SAMPLE CONTENT

CUET (UG)

COMMON UNIVERSITY ENTRANCE TEST

Based on notified syllabus prescribed by NTA

1352 MCQs

LOADED WITH AMAZING FEATURES

- Caution
- Connections
- Topic Test
- Concept Videos
- Subtopic wise MCQs
- Smart Key/Thinking Hatke

CHEMISTRY

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Target Publications® Pvt. Ltd.

For Common University Entrance Test CUET (UG) based on syllabus prescribed by National Testing Agency (NTA)

CUET (UG)
Chemistry

Salient Features

- **'1352'** MCQs for ample practice
- Synopsis to offer a crisp overview of the chapter
- Subtopic wise segregation of MCQs for efficient practice
- Connections, Cautions designed to impart holistic learning
- A list of Important formulae provided via Q.R. code for quick revision
- Video links/PDF provided via Q.R. codes for boosting conceptual retention
- Detailed solutions provided for better understanding
- Inclusion of Smart Keys/Thinking Hatke to promote lateral thinking and problem-solving ability
- Topic Test provided for self-assessment at the end of each chapter
- Solution to Topic Test accessible via Q.R. code
- Includes Passage-based MCQs with Answers (Solution provided through Q.R. code)
- Includes relevant questions of CUCET 2021
- Includes Question Paper of CUET (UG) 2022–18th August (Slot - 2) (Solution provided through Q.R. Code)

Please scan the adjacent QR code in *Quill - The Padhai App* to access the list of Important formulae segregated chapter-wise

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PREFACE

Common University Entrance Test, CUET (UG) is a pivotal juncture in a student's academic journey. It is a single-window opportunity for the students to seek admission in the premier institutions for undergraduate courses after class XII.

Target Publications, with more than a decade of experience and expertise in the domain of competitive examination, offers **'CUET (UG) Chemistry'** for all the CUET (UG) aspirants. This book is compiled according to the notified syllabus prescribed by NTA for CUET (UG).

It is a complete preparation and practice book with the unmatched comprehensive amalgamation of theory, MCQs, and the tools that will be needed to clear the exam successfully.

The content of this book is arranged in in a logical sequence to enable strategic learning. It provides the students with scientifically accurate context, several study techniques, and relevant supporting details essential for a better understanding of the concepts of Chemistry.

The chapter begins with **'Synopsis'** and is followed by '**Multiple Choice Questions'** (MCQs). The questions in the MCQs section are specially created and compiled to help students revise concepts as well as to give them practice of questions which require understanding of multiple-concepts. To aid students, detailed solutions are provided for difficult questions.

While ensuring the complete coverage of the syllabus in an effortless and easy to grasp format, emphasis is also given to optimize students' learning outcomes. Keeping the following key objectives in mind:
Time management, easy memorization, revision, and non-conventional yet simple methods for MCQ solving, we have infused several features such as, **Caution, Connections, Smart Key and Thinking Hatke**.

Topic Test is provided at the end of each chapter for self evaluation. Solution to Topic Test can be viewed by scanning the QR code provided at the end of each chapter.

A section of **Passage-based MCQs** covering a wide range of concepts is included at the end of the book. These passages are segregated chapter-wise and their solutions can be viewed through Q.R. code in a pdf format.

Question paper of CUET (UG) 2022–18th August (Slot - 2) is provided to offer students a glimpse of the complexity of questions asked in entrance examination, solution to which is provided through Q.R. code. The paper has been split topic wise to let the students know which of the topics were more relevant in the latest examination.

We are confident that this book will cater to the needs of students across varied backgrounds and effectively assist them to excel in the examination.

We hope the book benefits the learner as we have envisioned.

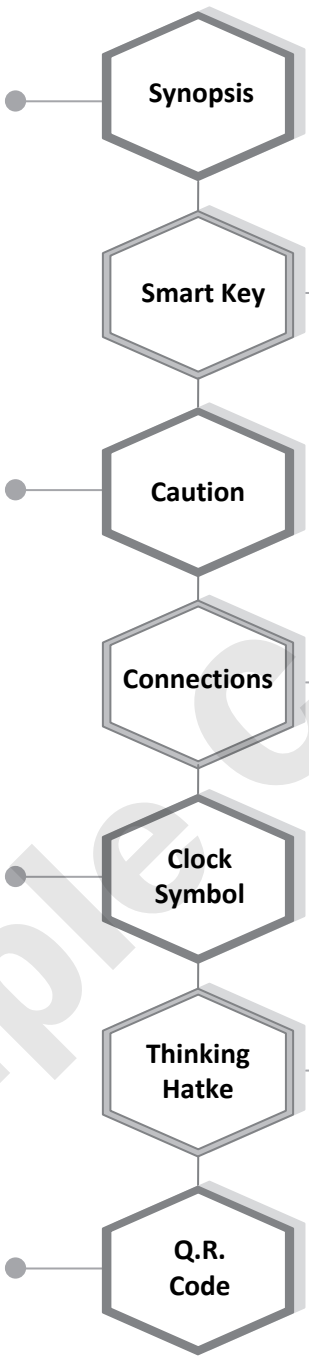
Publisher

Edition: Second

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

Please write to us on: mail@targetpublications.org

KEY FEATURES



'**Synopsis**' presents crisp summary of a topic in efficient form of pointers, tables, charts.

'**Smart Key**' comprises important theoretical or formula based short tricks which come handy while solving MCQ.

