. (c)

7. Which solid has the least melting point?
- SiO<sub>2</sub>
  - NaCl
  - Ag
  - CCl<sub>4</sub>

Gujarat Board-2016

Ans.(d)

8. Diamond is a–
- Solid containing hydrogen bond
  - Ionic solid
  - Covalent solid
  - Metallic solid

MP Board-2015

Ans. (c)

### Section-B : Very Short Answer

1. State the main characteristics of an ionic and network type of crystal and give a suitable example for each.  
ISC Board-2005
2. Why is glass considered as a super cooled liquid?  
All India-2008C
3. What is the coordination number of each type of ions in a rock salt type crystal structure?  
Delh-2008; All India-2008
4. “Stability of a crystal is related to the magnitude of its melting point”. How?  
All India-2009C
5. Some of the glass objects recovered from ancient monuments look milky instead of being transparent. Why?  
All India-2012C
6. What type of interactions hold the molecules together in a polar molecular solid?  
All India-2010
7. Write a distinguishing feature of metallic solids.  
All India-2010
8. Why are crystalline solids anisotropic?  
All India-2014C
9. ‘Crystalline solids are anisotropic in nature’. What does this statement mean?  
Delh-2011  
Foreign-2011
10. Which one of the following is an example of molecular solid CO<sub>2</sub> or SiO<sub>2</sub>?  
Foreign-2014
11. Write a distinguishing feature between a metallic solid and an ionic solid.  
All India-2014C
12. How would you distinguish between a metallic solid and an ionic solid other than by metallic luster?  
Foreign-2012
13. Write a feature which will distinguish a metallic solid from an ionic solid.  
Delh-2010; Foreign-2010

14. Give an example each of a molecular solid and ionic solid.

All India-2016

15. What is molecular crystal? Give example.

Tamil Nadu Board-2011

16. Solids have ..... volume and ..... shape.

Haryana Board-2021

17. Write any two characteristics of molecular solids.

Goa Board-2018

18. Classify the following solids as metallic, molecular, ionic or covalent solids:

(a) Sodium Chloride

(b) Silica

19. Draw a neat labelled diagram of a tetrahedral void observed in a crystal lattice.

Goa Board-2019

20. Write any one example of network solid.

Rajasthan Board-2019

21. At low temperature hydrogen is which type of molecular solid?

Rajasthan Board-2016

22. Fill in the blanks:

(a) Co-ordination number of Sodium in NaCl is .....

MP Board-2016

### Section-C : Short Answer

1. Write the properties of ionic crystals.

Tamil Nadu Board-2018

2. Ionic solids are hard and brittle. Explain.

Maharashtra Board-2018

3. Why are solids rigid?

Haryana Board -2016

4. Give any one difference between anisotropy and isotropy nature of solid.

Rajasthan Board-2017

5. Which of the following are polar molecular solids?

Solid sulphur dioxide, solid ammonia, iodine crystals, graphite, carbon tetrachloride.

Rajasthan Board-2013

### Section-E : Long Answer

1. What type of solids are electrical conductors, malleable and ductile?

"Ionic solids conduct electricity in molten state but not in solid state". Explain.

Assam Board-2020

## B. Amorphous and Crystalline Solids

### Section-A : Multiple Choice Questions

1. (a) Which of the following is not a molecular solid?

(a)  $N_2$

(b)  $I_2$

(c) SiC

(d)  $CO_2$

CBSE-2021

Ans. (b)

2. In a face centered cubic lattice, atom (A) occupies the corner positions and at (B) occupies the face centre positions. If one atom of (B) is missing from the face centered points, the formula of the compound is :

(a)  $A_2B_5$

(b)  $A_2B_3$

(c)  $AB_2$

(d)  $A_2B$

ISC Board-2017

Ans. (a)

3. Which of the following is not characteristic of crystalline solid?

(a) Melts at a sharp and characteristic temperature

(b) Definite characteristic geometrical shape

(c) Anisotropic in nature

(d) Pseudo solids or super cooled liquids

Gujarat Board-2021

Ans. (d)

4. Maximum amount of a solid solute that can be dissolved in a given amount of a liquid solvent does not depend upon:

(a) Pressure

(b) Temperature

(c) Nature of solute

(d) Nature of solvent

Haryana Board-2017

Ans. (a)

