

CHEMISTRY THEORY (043)

PRACTICE PAPER 1

M.M 70

Time : 3 hours

General Instructions:

Read the following instructions carefully.

- a) There are 33 questions in this question paper. All questions are compulsory.
- b) Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
- c) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
- d) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
- e) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
- f) There is no overall choice. However, internal choices have been provided.
- g) Use of calculators and log tables is not permitted. SECTION A (OBJECTIVE TYPE)

SECTION A: Objective Questions

(1 Mark)

Passage Based Questions

1. Read the passage given below and answer the following questions: (1x4=4)

Oxygen is the most abundant of all the elements on earth. Oxygen forms about 46.6% by mass of earth's crust. Dry air contains 20.946% oxygen by volume. However, the abundance of sulphur in the earth's crust is only 0.03-0.1%. Combined sulphur exists primarily as sulphates such as gypsum $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, epsom salt $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, baryte BaSO_4 and sulphides such as galena PbS , zinc blende ZnS , copper pyrites CuFeS_2 . Traces of sulphur occur as hydrogen sulphide in volcanoes. Organic materials such as eggs, proteins, garlic, onion, mustard, hair and wool contain sulphur. Selenium and tellurium are also found as metal selenides and tellurides in sulphide ores. Polonium occurs in nature as a decay product of thorium and uranium minerals. Livermorium is a synthetic radioactive element.

The following questions (i - iv) are multiple choice questions. Choose the most appropriate answer:

- (i) Which of the following group 16 elements show maximum catenation property?
(a) O (b) S (c) Se (d) Te
- (ii) Which of the following group 16 elements does not exist in -2 oxidation state?
(a) O (b) S (c) Se (d) Te
- (iii) Which of the following is most volatile?
(a) H_2O (b) H_2S (c) H_2Se (d) H_2Te
- (iv) Which of the following is the wrong statement?
(a) Ozone is diamagnetic gas (b) O_2 is paramagnetic
(c) O_3 molecule is bent (d) O – O bond lengths in ozone are unequal

2. Read the passage given below and answer the following questions: (1 x 4 = 4 Marks)

The carbonyl carbon atom is sp^2 -hybridised and forms three sigma (σ) bonds. The fourth valence electron of carbon remains in its p-orbital and forms a π -bond with oxygen by overlap with p-orbital of an oxygen. In addition, the oxygen atom also has two non bonding electron pairs. Thus, the carbonyl carbon and the three atoms attached to it lie in the same plane and the π -electron cloud is above and below this plane. The bond angles are approximately 120° as expected of a trigonal coplanar structure. The carbon-oxygen double bond is polarised due to higher electronegativity of oxygen relative to carbon. Hence, the carbonyl carbon is an electrophilic (Lewis acid), and carbonyl oxygen, a nucleophilic (Lewis base) centre. Carbonyl compounds have substantial dipole moments and are more polar than ethers.

In these questions (I -iv) a statement of Assertion followed by a statement of Reason is given.

Choose the correct answer out of the following choices.

- (a) Both Assertion and Reason are correct statements and Reason is the correct explanation of the assertion.
 - (b) Both Assertion and Reason are correct statements, but Reason is not the correct explanation of the assertion.
 - (c) Assertion is correct, but reason is incorrect statement.
 - (d) Assertion is incorrect statement but reason is correct statement.
- (i) **Assertion:** Benzaldehyde is less reactive than ethanal towards nucleophilic attack.
Reason: All the carbon atoms of benzaldehyde are sp^2 hybridized.
- (ii) **Assertion:** α hydrogen of aldehydes and ketones are slightly acidic in nature.
Reason: Enolate ion is stabilized by the resonance.
- (iii) **Assertion:** Ketones are not oxidized by Tollen's reagent
Reason: Tollen's reagent is mild oxidizing agent.
- (iv) **Assertion:** Benzaldehyde is not oxidized by iodoform
Reason: Absence of methyl ketone group.