'**Caution**' apprises students about commonly made mistakes.

'**Connections**' enable students to interlink concepts covered in different chapters.

'**Clock Symbol**' instructs students that the given MCQ can be solved apace by applying either smart keys or thinking hatke.

'**Thinking Hatke'** elucidates a simple non-conventional quick witted approach to arrive at the correct answer.

'**QR code**' provides:

i. Solution to Topic Test of each chapter.
ii. Access to the list of important formulae segregated chapter-wise, beneficial for last minute revision.
iii. Access to a video/pdf to boost understanding of a concept.
iv. Solutions to Passage-based MCQs.
v. Solution to CUET (UG) 2022 18th August (Slot - 2)

CONTENTS

Note: Symbol indicates the question can either be solved by applying a '**Smart Key'** or by '**Thinking Hatke'**

'**Caution**' makes students watchful against commonly made mistakes

'**Connections'** interlink concepts covered in different chapters

Broad features of CUET (UG)

Mode of Examination: Computer Based Test (CBT) mode						
Sections	**Subjects/ Tests**	**Questions to be Attempted**	**Marks per Question**	**Total Marks**	**Question Type**	**Duration**
Section IA - Languages	There are 13 different languages. Any of these languages may be chosen.	40 questions out of 50 in each language	5	200	• Language to be tested through Reading Comprehension based on different types of passages–Factual, Literary and Narrative, [Literary Aptitude and Vocabulary] • MCQ Based Questions	45 Minutes for each language
Section IB - Languages	There are 20 Languages. Any other language apart from those offered in Section I A may be chosen.					
Section II - Domain	There are 27 Domains specific Subjects being offered under this Section. A candidate may choose a maximum of Six Domains as desired by the applicable University/ Universities.	40 questions out of 50 in each subject	5	200	• Input text can be used for MCQ Based Questions • MCQs based on syllabus given on NTA website	45 Minutes for each Domain Specific Subjects
Section III General Test	For any such undergraduate programme/ programmes being offered by Universities where a General Test is being used for admission.	60 questions out of 75	5	300	• Input text can be used for MCQ Based Questions • General Knowledge, Current Affairs, General Mental Ability, Numerical Ability, Quantitative Reasoning (Simple application of basic mathematical arithmetic/algebra geometry/mensuration /stat taught till Grade 8), Logical and Analytical Reasoning	60 Minutes
Note: • One mark will be deducted for a wrong answer. • Unanswered/Marked for Review will be given no mark (0).						

Candidates are advised to visit the NTA CUET (UG) official website ***https://cuet.samarth.ac.in/*** *for latest updates regarding the Examination.*

How This Book Covers The Entire Syllabus of CUET (UG) Chemistry

CUET (UG) Syllabus	Subtopic No.	Subtopic name
UNIT I – Solid State		
Chapter 01 : The Solid State		
Classification of solids based on different binding forces: molecular, ionic covalent, and metallic solids	1.3	Classification of Crystalline Solids
Amorphous and crystalline solids (elementary idea)	1.2	Amorphous and Crystalline Solids
Unit cell in two dimensional and three-dimensional lattices	1.4	Crystal Lattices and Unit Cells
Calculation of density of unit cell	1.8	Calculations Involving Unit Cell Dimensions
Packing in solids	1.6	Close Packed Structures
Packing efficiency	1.7	Packing Efficiency
Voids	1.6	Close Packed Structures
Number of atoms per unit cell in a cubic unit cell	1.5	Number of Atoms in a Unit Cell
Point defects	1.9	Imperfections in Solids
Electrical and magnetic properties, Band theory of metals, conductors, semiconductors and insulators and n- and p-type semiconductors	1.10, 1.11	Electrical Properties, Magnetic Properties
UNIT II – Solutions		
Chapter 02 : Solutions		
Types of solutions	2.1	Types of Solutions
Expression of concentration of solutions of solids in liquids	2.2	Expressing Concentration of Solutions
The solubility of gases in liquids	2.3	Solubility
Solid solutions	2.1	Types of Solutions
Colligative properties – the relative lowering of vapour pressure, Raoult's law, elevation of B.P., depression of freezing point, osmotic pressure, Determination of molecular masses using colligative properties	2.4, 2.5, 2.6	Vapour Pressure of Liquid Solutions, Ideal and Non-ideal Solutions, Colligative Properties and Determination of Molar Mass
Abnormal molecular mass, Van't Hoff factor	2.7	Abnormal Molar Masses
UNIT III – Electrochemistry		
Chapter 03 : Electrochemistry		
Redox reactions	3.1	Redox Reactions
Conductance in electrolytic solutions, Specific and molar conductivity, Variations of conductivity with concentration, Kohlrausch's Law	3.5	Conductance of Electrolytic Solutions
Electrolysis and laws of electrolysis (elementary idea)	3.6	Electrolytic Cells and Electrolysis
Dry cell – electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, Standard electrode potential	3.2, 3.3, 3.7	Electrochemical Cells, Galvanic Cells, Batteries
Nernst equation and its application to chemical cells, Relation between Gibbs energy change and EMF of a cell	3.4	Nernst Equation
Fuel cells	3.8	Fuel Cells
Corrosion	3.9	Corrosion