5. Amorphous solid is:

(a) Rubber

(b) Plastic

(c) Glass

(d) All

Haryana Board-2018

Ans. (d)

6. Which type of solid is graphite?

(a) Ionic

(b) Molecular

(c) Metallic

(d) Covalent

Gujarat Board-2017

Ans. (d) :

7. In which of the following solid substance dispersion forces exist?

(a)  $SiO_2$

(b)  $CO_2$

(c)  $H_2O$

(d)  $SO_2$

Gujarat Board-2019

Ans. (b)

8. Dry Ice (Solid  $CO_2$ ) is a/an:

(a) Ionic crystal

(b) Covalent crystal

(c) Molecular crystal

(d) Metallic crystal

MP Board-2012

Ans. (c)

9. Which one of the following is non-crystalline or amorphous in nature?

(a) Diamond

(b) Graphite

(c) Common salt

(d) Glass

Jharkhand Board-2023

Ans. (b)

### Section-B : Very Short Answer

1. What type of defection can arise when  $\text{Sr}^{2+}$  (as  $\text{SrCl}_2$ ) is added as impurity in ionic solid  $\text{NaCl}$ . Justify your answer.  
Manipur Board 2020
2. Name the type of crystalline solid, which is electrical insulator in solid state but conduct electricity in aqueous solution.  
Karnataka board 2023
3. Explain Schottky defect and Frenkel defect.  
Uttarakhand Board 2022
4. 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 octahedral voids. What is the formula of the compound?  
CBSE-2019
5. Why are powdered substances more effective adsorbents than their crystalline forms?  
CBSE-2019
6. Correct the following statement.  
"Molarity of a solution is independent of temperature".  
ISC Board-2005
7. Mention three differences between crystalline and amorphous solids.  
ISC Board-2000
8. Explain why graphite is soft and can be used as lubricant?  
ISC Board-2009
9. Compare the crystals of copper and diamond giving one similarity and one difference.  
ISC Board-2010
10. Correct the statement : Diamond is crystalline while graphite is amorphous.  
ISC Board-2001
11. Graphite is anisotropic to electrical conduction. Explain.  
ISC Board-2001
12. Correct the statement : Graphite has a two-dimensional sheet like structure in which each carbon atom is  $\text{sp}^3$ -hybridised.  
ISC Board-2005
13. The crystal of diamond is made up of ..... while that of calcium chloride is made of .....  
ISC Board-2009
14. The crystal of graphite is made up of .....while that of sodium chloride is made up of.....  
ISC Board-2014
15. Write three differences between crystalline and amorphous solids.  
Odisha Board-2020
16. Write two differences between crystalline solids and amorphous solids.  
Manipur Board-2017

17. Given the differences between crystalline and amorphous solids with respect to shape and melting point.

Karnataka Board-2017

18. ....solids are electrical conductors, malleable and ductile.

Haryana Board-2022

19. Given one example of Ionic solid.

Haryana Board-2022

20. Write any three differences between crystalline and amorphous solids.

Kerala Board-2022

### Section-C : Short Answer

1. What are crystalline solids? Give two examples.  
Haryana Board-2017
2. Write down distinction between crystalline and amorphous solids on the basis of the following properties.  
(a) Melting point  
(b) Cleavage property and  
(c) Order in arrangement of constituent particles  
Gujarat Board 2023 (March)
- 3.(a) Write any two differences between crystalline and amorphous solids.  
(b) Draw the diagram showing impurity defect.  
Rajasthan Board-2020
4. Define chromophores and auxochromes.  
Rajasthan Board-2010
5. Define the terms crystalline & amorphous solids.  
Haryana Board-2016

### Section-D : Case Based Study

1. An amorphous solid 'A' which has a crown shaped structure, burns in air to form a gas 'B' which turns lime water milky. 'B' is also produced by roasting of sulphide ores. 'B' undergoes oxidation in the presence of  $\text{V}_2\text{O}_5$  to give 'C' and to carry out this oxidation low temperature and high pressure is mandatory to get a good yield of 'C'. 'C' is then absorbed in  $\text{H}_2\text{SO}_4$  to give 'D'. 'D' is then diluted to give a very important compound 'E'. 'E' is largely responsible for the manufacture of variety of compounds in industry. 'E' in concentrated form, when combined with Cu metal, gives compound 'F'.  
From this description  
(a) Elucidate the structure of 'A' to 'F'.  
(b) Give a balanced chemical equation for the conversion of 'E' to 'F'.  
(c) Give two important functions of 'E' in the chemical industry.  
CBSE-2020

