

SAMPLE PAPER - 1

CHEMISTRY CLASS-12 THEORY(043)

General Instructions:

Read the following instructions carefully

- (a) There are **33 questions** in this question paper with internal choice.
- (b) **SECTION-A** consists of **16 multiple choice questions** carrying **1 mark** each.
- (c) **SECTION-B** consists of **5 short answer questions** carrying **2 marks** each.
- (d) **SECTION-C** consists of **7 short answer questions** carrying **3 marks** each.
- (e) **SECTION-D** consists of **2 case-based questions** carrying **4 marks** each.
- (f) **SECTION-E** consists of **3 long answer questions** carrying **5 marks** each.
- (g) All questions are compulsory.
- (h) Use of log tables and calculators is not allowed.

SECTION - A

The following questions are multiple choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

Q.1 Which alcohol does not give Lucas test at room temperature?

- A) t-Butanol
- B) Benzyl alcohol
- C) Propan-2-ol
- D) Ethanol

Q.2 The element which exhibits the maximum number of oxidation states in the 3d - series of d-block elements is:

- A) Cr
- B) Fe
- C) Mn
- D) V

Q.3 Which among the following is least reactive towards nucleophilic substitution?

- A) Benzyl chloride
- B) Chlorobenzene
- C) Allyl bromide
- D) Methyl chloride

Q.4 For the reaction $A \rightarrow P$, if the concentration of A becomes half in 10 minutes, the rate constant for first order reaction is:

- A) 0.069 min^{-1}
- B) 0.693 min^{-1}
- C) 0.0069 min^{-1}
- D) 6.93 min^{-1}

Q.5 Which of the following is a reducing sugar?

- A) Sucrose
- B) Maltose
- C) Cellulose
- D) All of these

Q.6 Which of the following solutions has the highest osmotic pressure? (Assume complete ionization)

- A) 0.1 M NaCl
- B) 0.1 M K_2SO_4
- C) 0.1 M Urea
- D) 0.1 M Glucose

Q.7 The reaction between phenol and chloroform in presence of NaOH gives:

- A) Benzaldehyde
C) Salicylaldehyde
- B) Salicylic acid
D) Benzyl alcohol

Q.8 Gabriel Phthalimide synthesis is used for preparation of:

- A) Aniline
C) Secondary amines
- B) Primary amines
D) Tertiary amines

Q.9 Oxidation of 1° alcohol with PCC produces:

- A) Carboxylic acid
C) Ketone
- B) Aldehyde
D) Ester

Q.10 When MnO_2 is fused with KOH and O_2 , the product is:

- A) KMnO_4
C) Mn_2O_3
- B) K_2MnO_4
D) $\text{Mn}(\text{OH})_2$

Q.11 In the Arrhenius equation: $k = A \times e^{-E_a/RT}$, the slope of the plot $\ln k$ vs $1/T$ is:

- A) E_a/R
C) R/E_a
- B) $-E_a/R$
D) $-R/E_a$

Q.12 The product formed when CH_3COCH_3 is treated with I_2 and NaOH is:

- A) CH_3COONa
C) Both A and B
- B) CHI_3
D) CHI_3 only

Q.13 Given below are two statements labelled as Assertion(A) and reason(R)

Assertion(A): Aldehydes are generally more reactive than ketones towards nucleophilic addition.

Reason(R): Aldehydes have less +I alkyl group effect and less steric hindrance compared to ketones.

- A) Both A and R are true and R is the correct explanation of A
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.

Q.14 Given below are two statements labelled as Assertion(A) and reason(R)

Assertion(A): The standard electrode potential of copper is +0.34 V, so copper metal can liberate hydrogen gas from dilute acids..

Reason(R): A metal with a positive E° value is less reactive than hydrogen.

- A) Both A and R are true and R is the correct explanation of A
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.

Q.15 Given below are two statements labelled as Assertion(A) and reason(R)

Assertion(A): Phenols react with bromine water to give 2,4,6 – tribromophenol.

Reason(R): OH group activates the aromatic ring towards electrophilic substitution at ortho and para positions.

- A) Both A and R are true and R is the correct explanation of A
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) A is false but R is true.