CUET (UG) Syllabus	Subtopic No.	Subtopic name
UNIT IV – Chemical Kinetics		
Chapter 04 : Chemical Kinetics		
Rate of a reaction (average and instantaneous)	4.1	Rate of a Chemical Reaction
Factors affecting rates of reaction: concentration, temperature, catalyst; Order and molecularity of a reaction; Rate law and specific rate constant	4.2	Factors Influencing Rate of a Reaction
Integrated rate equations, and half-life (only for zero and first-order reactions)	4.3	Integrated Rate Equations
Concept of collision theory (elementary idea, no mathematical treatment)	4.5	Collision Theory of Chemical Reactions
Activation energy, Arrhenius equation	4.4	Temperature Dependence of the Rate of a Reaction
UNIT V – Surface Chemistry		
Chapter 05 : Surface Chemistry		
Adsorption – physisorption and chemisorption; Factors affecting adsorption of gases on solids	5.1	Adsorption
Catalysis: homogenous and heterogeneous, activity and selectivity; Enzyme catalysis	5.2	Catalysis
Colloidal state: the distinction between true solutions, colloids, and suspensions	5.3	Colloids
Lyophilic, lyophobic, multimolecular and macromolecular colloids; Properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation	5.4	Classification of Colloids
Emulsions – types of emulsions	5.5	Emulsions
UNIT VI – General Principles and Processes of Isolation of Elements		
Chapter 06 : General Principles and Processes of Isolation of Elements		
Principles and methods of extraction – concentration, oxidation, reduction, electrolytic method and refining	6.2, 6.3, 6.6, 6.7	Concentration of Ores, Extraction of Crude Metal from Concentrated Ore, Oxidation Reduction, Refining
Occurrence and principles of extraction of aluminium, copper, zinc, and iron.	6.1, 6.4, 6.5	Occurrence of Metals, Thermodynamic Principles of Metallurgy, Electrochemical Principles of Metallurgy
UNIT VII – p-Block Elements		
Chapter 07 : The p-Block Elements		
Group 15 elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties	7.1	Group 15 Elements
Nitrogen – preparation, properties, and uses	7.2	Dinitrogen
Compounds of nitrogen: preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only)	7.3, 7.4, 7.5	Ammonia, Oxides of Nitrogen, Nitric Acid
Phosphorus-allotropic forms	7.6	Phosphorus – Allotropic Forms
Compounds of phosphorus: preparation and properties of phosphine, halides (PCl_3, PCl_5) and oxoacids (elementary idea only).	7.7, 7.8, 7.9	Phosphine, Phosphorus Halides, Oxoacids of Phosphorus
Group 16 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties	7.10	Group 16 Elements
Dioxygen: preparation, properties, and uses; classification of oxides; ozone	7.11, 7.12, 7.13	Dioxygen, Simple Oxides, Ozone
Sulphur – allotropic forms	7.14	Sulphur – Allotropic Forms

CUET (UG) Syllabus	Subtopic No.	Subtopic name
Compounds of sulphur: preparation, properties, and uses of sulphur dioxide; sulphuric acid: industrial process of manufacture, properties and uses, oxoacids of sulphur (structures only).	7.15, 7.16, 7.17	Sulphur Dioxide, Oxoacids of Sulphur, Sulphuric Acid
Group 17 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties	7.18	Group 17 Elements
Compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only).	7.19, 7.20, 7.21, 7.22	Chlorine, Hydrogen Chloride, Oxoacids of Halogens, Interhalogen Compounds
Group 18 elements: General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses	7.23	Group 18 Elements
UNIT VIII – d- and f-Block Elements		
Chapter 08 : The 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	8.1, 8.2, 8.3	Position in the Periodic Table, Electronic Configuration and Occurrence of the d-Block Elements, General Properties of the Transition Elements (d-Block)
Preparation and properties of $K_2Cr_2O_7$ and $KMnO_4$	8.4	Some Important Compounds of Transition Elements
Lanthanoids – electronic configuration, oxidation states, chemical reactivity, and lanthanoid contraction and its consequences	8.5	The Lanthanoids
Actinoids – Electronic configuration, oxidation states, and comparison with lanthanoids.	8.6	The Actinoids
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Chapter 09 : Coordination Compounds		
Introduction, Werner's theory	9.1	Werner's Theory of Coordination Compounds
Ligands, Coordination number	9.2	Definitions of Some Important Terms Pertaining to Coordination Compounds
IUPAC nomenclature of mononuclear coordination compounds	9.3	Nomenclature of Coordination Compounds
Isomerism (structural and stereo)	9.4	Isomerism in Coordination Compounds
Bonding, VBT, Magnetic properties and shapes, CFT, Colour	9.5, 9.6	Bonding in Coordination Compounds, Bonding in Metal Carbonyls
Importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems)		Importance and Applications of Coordination Compounds
Unit X – Haloalkanes and Haloarenes		
Chapter 10 : Haloalkanes and Haloarenes		
Haloalkanes: Nomenclature	10.2	Nomenclature
Haloalkanes: Nature of C–X bond, Haloarenes: Nature of C–X bond	10.3	Nature of C–X bond of Haloalkanes and Haloarenes
Haloalkanes: Physical properties	10.6	Physical Properties of Haloalkanes and Haloarenes
Haloalkanes: Chemical properties, mechanism of substitution reactions. Optical rotation Haloarenes: Substitution reactions (directive influence of halogen for monosubstituted compounds only)	10.7	Chemical Reactions of Haloalkanes and Haloarenes
Uses and environmental effects of: dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT	10.8	Polyhalogen Compounds