### Section-E : Long Answer

1. Define Anisotropy. Distinguish between crystalline solids and amorphous solids.  
Maharashtra Board-2019

## C. Crystal Lattices and Unit Cells

### Section-A : Multiple Choice Questions

1. For unit cell  $\text{BaSO}_4$  crystal which option for axial angles is correct?  
 (a)  $\alpha = \beta = \gamma \neq 90^\circ$   
 (b)  $\alpha = \beta = 90^\circ \gamma = 120^\circ$   
 (c)  $\alpha = \gamma = 90^\circ \beta \neq 90^\circ$   
 (d)  $\alpha = \beta = \gamma = 90^\circ$

Gujarat Board 2023 (March)

Ans. (a)

2. Four alternatives are given in each part of this question. Select the correct alternative and write it in your answer book.

(a) The length of core of an fcc unit cell is  $a$  and its atomic radius is  $r$ . The relationship between then is

$$(a) \quad r = \left( \frac{\sqrt{3}}{4} \right) a \quad (b) \quad r = \left( \frac{\sqrt{2}}{4} \right) a$$

$$(c) \quad r = \frac{a}{2} \quad (d) \quad r = \left( \frac{\sqrt{4}}{6} \right) a$$

UP Board 2019

Ans. (a)

3. Example of Hexagonal crystal is—  
 (a) Diamond (b) Graphite  
 (c) Salt (d) Water

MP Board 2020

Ans. (b)

4. The crystal system having dimensions  $a \neq b \neq c$  and  $\alpha = \beta = \gamma = 90^\circ$  is —  
 (a) Hexagonal  
 (b) Monoclinic  
 (c) Triclinic  
 (d) Orthorhombic

UP Board 2023

Ans. (d)

5. In a orthorhombic system axis angles,  $\alpha = \beta = \gamma$  are —  
 (a) equal  $90^\circ$  (b) Less then  $90^\circ$   
 (c) greater than  $90^\circ$  (d) None of these

Jharkhand Board-2020

Ans. (a)

6. Number of octahedral sites per sphere in FCC structure:  
 (a) 1 (b) 3  
 (c) 6 (d) 4

Haryana Board-2016

Ans. (a)

7. What is the number of atoms in end centered unit cell?  
 (a) 4 (b) 1  
 (c) 2 (d) 6

Gujarat Board-2018

Ans. (c) :

8. What is the number of atoms in face centred unit cell?  
 (a) 2 (b) 4  
 (c) 6 (d) 3

Gujarat Board-2017

Ans. (b)

9. In which crystal system, edge length is not  $a \neq b \neq c$ ?  
 (a) Monoclinic (b) Hexagonal  
 (c) Orthorhombic (d) Triclinic

Gujarat Board-2020

Ans. (d)

10. Crystal structure of NaCl is—  
 (i) Face centred cubic (ii) Body centred cubic  
 (iii) Hexagonal (iv) Tetrahedral

MP Board-2015

Ans. (a)

### Section-B : Very Short Answer

1. What do you understand by Lattice point?  
 Uttarakhand Board 2022
2. Define crystal lattice.  
 J&K Board-2020

3. A cube solid is made up of two elements A and B. Element A forms hcp while atoms of element B occupy two-third of the octahedral voids. What is the formula of the solid?  
 CBSE-2019

4. (a) Atoms of element Q form ccp lattice and those of the element P occupy  $\frac{2}{3}$  rd of tetrahedral voids. What is the formula of the compound formed by the elements P and Q?  
 (b) What type of stoichiometric defect is shown by KCl and why ?  
 CBSE-2019

5. For sodium chloride crystal, state  
 (i) the type of unit cell.  
 (ii) the nature of forces holding the particles together.  
 (iii) the geometry of the sodium ions which are arranged around a chloride ion.  
 ISC Board-2001, 2003

