CONTENTS

1. Solid State 1

1.1 Classification of solids based on different binding force 1
1.2 Unit cell in two dimensional and three-dimensional lattice 2
1.3 Packing in solids, packing efficiency 2
1.4 Voids, number of atoms per unit cell in a cubic unit cell 2
1.5 Defects 3
1.6 Electrical and magnetic properties 4
1.7 Band theory of metals and conductors 5

2. Solutions 7

2.1 Types of Solutions 8
2.2 Expression of concentration of solutions of solids in liquids 9
2.3 The solubility of gases in liquids, solid solutions 11
2.4 Colligative properties – the relative lowering of vapour pressure 13
2.5 Raoult's law, elevation 16
2.6 Elevation of B.P., depression of freezing point, osmotic pressure 18
2.7 Determination of molecular masses using colligative properties 19
2.8 Abnormalmolecularmass, VantHofffactor 20

3 Electrochemistry 22

3.1 Redox Reactions 23
3.2 Conductance in electrolytic solutions 24
3.3 Kohlrausch's Law, electrolysis and laws 25
3.4 Dry cell – electrolytic cells and Galvanic cells; lead accumulator 26
3.5 EMF of a cell, standard electrode potential 27
3.6 Nernst equation and its application to chemical cells 27
3.7 Relation between Gibbs energy change and EMF of a cell 28
3.8 Fuel cells, corrosion 28

4. Chemical Kinetics 30

4.1 Rate of a Reaction 31
4.2 Order and molecularity of a reaction 31
4.3 Rate law and specific rate constant 33
4.4 Integrated rate equations, and half-life 34
4.5 Concept of collision theory 36
4.6 Activation energy, Arrhenius equation 36

5. Surface Chemistry 38

5.1 Adsorption – physisorption and chemisorption 39
5.2 Catalysis 40
5.3 Enzyme Catalysis 40
5.4 Colloidal state and properties of colloids 41
5.5 Tyndall effect, Brownian movement, electrophoresis, coagulation 43
5.6 Emulsions 43

6. General Principles & Processes of Isolation of Elements 44

6.1 Principles & methods of Extraction 45
6.2 Occurrence and principles of extraction of aluminum, copper, zinc, and iron 47

7. p-Block Elements 50

7.1 Group 15 elements: General introduction 51
7.2 Compounds of nitrogen and compounds of phosphorous 52
7.3 Group 16 elements: General introduction 54
7.4 Classification of oxides; ozone. Sulphur – allotropic forms 55
7.5 Oxoacids of sulphur 55
7.6 Electronic configuration, oxidation states, occurrence, trends in physical and chemical properties 56
7.7 Compounds of halogens and oxoacids of halogens 56

8. d & f Block Elements 58

8.1 General introduction 59
8.2 First-row transition metals 59
8.3 Lanthanoids 66
8.4 Actinoids 67

9. Coordination Compounds 68
9.1 Coordination compounds: Introduction, ligands, coordination number 69
9.2 IUPAC nomenclature of mononuclear coordination compounds.....70
9.3 Werner's theory.....72
9.4 Isomerism.....72
9.5 VBT and CFT.....73

10. Haloalkanes & Haloarenes 78
10.1 Haloalkanes: Nomenclature, physical and chemical properties 79
10.2 Mechanism of substitution reactions.....81
10.3 Haloarenes 83
10.4 Substitution reactions of haloarens.....86

11. Alcohols, Phenols & Ethers.....88
11.1 Alcohols: Nomenclature, methods of preparation.....89
11.2 Physical and chemical properties of alcohol 91
11.3 Phenols: Nomenclature, methods of preparation.....94
11.4 Physical and chemical properties of phenol.....95
11.5 Ethers: Nomenclature, methods of preparation.....96
11.6 Physical and chemical properties of ethers.....96

12. Aldehydes, Ketones & Carboxylic Acids 98
12.1 Aldehydes and Ketones: Nomenclature and methods of preparation.....99
12.2 Physical and chemical properties of aldehydes and ketones.....101
12.3 Carboxylic Acids: Nomenclature, acidic nature, methods of preparation 110
12.4 Physical and chemical properties of carboxylic acids.....112