CUET (UG) Syllabus	Subtopic No.	Subtopic name
UNIT XI – Alcohols, Phenols, and Ethers		
Chapter 11 : Alcohols, Phenols, and Ethers		
Alcohols: Nomenclature, Phenols: Nomenclature, Ethers: Nomenclature	11.2	Nomenclature
Alcohols: Methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary, and tertiary alcohols, mechanism of dehydration Phenols: Methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols	11.4	Alcohols and phenols
Alcohols: Uses with special reference to methanol and ethanol	11.5	Some Commercially Important Alcohols
Ethers: Methods of preparation, physical and chemical properties, uses	11.6	Ethers
UNIT XII – Aldehydes, Ketones, and Carboxylic Acids		
Chapter 12 : Aldehydes, Ketones, and Carboxylic Acids		
Aldehydes and Ketones: Nomenclature, nature of carbonyl group	12.1	Nomenclature and Structure of Carbonyl Group
Aldehydes and Ketones: Methods of preparation	12.2	Preparation of Aldehydes and Ketones
Aldehydes and Ketones: Physical properties	12.3	Physical Properties of Aldehydes and Ketones
Aldehydes and Ketones: Chemical properties, mechanism of nucleophilic addition, the reactivity of alpha hydrogen in aldehydes	12.4	Chemical Properties of Aldehydes and Ketones
Aldehydes and Ketones: Uses	12.5	Uses of Aldehydes and Ketones
Carboxylic Acids: Nomenclature	12.6	Nomenclature and Structure of Carboxyl Group
Carboxylic Acids: Methods of preparation	12.7	Methods of Preparation of Carboxylic Acids
Carboxylic Acids: Physical properties	12.8	Physical Properties of Carboxylic Acids
Carboxylic Acids: Acidic nature, chemical properties	12.9	Chemical Properties of Carboxylic Acids
Carboxylic Acids: Uses	12.10	Uses of Carboxylic Acids
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Amines: Structure	13.1	Structure of Amines
Amines: Classification	13.2	Classification of Amines
Amines: Nomenclature	13.3	Nomenclature of Amines
Amines: Methods of preparation	13.4	Preparation of Amines
Amines: Physical properties	13.5	Physical Properties of Amines
Amines: Chemical properties, uses, identification of primary secondary, and tertiary amines, cyanides and isocyanides	13.6	Chemical Properties of Amines
Diazonium salts: Preparation	13.7	Method of Preparation of Diazonium Salts
Diazonium salts: Chemical reactions	13.9	Chemical Properties of Diazonium Salts
Diazonium salts: Importance in synthetic organic chemistry	13.10	Importance of Diazonium Salts in Synthesis of Aromatic Compounds

CUET (UG) Syllabus	Subtopic No.	Subtopic name
UNIT XIV – Biomolecules		
Chapter 14 : Biomolecules		
Carbohydrates: Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D-L configurations, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen), importance	14.1	Carbohydrates
Proteins: Elementary idea of α-amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins	14.2	Proteins
Proteins: Enzymes	14.3	Enzymes
Vitamins: Classification and functions	14.4	Vitamins
Nucleic Acids: DNA and RNA	14.5	Nucleic Acids
Hormones: Elementary idea (excluding structure)	14.6	Hormones
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Chapter 15 : Polymers		
Classification: Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers, natural and synthetic like polythene, nylon, polyesters, bakelite, rubber	15.1, 15.2	Classification of Polymers, Types of Polymerisation Reactions
Biodegradable and non-biodegradable polymers	15.4	Biodegradable Polymers
UNIT XVI – Chemistry in Everyday Life		
Chapter 16 : Chemistry in Everyday Life		
Chemicals in medicines: Analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines	16.3	Therapeutic Action of Different Classes of Drugs
Chemicals in food: Preservatives, artificial sweetening agents, elementary idea of antioxidants	16.4	Chemicals in Food
Cleansing agents: Soaps and detergents, cleansing action	16.5	Cleansing Agents

Note: This book covers a few subtopics in addition to the syllabus prescribed by NTA to help students have thorough and complete understanding of the concepts.

01 The Solid State

Content and Concepts

Synopsis

➢ **Types of solids:**

Solids

Crystalline solids	**Amorphous solids**
E.g. NaCl, Fe • Regular arrangement of constituent particles • Shows anisotrophy • True solids • Long range order	**E.g.** Glass, Rubber • Random arrangement of constituent particles • Shows isotrophy • Pseudo solids or super cooled liquids • Only short range order

➢ **Characteristics of various types of crystalline solids:**

Types of crystalline solids	Constituent particles	Bonding/ attractive forces	Physical nature	Melting point	Electrical conductivity	Examples
Molecular solids	Small covalent molecules				Insulators	
i. Polar	Polar molecules	Dipole-dipole interactions	Soft	Low		HCl, SO_2
ii. Nonpolar	Nonpolar molecules	London or dispersion forces	Soft	Very low		Ar, He, CCl_4, H_2, Cl_2, I_2, CO_2
iii. Hydrogen bonded	Molecules capable of hydrogen bonding	Hydrogen bonding	Hard	Low		H_2O (ice)
Ionic solids	Positive and negative ions	Electrostatic or Coulombic	Hard and brittle	Very high	Insulators in solid state but conductors in molten state and in aqueous solutions.	NaCl, MgO, ZnS, CaF_2
Metallic solids	Positive ions in a sea of delocalized electrons	Metallic bonding	Hard, malleable and ductile	High	Conductors	Fe, Cu, Ag, Mg
Covalent or network solids	Atoms	Covalent bonding	Hard	Very high	Insulators	SiO_2 (quartz), SiC, $C_{diamond}$, AlN
			Soft	-	Conductor	$C_{graphite}$

