SAMPLE QUESTION PAPER

BLUE PRINT

Time Allowed : 3 hours **Maximum Marks :** 70

S. No.	Chapter	Passage based/ MCQs/A & R (1 mark)	SA-I (2 marks)	SA-II (3 marks)	LA (5 marks)	Total
1.	The Solid State	2(2)	1(2)	–	–	**12(23)**
2.	Solutions	1(1)	–	1(3)	–	
3.	Electrochemistry	1(1)	1(2)	–	1(5)	
4.	Chemical Kinetics	1(1)	–	1(3)	–	
5.	Surface Chemistry	1(1)	1(2)	–	–	
6.	The *p*-Block Elements	1(4)	–	1(3)	–	**7(19)**
7.	The *d*- and *f*-Block Elements	1(1)	1(2)	1(3)	–	
8.	Coordination Compounds	1(1)	–	–	1(5)	
9.	Haloalkanes and Haloarenes	2(2)	1(2)	–	–	**14(28)**
10.	Alcohols, Phenols and Ethers	1(4)	1(2)	–	–	
11.	Aldehydes, Ketones and Carboxylic Acids	2(2)	1(2)	1(3)	–	
12.	Amines	1(1)	1(2)	–	1(5)	
13.	Biomolecules	1(1)	1(2)	–	–	
	Total	**16(22)**	**9(18)**	**5(15)**	**3(15)**	**33(70)**

Subject Code : 043

CHEMISTRY

Time allowed : 3 hours ***Maximum marks : 70***

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)

1. Read the passage given below and answer the following questions :

Alcohols are oxidised to carbonyl compounds by chromium (VI) compounds. The products depend on the structure of the substrate and the specific chromium reagent. Alcohols are also oxidised by the jones reagent (CrO_3 in aq H_2SO_4).

Primary alcohols are oxidised to aldehydes, which are further oxidised to carboxylic acids under the specific reaction conditions.

$$CH_3CH_2OH \xrightarrow{CrO_3/H_2SO_4} CH_3COOH$$

Secondary alcohols are oxidised to ketones and tertiary alcohols are not oxidised. In this case aldehydes cannot be separated out. For getting aldehydes PCC (pyridinium chlorochromate) is used.

The following questions are multiple choice questions. Choose the most appropriate answer.

(i) Which of the following reagents cannot convert primary alcohol to carboxylic acid?

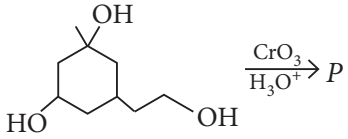
(a) Potassium permanganate (b) Jones reagent

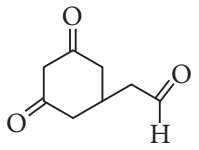
(c) Pyridinium chlorochromate (d) Chromic acid

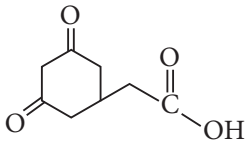
(ii) During oxidation of alcohols to carbonyl compounds Cr^{+6} of (PCC) is converted to

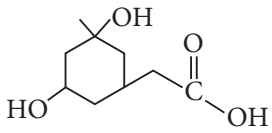
(a) Cr^{3+} (b) Cr^{2+} (c) Cr^{4+} (d) Cr

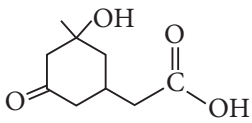
(iii) In the following reaction, the product *P* is



(a) 

(b) 

(c) 

(d) 

(iv) Which of the following steps does not represent the reaction of PCC with alcohols

(a) Attack of oxygen on the chromium to form Cr–O bond

(b) Proton transfer

(c) Break of the O-Cr bond

(d) Conversion of Cr (VI) to Cr (III)

OR

What is the chemical formula of PCC?