Q.16 Given below are two statements labelled as Assertion(A) and reason(R)

Assertion(A): Proteins lose their biological activity when denatured.

Reason(R): Denaturation affects the primary structure of proteins.

- A) Both A and R are true and R is the correct explanation of A
- B) Both A and R are true but R is not the correct explanation of A.
- C) A is true but R is false.
- D) A is false but R is true.

SECTION - B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

Q.17 Define pseudo-first-order reaction. Give one example

Q.18 An aqueous solution of glucose freezes at -0.23°C . Calculate the molality of the solution.
(Given: for water = $1.86 \text{ K kg mol}^{-1}$)

Q.19 Covert the following:

- a) tertiary butyl alcohol to 1-bromo-2-methylpropane
- b) Phenol to anisole.

Q.20 Which is more reactive towards nucleophilic substitution: Propanal or benzaldehyde and why?

[OR]

Predict the product(s) and mechanism for the reaction between benzaldehyde and ethyl magnesium bromide followed by acid hydrolysis.

Q.21 How glucose reacts with the following and write the reactions involved.

- (i) $\text{Br}_2/\text{H}_2\text{O}$
- (ii) $(\text{CH}_3\text{CO})_2\text{O}$

SECTION - C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

Q.22 Answer the following

- (i) Write the IUPAC name of the complex: $[\text{Co}(\text{en})_3]^{3+}$
- (ii) Write the formula of Pentaammineaquaruthenium(III) chloride
- (iii) Define homoleptic and heteroleptic complexes.

Q.23

- (i) Define Kohlrausch law of independent migration of ions.
- (ii) Standard electrode potential (E°) of the galvanic cell: $\text{Zn(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag(s)}$ is 1.56V . Calculate equilibrium constant K_c for this reaction at 298K .

[OR]

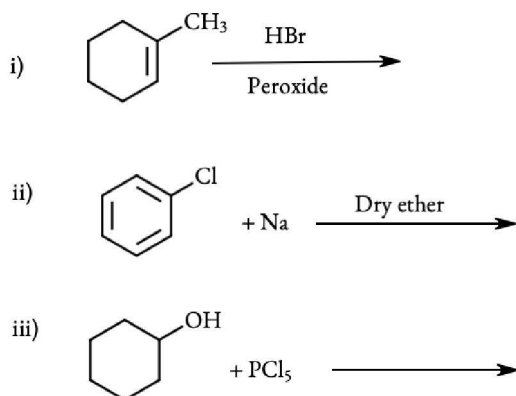
- (i) A student measures the conductivity of NaCl solution and finds that it decreases on dilution. Explain why, even though degree of dissociation increases.
- (ii) The standard reduction potential of Ag^+/Ag is $+0.80 \text{ V}$ and Cu^{2+}/Cu is $+0.34 \text{ V}$. Predict which metal will displace the other from its salt solution and justify your answer.

Q.24 Compound M has molecular formula $\text{C}_7\text{H}_6\text{O}_2$. It decolorises bromine water and gives effervescence with NaHCO_3 , but does not react with FeCl_3 solution. Identify M and justify your

answer. Write reactions involved.

Q.25 The rate constant for the decomposition of a hydrocarbon is $2 \times 10^{-5} \text{ s}^{-1}$ at 350 K and $8 \times 10^{-5} \text{ s}^{-1}$ at 410 K. Calculate the activation energy

Q.26 Complete the following reactions



Q.27 The following data are obtained for the reaction: $2A + B \rightarrow C + D$

$[A]/\text{mol L}^{-1}$	$[A]/\text{mol L}^{-1}$	Initial rate($\text{mol L}^{-1} \text{ s}^{-1}$)
0.2	0.2	5.0×10^{-3}
0.4	0.2	2.0×10^{-2}
0.2	0.4	1.0×10^{-2}

(a) Determine the order of the reaction with respect to A and B.

(b) Write the rate law.

(c) Calculate rate constant.

Q.28 A compound (A) with formula $\text{C}_7\text{H}_6\text{O}$ gives reddish-brown precipitate with 2,4-DNP and shows a positive Tollens test. On oxidation with KMnO_4 , it gives benzoic acid. (A) undergoes Cannizzaro reaction on heating with concentrated NaOH .

a) Identify (A).

b) Write equations for all reactions mentioned.