➢ **Types of unit cells:**

Unit cells

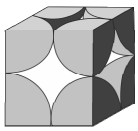
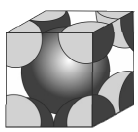
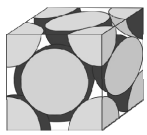
- **Simple or primitive unit cells** have lattice points only at the corners.
- **Centred unit cells**
  - **Face-centred unit cells** have lattice points at the corners and at the centre of each face.
  - **Body-centred unit cells** have lattice points at the corners and at the body centre of the unit cell.
  - **End-centred unit cells** have lattice points at the corners and at the centre of any two opposite faces.

➢ **Crystal systems:**

No.	Crystal system	Type	Edge length	Angle	Example
1.	Cubic	Simple/primitive	a = b = c	$\alpha = \beta = \gamma = 90°$	NaCl, zinc blende, Cu
2.		Body-centred	a = b = c	$\alpha = \beta = \gamma = 90°$	
3.		Face-centred	a = b = c	$\alpha = \beta = \gamma = 90°$	
4.	Tetragonal	Primitive	a = b ≠ c	$\alpha = \beta = \gamma = 90°$	White tin, SnO_2, TiO_2, $CaSO_4$
5.		Body-centred	a = b ≠ c	$\alpha = \beta = \gamma = 90°$	
6.	Orthorhombic	Primitive	a ≠ b ≠ c	$\alpha = \beta = \gamma = 90°$	Rhombic sulphur, KNO_3, $BaSO_4$
7.		Body-centred	a ≠ b ≠ c	$\alpha = \beta = \gamma = 90°$	
8.		Face-centred	a ≠ b ≠ c	$\alpha = \beta = \gamma = 90°$	
9.		End-centred	a ≠ b ≠ c	$\alpha = \beta = \gamma = 90°$	
10.	Monoclinic	Primitive	a ≠ b ≠ c	$\alpha = \beta = 90°, \gamma \neq 90°$	Monoclinic sulphur, $Na_2SO_4.10H_2O$
11.		End-centred	a ≠ b ≠ c	$\alpha = \beta = 90°, \gamma \neq 90°$	
12.	Triclinic	Primitive	a ≠ b ≠ c	$\alpha \neq \beta \neq \gamma \neq 90°$	$K_2Cr_2O_7$, H_3BO_3, $CuSO_4.5H_2O$
13.	Hexagonal	Primitive	a = b ≠ c	$\alpha = \beta = 90°, \gamma = 120°$	ZnO, graphite, CdS
14.	Rhombohedral or trigonal	Primitive	a = b = c	$\alpha = \beta = \gamma \neq 90°$	Calcite ($CaCO_3$), Cinnabar (HgS)

Scan the adjacent Q. R. Code in *Quill - The Padhai App* to view the diagrams showing the unit cells of 14 types of Bravais lattices.

➢ **Three types of cubic lattices and number of atoms per cubic unit cell:**

Unit cell	Simple cubic	Body-centred cubic	Face-centred cubic
Representation			
Contribution of atoms at corners	8 × 1/8 = 1	8 × 1/8 = 1	8 × 1/8 = 1
Contribution of atoms at faces	0	0	6 × ½ = 3
Contribution of atoms in centre	0	1	0
Number of atoms per unit cell	1	2	4

➢ **Close packed structures:**

The three dimensional close packed structure can be made in three stages:

Stage I : Linear packing in one dimension		
Linear packing	In this arrangement, the spheres are placed in a horizontal row touching each other. Coordination number = **2**	

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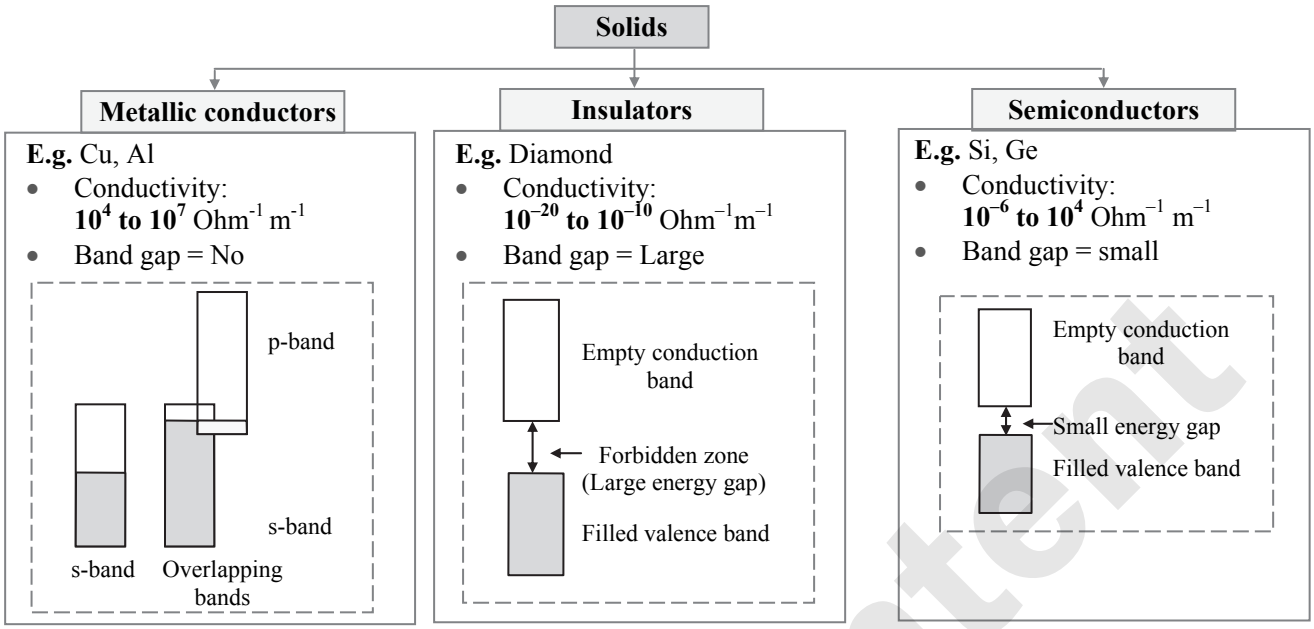
To see complete chapter buy **Target Notes** or **Target E-Notes**