(a) $[C_5H_5NH]^+ [CrO_3Cl^-]^-$ (b) $[C_5H_4NH_2]^+ [CrO_2Cl_2]^-$

(c) $[C_6H_5NH_3]^+ [CrO_3]^-$ (d) None of these

2. Read the passage given below and answer the following questions :

Group-17 elements of *p*-block are known as halogens. Halogens are very reactive. Fluorine reacts with all the elements except helium, neon and argon to form fluorides. Chlorine is less reactive, but still react with all the elements with the exception (does not react directly) of carbon, nitrogen, oxygen and group 18 elements. With metals they typically forms extended structure with high ionic character when the metals are in low oxidation states.

The compounds with non-metals contain covalent bonding. Flourine is the most oxidizing of the halogens and it stabilizes high oxidation states.

For *p*-block elements, the stability of the halides generally decreases with increasing size of the halogens. So, the fluoride is most stable than the chloride, which in turn is more stable than the bromide.

In these questions (Q. No. i-iv), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

(i) Assertion : Halogens do not occur in free state.

Reason : Halogens are highly reactive.

OR

Assertion : Xenon forms fluorides.

Reason : Because 5*d*-orbitals are available for valence shell expansion.

(ii) Assertion : F_2 and Cl_2 when passed through water, F_2 is more reactive.

Reason : F_2 is most electronegative.

(iii) Assertion : F – F bond has low bond dissociation energy.

Reason : The fluorine has lower reactivity.

(iv) **Assertion :** Bond dissociation energy is $F_2 > Cl_2$.
Reason : F_2 has more electronic repulsion than Cl_2.

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

3. When river water meets sea water delta formation takes place. This is due to the phenomenon of
(a) electrophoresis (b) dialysis (c) coagulation (d) adsorption.

4. The common oxidation states of Ti are
(a) +2, +3 (b) +3, +4 (c) –3, – 4 (d) +2, +3, +4

5. A binary liquid solution is prepared by mixing *n*-heptane and ethanol. Which one of the following statements is correct regarding the behaviour of the solution?
(a) The solution formed is an ideal solution.
(b) The solution is non-ideal, showing +ve deviation from Raoult's law.
(c) The solution is non-ideal, showing –ve deviation from Raoult's law.
(d) *n*-Heptane shows +ve deviation while ethanol shows –ve deviation from Raoult's law.

OR

Which of the following statements is correct?
(a) Lowering of vapour pressure takes place only in ideal solutions.
(b) Lowering of vapour pressure does not depend upon the solvent at a given concentration of the solute.
(c) Solvents with higher boiling points have higher vapour pressure.
(d) Relative lowering of vapour pressure does not depend upon the solvent at a given concentration of the solute.

6. The increasing order for nucleophilicity would be ?
(a) $Cl^- < Br^- < I^-$ (b) $I^- < Cl < Br^-$ (c) $Br^- < Cl^- < F^-$ (d) $I^- < Br^- < Cl^-$

OR

$CH_3CH_2CH_2Br + NaCN \longrightarrow CH_3CH_2CH_2CN + NaBr$ will be fastest in
(a) ethanol (b) methanol
(c) *N*-*N*-dimethylformamide (d) water.

7. Percentage of free space in a body-centred cubic unit cell is
(a) 34% (b) 28% (c) 30% (d) 32%

8. The pair in which both species have same magnetic moment (spin only value) is
(a) $[Cr(H_2O)_6]^{2+}$, $[CoCl_4]^{2-}$ (b) $[Cr(H_2O)_6]^{2+}$, $[Fe(H_2O)_6]^{2+}$
(c) $[Mn(H_2O)_6]^{2+}$, $[Cr(H_2O)_6]^{2+}$ (d) $[CoCl_4]^{2-}$, $[Fe(H_2O)_6]^{2+}$

OR

A complex of platinum, ammonia and chlorine produces four ions per molecule in the solution. The structure consistent with the observation is
(a) $[Pt(NH_3)_4]Cl_4$ (b) $[Pt(NH_3)_2]Cl_4$
(c) $[Pt(NH_3)_5Cl]Cl_3$ (d) $[Pt(NH_3)_4Cl_2]Cl_2$

9. For a first order reaction $A \rightarrow B$, the reaction rate at reactant concentration of 0.01 M is found to be 2.0×10^{-5} mol L^{-1} s^{-1}. The half-life period of the reaction is
(a) 220 seconds (b) 30 seconds (c) 300 seconds (d) 347 seconds.