SECTION - D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

Q. 29 Isomerism in coordination compounds

Isomers are substances with the same molecular formula but differing in structure or spatial arrangement. In coordination chemistry, isomerism is classified into:

Structural isomerism — differences in connectivity/bonding of ligands.

Types:

- Ionization isomerism
- Hydrate isomerism
- Coordination isomerism
- Linkage isomerism

Stereoisomerism — same bonding sequence but different spatial arrangement.

Types:

- Geometrical isomerism
- Optical isomerism

Answer the following questions:

a) Write the linkage isomer of: $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$

[OR]

Write the ionization isomer of $[\text{Cr}(\text{H}_2\text{O})_5\text{Br}]\text{SO}_4$

b) Draw *cis* - and *trans* - isomers of plain: $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

c) Give example to the complex which shows hydrate isomerism.

Q.30 Galvanic and Electrolytic cells

Electrochemistry is the branch of chemistry that deals with the relationship between chemical energy and electrical energy. It involves redox reactions where oxidation and reduction occur at separate electrodes, connected through an external circuit. Electrochemical processes are broadly classified into:

1. Galvanic (Voltaic) Cells — In galvanic cells chemical energy converts to electrical energy. Electricity produces due the spontaneous chemical redox reaction. Examples: Daniell cell, fuel cells, corrosion etc.

2. Electrolytic Cells — These use electrical energy to drive non-spontaneous reactions. Examples: electrolysis of molten NaCl, electro refining of copper.

Measurement of electrode potential involves standard hydrogen electrode (SHE) as a reference, with potentials calculated under standard conditions (1 M, 1 atm, 298 K). The Nernst equation relates cell potential to ion concentrations, given by:

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.059}{n} \log Q$$

Applications include metal refining, electroplating, batteries, corrosion prevention, and industrial electrolysis. Controlling cell potential is essential in preventing unwanted side reactions and ensuring process efficiency.

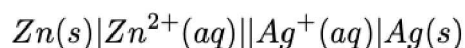
Answer the following questions:

a) Write the product formed at anode by the electrolysis of dilute aq. NaCl using Pt electrodes.

[OR]

Write the possible oxidation reaction at anode by the electrolysis of aq. AgNO_3 using Pt electrodes.

b) Write oxidation half and reduction half and also the net cell equation (Balanced redox reaction) of the galvanic cell:



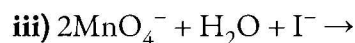
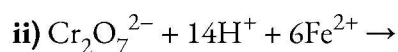
c) Write one function of salt bridge in galvanic cell.

SECTION - E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

Q. 31 Answer the following

a) Complete the following reactions:



b) Answer the following

i) Why does Zn not show variable oxidation states?

ii) Zn, Cd, and Hg are considered d-block elements but not transition metals. Why?

[OR]

a) Write the reactions involved in the synthesis of $\text{K}_2\text{Cr}_2\text{O}_7$ from the chromite ore.

b) Answer the following:

i) Why do Zr and Hf exhibit similar properties?

ii) Why do transition elements exhibit higher enthalpies of atomization?

Q. 32 Answer the following

a) Write any three differences between ideal and non-ideal solutions.

b) Define:

i) Osmotic pressure

ii) Colligative properties

[OR]

a) The vapour pressure of water is 12.3 kPa at 300 K. Calculate vapour pressure of 1 molal solution of a non-volatile solute in it.

b) Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114 g octane to reduce its vapour pressure to 80%.

Q.33 Answer the following

a) Write a chemical test to distinguish the following pair of compounds:

i) ethanamine and diethyl amine

ii) ethanamine and aniline

b) Write a short note on the following

i) Gabriel-phthalime synthesis

ii) Hoffmann -Bromide synthesis of amines

iii) Acylation of amines

[OR]

Answer the following

a) Convert the following

i) Nitrobenzene to benzene

ii) Aniline to p-bromo acetanilide

iii) Benzamide to phenol

b) Answer the following:

i) pK_b of aniline is more than that of methylamine. Explain why?

ii) Methylamine in water reacts with ferric chloride to precipitate hydrated ferric oxide. Explain