13. Organic Compounds Containing Nitrogen..... 115
13.1 Amines: Nomenclature, classification, methods of preparation.....116
13.2 Physical and chemical properties, uses.....117

14. Biomolecules 127
14.1 Carbohydrates – Classification.....128
14.2 Proteins 130
14.3 Nucleic Acids: DNA and RNA.....130

15. Polymers 134
15.1 Classification – Natural and synthetic 135
15.2 Methods of polymerization 135
15.3 Biodegradable and non-biodegradable polymers 136

16. Chemistry in Everyday Life..... 137
16.1 Chemicals in medicines 138
16.2 Chemicalsin food 142
16.3 Cleansing agents 143

MOCK TEST

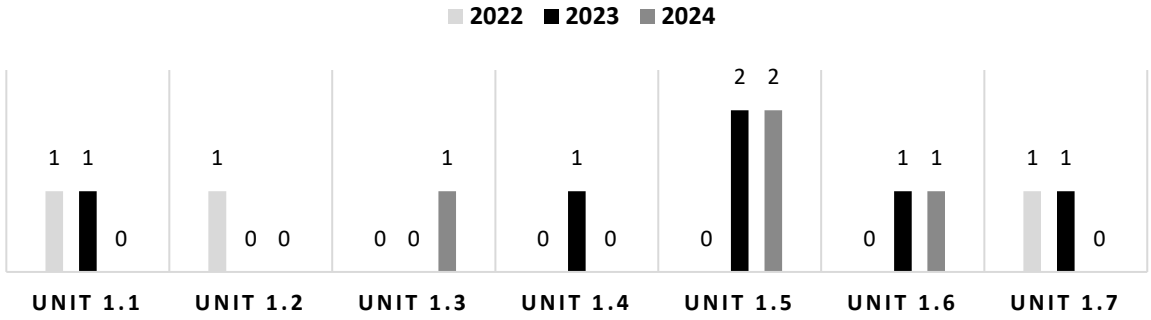
Mock Test – 1.....145
Mock Test – 2.....154
Mock Test – 3.....170
Mock Test – 4.....183
Mock Test – 5.....198
Mock Test – 6.....213
Mock Test – 7.....227
Mock Test – 8.....241
Mock Test – 9.....254
Mock Test – 10.....263

ANSWER SHEET 278

CHAPTER 1

Solid State

NUMBER OF QUESTIONS ASKED IN CUET (UG) CHEMISTRY



Unit 1.1: Classification of solids based on different binding force

PREVIOUS YEAR EXAM QUESTIONS

[2022, Shift-2]

1. Among the following statements, choose the correct statements,

(A) In Ionic solid, ions are the constituent particles.

(B) Ionic solids are soft.

(C) Ionic solid are electrical insulators in the solid state.

(D) Ionic solid conduct electricity in molten state.

(E) Ionic solid have low melting and boiling points.

Choose the correct answer from the options given below:

(1) A, C & D only
(2) A, D & E only
(3) A, B & C only
(4) A, C & E only

[2023 Shift-2]

2. Match List I with List II.

LISTI	LIST II
A. Hexagonal	I. $\propto -\beta - y - 90^o$
B. Orthorhombic	II. $\propto = y - 90° - 90^o$
C. Inclinic	III $\propto -\beta - 90°, y - 120^o$
D. Monoclinic	IV$\propto = \beta = y = 90°$

Choose the correct answer from the options given below:

(1) A-III. B-I, C-IV, D-II
(2) A-II, B-III, C-I, D-IV
(3) A-II. B-I, C-IV, D-III
(4) A-III, B-IV, C-I. D.II

Answer Key	
1	2
(1)	(4)

Explanation:

1. Correct Answer is (1): In Ionic solid, ions are the constituent particles. This is correct because ionic solids are composed of positively charged metal ions and negatively charged non-metals ion which are held together by electrostatic forces to form a crystal lattice.