➢ **Classification of solids based on electrical properties:**



➢ **Types of extrinsic semiconductors:**

n-type semiconductors	p-type semiconductors
It is an extrinsic semiconductor, which is obtained by adding group 15 element to an intrinsic semiconductor which belongs to group 14.	It is an extrinsic semiconductor, which is obtained by adding group 13 element to an intrinsic semiconductor which belongs to group 14.
E.g. Silicon doped with phosphorus	**E.g.** Silicon doped with boron

➢ **Classification of solids based on response to magnetic field:**

Substance	Characteristics	Examples
Diamagnetic materials	• Repelled weakly in magnetic field. • All electrons are paired.	Benzene, NaCl, H_2O, etc.
Paramagnetic materials	• Weakly attracted in magnetic field. • Unpaired electrons are present. • Permanent magnetisation is not possible.	Oxygen, Cu^{2+}, Fe^{3+}, Cr^{3+}, etc.
Ferromagnetic materials	• Strongly attracted in magnetic field. • Unpaired electrons are present. • Permanent magnetisation is possible.	Fe, Co, Ni, Gd, CrO_2, etc.
Antiferromagnetic materials	• The number of domains that are aligned in parallel direction is equal to the number of domains that are aligned in anti-parallel direction.	MnO
Ferrimagnetic materials	• The number of domains that are aligned in parallel direction is not equal to the number of domains that are aligned in anti-parallel direction. • Weakly attracted by a magnetic field.	Fe_3O_4 (magnetite), Ferrites like $MgFe_2O_4$, $ZnFe_2O_4$, etc.

Multiple Choice Questions

1.1 General Characteristics of Solid State

1. Which of the following conditions favours the existence of a substance in the solid state?
   (A) High temperature
   (B) Low temperature
   (C) High thermal energy
   (D) Weak cohesive forces

1.2 Amorphous and Crystalline Solids

1. Which of the following is NOT a characteristic of a crystalline solid?
   (A) Definite and characteristic heat of fusion
   (B) Isotropic nature
   (C) A regular periodically repeated pattern of arrangement of constituent particles in the entire crystal
   (D) A true solid

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To see complete chapter buy **Target Notes** or **Target E-Notes**

Answers to MCQs

1.1 :	1.	(B)													
1.2 :	1.	(B)	2.	(B)	3.	(D)									
1.3 :	1.	(D)	2.	(A)	3.	(A)	4.	(C)	5.	(C)	6.	(D)	7.	(D)	8.	(A)
1.4 :	1.	(A)	2.	(B)	3.	(D)	4.	(B)	5.	(C)	6.	(B)				
1.5 :	1.	(B)	2.	(A)												
1.6 :	1.	(B)	2.	(C)	3.	(B)	4.	(B)	5.	(A)	6.	(B)				
1.7 :	1.	(D)	2.	(B)	3.	(A)	4.	(C)	5.	(B)	6.	(B)				
1.8 :	1.	(B)	2.	(C)	3.	(D)	4.	(C)	5.	(B)						
1.9 :	1.	(B)	2.	(A)	3.	(A)	4.	(D)	5.	(A)	6.	(B)	7.	(A)		
1.10 :	1.	(A)	2.	(A)	3.	(A)	4.	(B)	5.	(C)	6.	(C)				
1.11 :	1.	(A)	2.	(D)	3.	(D)	4.	(D)								

Solutions to MCQs

1.1 General Characteristics of Solid State

1. (B)
Lowering the temperature of a substance reduces the thermal energy of its particles. This allows the intermolecular forces to hold the particles close to each other and occupy fixed positions with respect to each other. The particles may still be able to oscillate about their mean positions; however, the substance will now exist in the solid state.

1.2 Amorphous and Crystalline Solids

1. (B)
Crystalline solids are anisotropic.

2. (B)

3. (D)
Amorphous solids are isotropic, as these substances show same properties in all directions.

1.3 Classification of Crystalline Solids

1. (D)

2. (A)
Solid I_2 is a non-polar molecular solid in which constituent particles are non-polar molecules held by weak dispersion forces or London forces.