Multiple Choice questions

Following questions (No. 3 -11) are multiple choice questions carry 1 mark each:

Q.3 The crystal field splitting energy for octahedral (Δ_o) and tetrahedral complex is related as

- (a) $\Delta_t = 0.55 \Delta_o$
- (b) $\Delta_t = 0.88 \Delta_o$
- (c) $\Delta_t = 0.44 \Delta_o$
- (d) $\Delta_t = 0.66 \Delta_o$

Q.4 Glucose on oxidation with Br_2 water gives

- (a) Gluconic acid
- (b) Tartaric acid
- (c) Saccharic acid
- (d) Meso -oxalic acid

OR

In aqueous solution an amino acid exist as

- (a) Cation (b) Anion
(c) Zwitter ion (d) Neutral molecule

Q.5 Which of the following has highest boiling point ?

- (a) CH_3F (b) CH_3Cl (c) CH_3Br (d) CH_3I

Q.6 Reaction of Phenol with chloroform in the presence of dilute sodium hydroxide finally introduces which one of the following functional group?

- (a) $-\text{COOH}$ (b) $-\text{CHO}$
(c) $-\text{CH}_2\text{Cl}$ (d) $-\text{CHCl}_2$

Q.7 Which of the following ions is the most stable in aqueous solution ?

- (a) Mn^{2+} (b) Cr^{3+} (c) V^{3+} (d) Ti^{3+}

Q.8 EDTA is a

- (a) Bidentate ligand (b) Tridentate ligand
(c) Tetradentate ligand (d) Hexadentate ligand

OR

How many moles of AgCl will be precipitated when an excess of AgNO_3 is added to a molar solution of $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$?

- (a) 1 mol of AgCl (b) 2 moles of AgCl
(c) 3 moles of AgCl (d) 4 moles of AgCl

Q.9 Order of basic strength of amines in aqueous solution is

- (a) $(\text{C}_2\text{H}_5)_2\text{NH} > (\text{C}_2\text{H}_5)_3\text{N} > \text{C}_2\text{H}_5\text{NH}_2 > \text{NH}_3$
(b) $(\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2 > (\text{C}_2\text{H}_5)_3\text{N} > \text{NH}_3$
(c) $(\text{C}_2\text{H}_5)_3\text{N} > (\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2 > \text{NH}_3$
(d) $(\text{C}_2\text{H}_5)_3\text{N} > (\text{C}_2\text{H}_5)_2\text{NH} > \text{NH}_3 > \text{C}_2\text{H}_5\text{NH}_2$

OR

Aniline on heating with chloroform and ethanolic potassium hydroxide gives.....

- (a) Phenylisocyanide (b) Benzonitrile
(c) N-methylaniline (d) Chlorobenzene

Q.10 An ideal solution is formed when its components:

- (a) have no volume change on mixing

- (b) have no enthalpy change on mixing
- (c) have both of the above characteristics
- (d) have high solubility.

Q.11 Magnetic moment of 2.84 B.M. is given by :

(At. Nos. Ni = 28, Ti = 22, Cr = 24, Co = 27)

- (a) Cr^{3+} (b) Co^{2+} (c) Ni^{2+} (d) Ti^{3+}

OR

Four successive members of the first series of the transition metals are listed below .For which one of them the standard potential ($E^\circ \text{M}^{2+}/\text{M}$) value has a positive sign ?

- (a) $\text{Cu}(\text{Z}=29)$ (b) $\text{Fe}(\text{Z}=26)$ (c) $\text{Co}(\text{Z}=27)$ (d) $\text{Ni}(\text{Z}=28)$

Assertion -Reason

In the following questions (Q.No. 12 -16) a statement of Assertion followed by a statement of Reason is given .Choose the correct answer out of the following Choices

- (a) Both Assertion and Reason are correct statements and Reason is the correct explanation of the assertion.
- (b) Both Assertion and Reason are correct statements, but Reason is not the correct explanation of the assertion.
- (c) Assertion is correct, but reason is incorrect statement.
- (d) Assertion is incorrect statement but reason is correct statement.

Q.12 **Assertion:** Hydrazones of acetaldehydes are not prepared in highly acidic medium

Reason: Hydrazines are basic in nature.

Q.13 **Assertion:** p-Nitrophenol is stronger acid than o-Nitrophenol.