Ionic solids are soft is incorrect because ionic solids are generally hard and brittle.

Ionic solids are electrical insulators in the solid state. This is correct because in the solid state, the ions in the crystal lattice are held in fixed position and are not free to move, so they cannot conduct electricity.

Ionic solid conduct electricity in molten state. This is correct because when ionic crystal heated at high temperature, the crystal lattice breaks down and the ion becomes free to move, creating a liquid called

molten salt. In this state the ions can carry an electric current and the substance can conduct electricity.
Ionic solid have low melting and boiling point. This is incorrect because ionic solids typically have high melting point and boiling point due to the string electrostatic forces between the ions in the crystal.

2. Correct Answer is (4):
Hexagonal $\rightarrow \propto -\beta - 90°, y - 120^o$
Orthorhombic $\rightarrow \propto = \beta = y = 90°$
Inclinic $\rightarrow \propto -\beta - y - 90^o$
Monoclinic $\rightarrow \propto = y - 90° - \ 90^o$

1.2 unit cell in two dimensional and three-dimensional lattice

PREVIOUS YEAR EXAM QUESTIONS

[2022, Shift-2]

1. Atoms of element B form hcp lattice and those of the element A occupy 2/3 rd of tetrahedral voids. What is the formula of the compound formed by the elements A and B?
(1) A_3B_4 (2) A_4B_3
(3) A_2B_3 (4) A_3B_2

Answer Key
1
(2)

Explanation:

1. Correct Answer is (2): In HCP strcuture if the number of closed packed structure are N then the octahedral void generated is N and the number of tetrahedral void generated is 2N. according to question atoms of element B will be 6 an thus there wil be 12 tetrahedral voids. As A occupy 2/3 of tetrahedral voids.
The number of A= $\frac{2}{3} \times 12 = 8$
The formula of the compound is A_8B_6
The formula of the compound is A_4B_3

1.3 packing in solids, packing efficiency

PREVIOUS YEAR EXAM QUESTIONS

[Offline 15 May 2024, Shift-1]

1. The Cu metal crystallises into fcc lattice with a unit cell edge length of 361 pm. The radius of Cu atom is:
(1) 127 pm (2) 181 pm
(3) 157 pm (4) 108 pm

Answer Key
1
(1)

Explanation:

1. Correct Answer is (1): To calculate the radius of a Cu (Copper) atom in an FCC lattice, we can use the relationship between the edge length (a) of the unit cell and the atomic radius (r) in an FCC structure.
FCC Structure:
In a face-centered cubic (FCC) lattice, the atoms at the corners and the faces are arranged such that the atoms along the diagonal of the face are in contact. For an FCC lattice:
Diagonal of the face $= 4r$
The diagonal of the face is related to the edge length of the unit cell (a) by the Pythagorean theorem:
Diagonal of the face $= \sqrt{2}a$
So, we can equate the two expressions for the diagonal:
$\sqrt{2}a = 4r$
$r = \frac{\sqrt{2}a}{4}$
The edge length $a = 361$ pm.
$r = \frac{\sqrt{2} \times 361}{4}$
$r = \frac{1.414 \times 361}{4}$
$r = \frac{510.874}{4} \approx 127.7$ pm

1.4 voids, number of atoms per unit cell in a cubic unit cell

PREVIOUS YEAR EXAM QUESTIONS

[2023: Shift-3]

1. A compound forms hexagonal closed packed structure. What is the number of tetrahedral voids in 0.8 mol of it?
(1) 1.5055×10^{23}
(2) 2.4088×10^{23}
(3) 9.635×10^{23}
(4) 3.011×10^{23}

Answer Key
1
(3)

COMMON UNIVERSITY ENTRANCE TEST

(CUET-UG)

– PAPER –

CHEMISTRY

MOCK TEST

MOCK TEST

1

MOCK TEST

1. **Which of the following is NOT a state function?**
   (1) Enthalpy (2) Work
   (3) Entropy (4) Internal energy