3. (A) **4. (C)** **5. (C)**

6. (D)

7. (D)
Graphite is a covalent or network solid and is a good conductor of electricity. Hence, (D) is the right option.

8. (A)

1.4 Crystal Lattices and Unit Cells

1. (A) **2. (B)** **3. (D)**
4. (B) **5. (C)**
6. (B)

Thinking Hatke – Q. 6
Triclinic is the most unsymmetrical system. Hence, option (B) is the correct answer.

1.5 Number of Atoms in a Unit Cell

1. (B) **2. (A)**

1.6 Close Packed Structures

1. (B) **2. (C)** **3. (B)**
4. (B)
5. (A)

Atom/ion	Location	Contribution to a unit cell
A	Corners of cube	$\frac{1}{8} \times 8 = 1$
B	Centre of cube	1
Ratio	A : B = 1 : 1	
Formula	AB	

6. (B)
The number of 'Y' atoms in ccp unit cell, n = 4
Number of 'X' atoms

$= \frac{1}{3} \times$ Number of tetrahedral voids

$= \frac{1}{3} \times 2n = \frac{1}{3} \times 2 \times 4 = \frac{8}{3}$

Page no. **11** to 19**9** are purposely left blank.

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Passage-based MCQs

Read the given passages and answer the questions based on it.

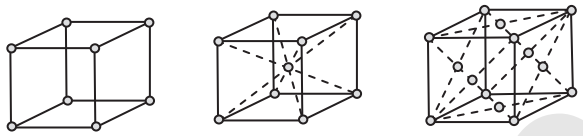
01 The Solid State

Passage (for Q. 1 to Q. 5)

Lattice is a geometrical arrangement of points in a three-dimensional periodic array. A crystal structure is obtained by attaching a constituent particle to each of the lattice points.

A French mathematician, Bravais, showed that there are only 14 possible three-dimensional lattices. These are called Bravais lattices. Fourteen Bravais lattices are divided into seven crystal systems. In other words, seven crystal systems are associated with 14 Bravais lattices also called 14 unit cells. The seven crystal systems are named as cubic, tetragonal, orthorhombic, rhombohedral, monoclinic, triclinic and hexagonal system.

There are three kinds of unit cells in cubic system: primitive or simple cubic (sc), body-centred cubic (bcc) and face-centred cubic (fcc).



Primitive (or simple) | Body-centred | Face-centred

Three Type of Cubic Cells

Primitive (simple) cubic unit cell has atoms only at its corner. Each atom at a corner is shared between eight adjacent unit cells. As a result the corner atom contributes its $1/8^{th}$ part to the given unit cell. Thus, a simple cubic unit cell has $1/8 \times 8 = 1$ atom per unit cell.

1. Which of the following is the most symmetrical crystal system?
   (A) Cubic (B) Tetragonal
   (C) Orthorhombic (D) Triclinic

2. The number of types of orthorhombic unit cell is _____.
   (A) 7 (B) 3 (C) 4 (D) 2

3. In a face-centred cubic cell, an atom at the face contributes _____ to the unit cell.
   (A) 1/4 part (B) 1/8 part
   (C) 1 part (D) 1/2 part

4. How many total spheres of constituent particles are present in a primitive cubic unit cell?
   (A) 2 (B) 1
   (C) 4 (D) 3

5. Na and Mg crystallize in bcc and fcc type crystals, respectively, then the number of atoms of Na and Mg present in the unit cell of their respective crystal is _____.
   (A) 4 and 2 (B) 9 and 14
   (C) 14 and 9 (D) 2 and 4

Passage (for Q. 6 to Q. 10)

In a crystalline solid, constituent particles are close packed, leaving the minimum vacant space. The three dimensional close packed structure can be made in three stages:

i. Stage I : Linear packing in one dimension
ii. Stage II : Planar packing in two dimensions
iii. Stage III : Close packing in three dimensions

There is only one way of arranging spheres in a one-dimensional close packed structure, that is to arrange them in a row and touching each other.

There are two ways to obtain planar packing in two dimensions: AAAA type, square close packed structure and ABAB type, hexagonal close packed structure.

Stacking of two dimensional layers gives rise to three dimensional crystal structures. Two dimensional square close packed layers are found to stack only in one way to give AAAA type, simple cubic structure. Two dimensional hexagonal close packed layers are found to stack in two distinct ways. Accordingly two crystal structures are formed: ABAB type, hexagonal close packed (hcp) structure and ABCABC type, cubic close packed (ccp) or face-centred cubic (fcc) structure.

The tetrahedral and octahedral voids occur in hcp and ccp/fcc structures. There are two tetrahedral voids associated with each close packed sphere. The number of octahedral voids is half that of tetrahedral voids.