Reason: Intramolecular H- bonding makes o-isomer weaker than p-isomer.

OR

Assertion: C-O-C bond angle in ether is higher than water

Reason: Greater repulsion between bulkier alkyl groups as compared to smaller H atoms

Q.14 **Assertion:** Aquatic species are more comfortable in cold water as compared to warm water

Reason: The solubility of oxygen in water decrease with increase in temperature.

Q.15 **Assertion:** Glucose does not give DNP test.

Reason: It form hemiacetal between the -CHO group & -OH group on the C_5 atom.

Q.16 **Assertion:** Electron gain enthalpy of Cl is more negative than fluorine.

Reason: Fluorine is more electronegative than chlorine.

SECTION B : Short Answer Type I Questions (2 Marks)

Q.17. Give reasons

- (i) Why is methylchloride hydrolysed more easily than chlorobenzene ?
- (ii) Why p-Nitrochlorobenzene is more reactive than Chlorobenzene towards nucleophilic substitution reactions ?

OR

Carry out the following conversions in not more than 2 steps:

- (i) Ethanol to But-1-yne
- (ii) Propene to 1-Iodopropane

Q.18 Draw the structures of the following:

- (i) XeO_3
- (ii) HClO_3

Q.19 A metal oxide has the formula $\text{M}_{0.96}\text{O}_{1.00}$. What fractions of the metal exist as M^{2+} and M^{3+} ions ?

Q.20 Define azeotropes. What type of azeotrope is formed by negative deviation from Raoult's law ? Give an example

Q.21 An optically active compound having molecular formula $\text{C}_7\text{H}_{15}\text{Br}$ reacts with aqueous KOH to give a racemic mixture of products. Write the mechanism involved in the reaction.

Q.22 Explain the following with example

- (i) Kolbe's reaction
- (ii) Williamson's ether synthesis

Q.23 Write one difference in each of the following :

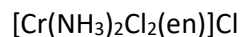
- (i) Coagulation and peptisation
- (ii) Lyophobic and lyophilic colloid.

OR

Write the dispersed phase and dispersion medium of the following colloidal system:

- (a) Smoke
- (ii) Milk

Q.24 (i) Write the IUPAC name of the following complex:



(ii) Write the formula for the following complex:



OR

The spin only magnetic moment of $[\text{MnBr}_4]^{2-}$ is 5.9 B.M. Predict the geometry of the complex ion. [Atomic number of Mn = 25]

Q.25 Explain what is observed, when

- (i) an electric current is passed through a sol.
- (ii) KCl, an electrolyte is added to hydrated ferric oxide sol.

SECTION – C

Q.26 Explain the following :

- (a) ICl is more reactive than I₂
- (b) NaBiO₃ is stronger oxidizing agent
- (c) Noble gases have very low boiling point.

Q.27 Define the following as related to proteins.

- (a) Peptide linkage
- (b) Primary structure
- (c) Denaturation

Q.28 The elements of 3d transition series are given as :

Sc, Ti, V, Cr Mn Fe Co Ni Cu Zn

Answer the following:

- (i) Write the element which shows maximum number of oxidation states. Give reason.
- (ii) Which element has the highest melting point and why ?
- (iii) Which element is a strong oxidizing agent in +3 oxidation state and why ?

OR

Explain giving reasons:

- (i) Which is stronger reducing agent Cr²⁺ or Fe²⁺ ?
- (ii) A compound of vanadium has a magnetic moment of 1.73 B.M . Work out the electronic configuration of vanadium ion in the compound.
- (iii) The transition metals generally form coloured compounds.

Q.29 An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B' which on heating with Br₂ and KOH forms a compound 'C' of molecular formula C₆H₇N. Write the structures and IUPAC names of compounds A, B and C

OR

Account for the following:

- (i) pK_b of aniline is more than that of methylamine
- (ii) Aniline does not undergo Friedel-Crafts reaction.
- (iii) Gabriel phthalimide synthesis is preferred for synthesising primary amines.

Q.30 An element has atomic mass 93 g mol⁻¹ and density 11.5 g cm⁻³. If the edge length of its unit cell is 300 pm, identify the type of unit cell.