2. **The rate constant of a reaction increases by a factor of 4 when the temperature is increased from 300 K to 320 K. What is the activation energy of the reaction?**
   (1) 28.75 kJ/mol (2) 57.5 kJ/mol
   (3) 115 kJ/mol (4) 230 kJ/mol

3. **For the reaction, $N_2(g)+3H_2(g)\rightarrow 2NH_3(g)$, the equilibrium constant Kc at 500 K is 0.04. If the initial concentrations of N_2 and H_2 are 1 M and 3 M respectively, the concentration of NH_3 at equilibrium is:**
   (1) 0.1 M (2) 0.2 M
   (3) 0.4 M (4) 0.8 M

4. **Which of the following oxides is amphoteric?**
   (1) SiO_2 (2) Al_2O_3
   (3) P_2O_5 (4) MgO

5. **The color of $KMnO_4$ is due to:**
   (1) d-d transition
   (2) Charge transfer transition
   (3) p-p transition
   (4) Ligand-to-metal charge transfer

6. **The number of unpaired electrons in $[Fe(CN)_6]^{4-}$ is:**
   (1) 0 (2) 1
   (3) 4 (4) 5

7. **Which of the following compounds does not exhibit tautomerism?**
   (1) Acetone (2) Phenol
   (3) Ethyl acetoacetate (4) Benzene

8. **The major product formed when CH_3CH_2OH is heated with HI is:**
   (1) CH_3CH_2I (2) $CH_2=CH_2$
   (3) CH_3CH_3 (4) None of these

9. **Identify the product in the following reaction:**
   $CH_3COCH_3+Br_2+NaOH\rightarrow$
   (1) CH_3COOH (2) $CHBr_3$
   (3) CH_3CHO (4) CH_3CH_2Br

10. **Which vitamin deficiency causes rickets?**
    (1) Vitamin A (2) Vitamin B
    (3) Vitamin C (4) Vitamin D

11. **What is the IUPAC name of the compound $CH_3CH=CHCH_2CH_3$?**
    (1) Pentene (2) 1-Pentene
    (3) 2-Pentene (4) 3-Pentene

12. **In the context of environmental chemistry, which gas is primarily responsible for the greenhouse effect?**
    (1) Oxygen (2) Nitrogen
    (3) Carbon dioxide (4) Argon

13. **Which of the following is the correct symbol for the element with atomic number 11?**
    (1) Na (2) K
    (3) Ca (4) Mg

14. **Which of the following compounds is an example of a covalent compound?**
    (1) NaCl (2) K_2SO_4
    (3) CO_2 (4) MgO

15. **Which of the following is not a noble gas?**
    (1) Neon (2) Argon
    (3) Nitrogen (4) Xenon

16. **Which of the following is a characteristic property of transition metals?**
    (1) High ionization energy (2) Low melting points
    (3) High density (4) Non-conductive

17. **Which of the following is an example of an allotrope of carbon?**
    (1) Diamond (2) Sodium
    (3) Nitrogen (4) Water

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(2)	(2)	(1)	(2)	(4)	(1)	(4)	(1)	(2)	(4)
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
(3)	(3)	(1)	(3)	(3)	(3)	(1)	(3)	(1)	(3)
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
(1)	(3)	(4)	(2)	(4)	(2)	(1)	(4)	(1)	(1)
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
(2)	(1)	(3)	(2)	(1)	(2)	(1)	(2)	(3)	(4)
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
(2)	(1)	(4)	(4)	(4)	(1)	(3)	(2)	(4)	(1)

Explanation:

1. Correct Answer is (2): Work is not state function its path function. State function depend on initial and final state it does not depend on path.

Enthalpy, entropy and internal energy all are state function.