6. What is the coordination number of a sphere in a square close packed structure in two dimensions?
   (A) 2 (B) 3
   (C) 4 (D) 6

7. In hcp structure, each sphere is surrounded by _____ neighbouring spheres.
   (A) 6 (B) 8
   (C) 10 (D) 12

8. In cubic close packed structure, the spheres of the _____ layer are aligned with the spheres of the first layer.
   (A) second (B) third
   (C) fourth (D) fifth

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CUET (UG) - 2022 Question Paper

18th August 2022 (Slot - 2)

The Solid State

1. Packing efficiency in a Body-centred cubic structure is:

(A) $\frac{\text{Volume occupied by one sphere in the unit cell}}{\text{Total volume of the unit cell}}$ %

(B) $\frac{\text{Volume occupied by two spheres in the unit cell}}{\text{Total volume of the unit cell}} \times 100\%$

(C) $\frac{\text{Volume occupied by two spheres in the unit cell}}{\text{Total volume of the unit cell}}$ %

(D) $\frac{\text{Volume occupied by one sphere in the unit cell}}{\text{Total volume of the unit cell}} \times 100\%$

2. Choose the INCORRECT statement regarding paramagnetic substances.
   (A) Paramagnetism is due to the presence of one or more unpaired electrons.
   (B) Paramagnetic substances are weakly attracted by a magnetic field.
   (C) They are magnetised in a magnetic field in the opposite directions.
   (D) They lose their magnetism in the absence of magnetic field.

3. In which of the following crystal systems, body centred variation is NOT possible?
   (A) Cubic (B) Tetragonal
   (C) Hexagonal (D) Orthorhombic

Solutions

4. 1.00 m solution of KCl refers to 1 mol of KCl dissolved in:
   (A) 1 kg of water (B) 1 kg of solution
   (C) 1 litre of water (D) 1 litre of solution

5. Van't Hoff factor, i, is NOT calculated by:

(A) $\frac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$

(B) $\frac{\text{Observed colligative property}}{\text{Calculated colligative property}}$

(C) $\frac{\text{Total number of moles of particles after association}}{\text{Number of moles of particles before association}}$

(D) $\frac{\text{Number of moles of particles before dissociation}}{\text{Total number of moles of particles after dissociation}}$

6. Solubility of a gas in a given solvent depends on:
   i. Nature of the gas
   ii. Nature of the solvent
   iii. Boiling point of solvent
   iv. Pressure

   Choose the CORRECT answer from the options given below:
   (A) i and ii only (B) ii, iii and iv only
   (C) i, ii and iv only (D) iii and iv only

Electrochemistry

7. The values of conductivity of some materials at 298.15 K are given below. Which one of them is expected to be an insulator?
   (A) 2.1×10^{3} S m^{-1}
   (B) 1.0×10^{-16} S m^{-1}
   (C) 1.0×10^{-7} S m^{-1}
   (D) 0.12 S m^{-1}

8. For strong electrolytes, Λ_m increases slowly with dilution and is represented by the equation:
   $\Lambda_m = \Lambda_m^{\circ} - AC^{1/2}$
   $CaCl_2$ is which one of the following type of electrolyte?
   (A) 1 – 2 (B) 2 – 2
   (C) 1 – 1 (D) 2 – 1

9. Identify the CORRECT statement from the following for the reaction occurring in Daniell cell.
   $Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$
   (A) Zinc electrode is reduction half-cell and the copper electrode is the oxidation half cell.
   (B) Copper electrode is reduction half-cell and the zinc electrode is the oxidation half-cell.
   (C) The standard electrode potential of zinc is more than that of copper.
   (D) The flow of electrons takes place from copper to zinc in the external circuit.

Chemical Kinetics

10. The factors influencing the rate of a reaction, when all the components are in the liquid state, are:
    i. concentration ii. pressure
    iii. temperature iv. catalyst
    Choose the CORRECT answer from the options given below:
    (A) i, ii and iii only (B) ii, iii and iv only
    (C) i, iii and iv only (D) i, ii and iv only

11. The rate constant of a reaction (k) is 145 L^2 mol^{-2} s^{-1}. What is the order of the reaction?
    (A) Zero (B) Third
    (C) Second (D) First

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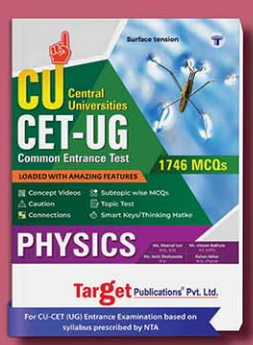

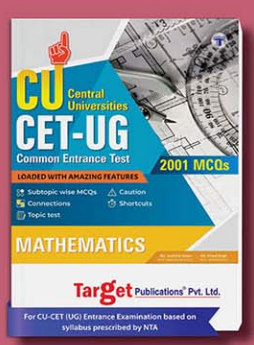

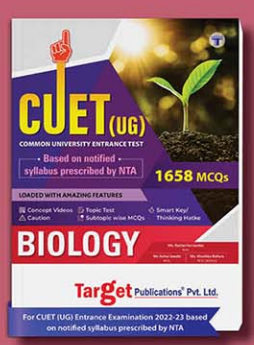

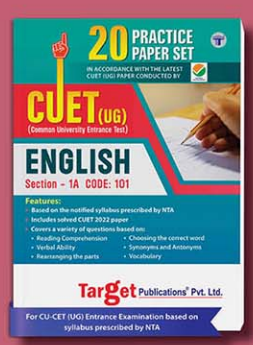

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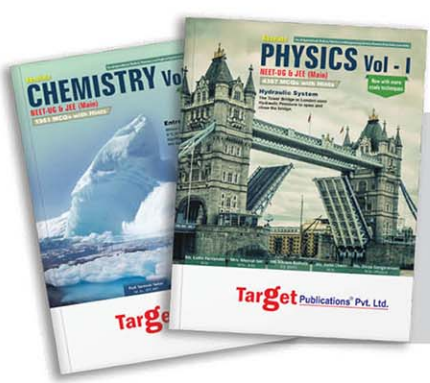

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