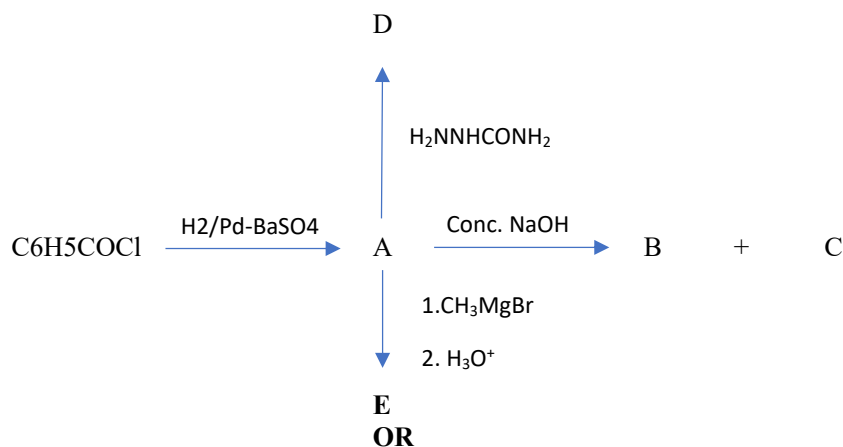
SECTION D: Long Answer Type Questions (5 Marks)

- Q.31 (a) Define the term Molar conductivity of a solution and explain how molar conductivity change with change in concentration of a solution for weak and strong electrolyte.
- (b) Calculate the emf of the following cell at 298 K :
 $\text{Fe(s)}|\text{Fe}^{2+}(0.001\text{M})||\text{H}^+(0.01\text{M})|\text{H}_2(\text{g})(1\text{bar}),\text{Pt}$
 (Given $E^\circ \text{Fe}^{2+}|\text{Fe} = -0.44\text{V}$ $E^\circ \text{H}^+|\text{H}_2 = 0.00\text{V}$)

OR

- (a) State Kohlrausch's law of independent migration of ions. Write an expression for the molar conductivity of formic acid at infinite dilution according to Kohlrausch's law.
- (b) The molar conductivity of 0.025 mol L⁻¹ methanoic acid is 46.1 S cm² mol⁻¹. Calculate its degree of dissociation and dissociation constant. Given $\lambda_0(\text{H}^+) = 349.6\text{ S cm}^2\text{ mol}^{-1}$ and $\lambda_0(\text{HCOO}^-) = 54.6\text{ S cm}^2\text{ mol}^{-1}$

- Q.32 (a) Write the structures of A,B,C,D & E in the following reactions:



- (a) Write the structures of the main products when ethanal (CH_3CHO) reacts with the following Reagents.
 (i) HCN (ii) dil. NaOH (iii) Zn – Hg / conc. HCl
- (b) Arrange the following in increasing order of their reactivity towards nucleophilic addition reaction :
 Ethanal, Propanal, Propanone , Butanone
- (c) Give a chemical test to distinguish between following pair of compounds
 Propanal and Propanone (5)
- Q.33 (a) A first order reaction takes 40 minutes for 30 % decomposition. Calculate $t_{1/2}$.

- (b) The following results have been obtained during the kinetics of the reaction:



Experiment No.	[A]	[B]	Initial Rate of formation of D
1	0.1 M	0.1 M	$6.0 \times 10^{-3}\text{ M min}^{-1}$
2	0.3 M	0.2 M	$7.2 \times 10^{-2}\text{ M min}^{-1}$
3	0.3 M	0.4 M	$2.88 \times 10^{-1}\text{ M min}^{-1}$
4	0.4 M	0.1 M	$2.4 \times 10^{-2}\text{ M min}^{-1}$

Determine the Rate law and the rate constant for the reaction:

OR

- (a) Rate constant k for first order reaction has been found to be $2.54 \times 10^{-3}\text{ s}^{-1}$. Calculate its three fourth life

(b) A reaction is first order in A and second order in B. (i) Write the differential rate equation. (ii) How is the rate affected on increasing the concentration of B three times? (iii) How is the rate affected when the concentrations of both A and B are doubled?