2. Correct Answer is (2): $K = A.e^{-Ea/RT}$

$K_1 = A.e^{-Ea/RT1}$

$K_2 = A.e^{-Ea/RT2}$

$\frac{K_2}{K_1} = \frac{A.e^{-Ea/RT2}}{A.e^{-Ea/RT1}}$

$\log 4 = \frac{E_a}{2.303R} \times [\frac{1}{T_1} - \frac{1}{T_2}]$

$\log 4 = \frac{E_a}{2.303 \times 8.314} \times [\frac{1}{300} - \frac{1}{320}]$

$E_a = 57.5 kJ/mol$

3. Correct Answer is (1): $Kc = \frac{[NH_3^2]}{[N_2][H_2^3]}$

$0.04 = \frac{[NH_3^2]}{1 \times (3)^3}$

$[NH_3^2] = 1.08$

$[NH_3] = 0.1M$

4. Correct Answer is (2): SiO_2 is acidic in nature.

Amphoteric oxides react with both acids and alkalis to form salt and water.

Aluminium oxides react with both acids and bases, so it is considered amphoteric oxide.

Phosphorus pentoxide is acidic oxide and it is used as a desiccating and dehydrating agent because it is an anhydride of phosphoric acid.

MgO is basic oxide.

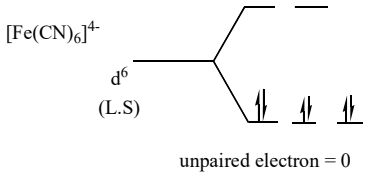
5. Correct Answer is (4): A **d-d transition** refers to the electronic transition between two d-orbitals in a transition metal ion. These transitions occur when an electron moves from one of the d-orbitals of a metal ion to another d-orbital of the same metal ion.

A **charge transfer transition** refers to the movement of an electron from one atom, ion, or molecule to another within a complex or between different species. This transition involves the transfer of charge between different components in a system, typically from a donor to an acceptor.

A common example of p-p transitions is found in organic molecules like aromatic hydrocarbons, where the transition of electrons between p orbitals in conjugated systems can result in absorption in the UV or visible region.

The purple colour of $KMnO_4$ ion is due to ligand to metal charge transfer. In $KMnO_4$, the central manganese atom has +7 oxidation state. The oxygen in $KMnO_4$ will donate electrons to the vacant orbital of manganese and as a result a charge transfer spectra occurs.

6. Correct Answer is (1):

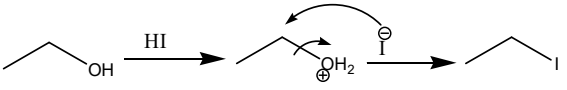


unpaired electron = 0

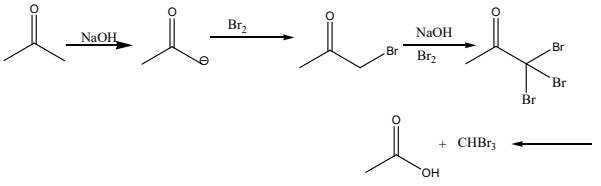
7. Correct Answer is (4): In acetone there is 6 alpha-hydrogen.

For tautomerism there must be a alpha-hydrogen present. In benzene there is no alpha-hydrogen present.

8. Correct Answer is (1):



9. Correct Answer is (2):



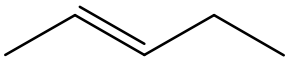
10. Correct Answer is (4): Vitamin A deficiency can lead to several health issues, particularly affecting vision, immunity, and skin health.

Vitamin B deficiencies can cause a variety of health problems, as there are several types of B vitamins, each responsible for different functions in the body.

Vitamin C deficiency can lead to a condition called **scurvy**. Vitamin C (ascorbic acid) is crucial for the body's production of collagen, a protein that helps maintain healthy skin, blood vessels, bones, and cartilage

Vitamin D is important for healthy bones and teeth. If the body does not get sufficient amount of vitamin D, it leads to a deficient disease called rickets in children.

11. Correct Answer is (3):



2-pentene

12. Correct Answer is (3): The primary greenhouse gases in earths atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone.

13. Correct Answer is (1): The correct symbol for the element with atomic number 11 is **Na** (Sodium).

So, the correct answer is: **Na**

Atomic number of K is 19

Atomic number of Ca is 20

Atomic number of Mg is 12

14. Correct Answer is (3): The compound **CO2 (carbon dioxide)** is a covalent compound. In CO2, carbon and oxygen atoms share electrons to form covalent bonds.