6. Crystals of ..... and ..... have face centered cubic lattices.  
 ISC Board-2004

7. (i) Name the crystal structure of copper metal.  
 (ii) What is the coordination number of copper in its crystalline state?  
 ISC Board-2013, 2015

8. Express the relationship between atomic radius (r) and the edge length (a) in the fcc unit cell.  
 Foreign-2014

9. Express the relationship between atomic radius (r) and the edge length (a) in the bcc unit cell.  
Foreign-2014
10. Aluminium crystallizes in fcc structure. Atomic radius of the metal is 125 Pm. What is length of the side of the unit cell of the metal?  
All India-2013
11. Define the following terms in relation to crystalline solids.  
(a) Unit cell  
(b) Coordination number  
Give one example in each case.  
All India-2011
12. An ionic compound  $AB_2$  possesses  $CaF_2$  type crystal structure. Write the coordination number of  $A^{2+}$  and  $B^-$  ions in crystals  $AB_2$ .  
All India-2009C
13. Define primitive unit cells.  
All India-2015; Delh-2009
14. The smallest repeating unit in crystal lattice which when repeated over and over again produces the complete crystal is \_\_\_\_\_.  
Odisha Board-2020
15. Aluminium crystallizes in an FCC structure. Atomic radius of the metal is 125pm. Calculate the edge length of unit cell of the metal.  
Karnataka Board-2014
16. (a) Based on the nature of intermolecular forces, classify the following solids.  
(i)  $SiO_2$   
(ii) Ice  
(b)  $ZnO$  turns yellow on heating. Why?  
Kerala Board-2018
17. Write the value of axial distances and axial angles of triclinic crystal.  
Rajasthan Board-2017
18. Fill the blanks:  
(a) There are \_\_\_\_\_ type of crystal system.  
MP Board-2017
19. What is the coordination number of  $Cs^+$  and  $Cl^-$  in  $CsCl$  structure?  
MP Board-2015
20. Define Crystal Lattice.  
J & K board-2023

### Section-C : Short Answer

1. Calculate number of particles per unit cell in a FCC crystal.  
Haryana Board-2017
- 2.(i) Write two difference between crystalline and amorphous solids.  
(ii) Draw a diagram for anisotropic behaviour of crystalline solids.  
Rajasthan Board-2011
3. What are lattice compounds? Write one example of such compounds.  
Rajasthan Board-2010

4. Sketch the:  
(a) Simple cube  
(b) Face-centred cube and  
(c) Body centred cube  
Tamil Nadu Board-March, 2016
5. (a) Give the significance of a 'lattice point'. Which point defect increases the density of a crystal?  
Assam Board-2020
6. Element B crystallizes in body centered cubic (bcc) unit cell. Calculate approximate number of unit cells in 9.2 gm of element B. (Atomic number of B = 23)  
Assam Board-2023
7. (a) 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?  
(b) Why is potassium chloride sometimes violet instead of pure white?  
Meghalaya Board-2018

## D. No. of Atoms in a Unit Cell

### Section-A : Multiple Choice Questions

8. Sodium metal crystallises in bcc structure. How many unit cell are present in 9.2 g crystal of sodium metal? [Atomic Mass:  $Na = 23 \text{ gmol}^{-1}$ ]  
(a)  $3.2 \times 10^{24}$  (b)  $1.20 \times 10^{23}$   
(c)  $2.4 \times 10^{23}$  (d)  $6.022 \times 10^{24}$   
Gujarat Board 2023 (March)

Ans. (c)

9. The number of atoms per unit cell in a body-centred cubic unit cell is  
(a) 4 (b) 2  
(c) 1 (d) 3  
CBSE-2021

Ans. (b)

10. Total number of atoms present in Face Centred Cubic unit cell are.....  
(a) 3 (b) 4  
(c) 2 (d) 1  
Gujarat Board-2021

Ans. (b)

11. (a) The number of octahedral voids in the unit cell of ccp lattice is:  
(a) 2 (b) 3  
(c) 4 (d) 6  
Odisha Board-2023

Ans. (c)

12. The total number of atoms per unit cell in bcc is:  
(a) 3 (b) 1  
(c) 4 (d) 2  
Tamil Nadu Board-2018

Ans. (d)