- **NaCl (sodium chloride)**: This is an ionic compound, formed by the transfer of electrons from sodium (Na) to chlorine (Cl).
- **K2SO4 (potassium sulfate)**: This is also an ionic compound where potassium (K) and sulfate (SO4) ions are held together by ionic bonds.
- **MgO (magnesium oxide)**: This is another ionic compound, formed by the transfer of electrons from magnesium (Mg) to oxygen (O).

15. Correct Answer is (3): Neon, Argon and Xenon are noble gases, Nitrogen is not noble gas.

Nitrogen is not a noble gas. The noble gases include Neon, Argon, and Xenon, which are found in Group 18 of the periodic table and are characterized by their inertness due to having a full set of electrons in their outermost shell. Nitrogen, on the other hand, is a nonmetal in Group 15 and does not share these properties.

16. Correct Answer is (3): These elements have metallic properties such as metallic lusture,high tensile strength,ductility, malleability, high thermal and electrical conductivity, low volatility(except Zn, Cd, Hg), hardness etc. Their melting points are high.

17. Correct Answer is (1): Diamond is an allotrope of carbon, meaning it is one of the different forms in which carbon can exist, with distinct physical properties. Other allotropes of carbon include graphite and graphene.

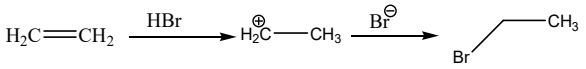
18. Correct Answer is (3): The term "king of chemicals" is often used to refer to **sulfuric acid (H_2SO_4)**. It is called this because of its widespread industrial uses and its importance in the production of fertilizers, chemicals, and petroleum refining. Sulfuric acid plays a crucial role in many chemical reactions and is a key substance in various industries.

19. Correct Answer is (1): Ionization energy decreases down the group: As you move down Group 1 from lithium (Li) to cesium (Cs), the ionization energy decreases. This is because the atomic radius increases, and the outermost electron is farther from the nucleus, making it easier to remove.

Ionization energy increases left to right in periodic table.

20. Correct Answer is (3): In the +3 oxidation state (Fe^3+), iron loses the two 4s electrons and one 3d electron: 3d^5 (4s^0). half filled anf fully filled electrons are more stable.

21. Correct Answer is (1):



22. Correct Answer is (3): Methanol and **ethanol** have a mild alcoholic odor but are not sweet.

- **Acetone** has a strong, pungent odor characteristic of ketones.
- **Ethyl acetate** is an ester and is well-known for its sweet, fruity smell, commonly used in perfumes and flavorings.

23. Correct Answer is (4): Temperature: Increasing the temperature usually increases the rate of a chemical reaction because the reactant molecules gain kinetic energy, leading to more frequent and energetic collisions.

Concentration of reactants: Higher concentration of reactants increases the rate of reaction as it raises the probability of collisions between reactant molecules.

CUET UG CHEMISTRY MOCK TEST 1

ANSWER SHEET

Name _____

Seat Number

Booklet Code

A

Medium

E

Marks Obtained

ANSWER COLUMNS

Checked By _____

Q. No.	ANSWER ①	②	③	④
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○
21	○	○	○	○
22	○	○	○	○
23	○	○	○	○
24	○	○	○	○
25	○	○	○	○

Q. No.	ANSWER ①	②	③	④
26	○	○	○	○
27	○	○	○	○
28	○	○	○	○
29	○	○	○	○
30	○	○	○	○
31	○	○	○	○
32	○	○	○	○
33	○	○	○	○
34	○	○	○	○
35	○	○	○	○
36	○	○	○	○
37	○	○	○	○
38	○	○	○	○
39	○	○	○	○
40	○	○	○	○
41	○	○	○	○
42	○	○	○	○
43	○	○	○	○
44	○	○	○	○
45	○	○	○	○
46	○	○	○	○
47	○	○	○	○
48	○	○	○	○
49	○	○	○	○
50	○	○	○	○

Note : Roll Number, Subject Code & Centre Code Should Be Filled In the Boxes Using The Pattern Given As :