10. Bromination of aniline gives 2,4,6-tribromoaniline, whereas the nitration of aniline with mixed acids gives *m*-nitroaniline. In the case of nitration, the *m*-derivative is formed because

(a) in the presence of strong acids, the amino group is protonated to $-NH_3^+$ which is *m*-orienting

(b) *m*-nitroaniline is thermodynamically more stable than the *ortho* and *para*-isomers

(c) nitro group cannot enter *ortho* and *para* positions due to steric factor

(d) the mechanism for bromination and nitration are different.

OR

Primary amines on heating with CS_2 followed by excess of mercuric chloride yields isothiocyanates. The reaction is called

(a) Hofmann mustard oil reaction (b) Perkin reaction

(c) Fries reaction (d) Diels–Alder reaction.

11. The number of tetrahedral and octahedral voids in hexagonal primitive unit cell are

(a) 8, 4 (b) 2, 1 (c) 12, 6 (d) 6, 12

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) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

12. **Assertion :** Kohlrausch law helps to find the molar conductivity of weak electrolyte at infinite dilution.

Reason : Molar conductivity of a weak electrolyte at infinite dilution cannot be determined experimentally.

13. **Assertion :** Disruption of the native structure of a protein is called denaturation.

Reason : The change in colour and appearance of egg during cooking is due to denaturation.

14. **Assertion :** *m*-Chlorobenzoic acid is a stronger acid than *p*-chlorobenzoic acid.

Reason : In *m*-chlorobenzoic acid both – *I*-effect and +*R*-effect of Cl operate but in *p*-chlorobenzoic acid only +*R*-effect of Cl operates.

OR

Assertion : H-atom of carboxylic group is readily replaced than H-atom of alcoholic group.

Reason : Resonance gives extra stabilization to carboxylic acid.

15. **Assertion :** Aldehydes and ketones both react with Tollen's reagent to from silver mirror.

Reason : Both, aldehydes and ketones contain a carbonyl group.

16. **Assertion :** Carbon-halogen bond in aryl halide has partial double bond character.

Reason : Aryl halides undergo nucleophilic substitution easily.

SECTION - B

The following questions, Q. No. 17-25 are short answer type and carry 2 marks each.

17. The specific conductance of decinormal solution of an electrolyte at 250°C is 1.12×10^{-2} ohm^{-1} cm^{-1}. The resistance of the solution contained in the cell is found to be 65 ohms. Calculate the cell constant.

18. How are the following conversions carried out? (Write reactions and reactions conditions only).

(i) Propanoic acid to 1-propanol. (ii) Acetophenone to benzoic acid

19. (a) Give an example of an associated colloid.

(b) What is meant by the term 'peptisation'?

20. Name the products obtained when an amide containing three carbon atoms is

(a) reduced by $LiAlH_4$

(b) treated with Br_2 + KOH.

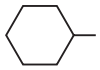
21. What happens when

(i) *n*-butyl chloride is treated with alcoholic KOH

(ii) bromobenzene is treated with Mg in the presence of dry ether

OR

Identify *A*, *B*, *C* and *R* in the following :

(i)  $\xrightarrow{\text{dry ether}} A \xrightarrow{H_2O} B$ (ii) $R-Br + Mg \xrightarrow{\text{dry ether}} C \xrightarrow{D_2O} CH_3\underset{\underset{D}{|}}{C}HCH_3$

22. A sample of ferrous oxide has actual formula, $Fe_{0.93}O_{1.00}$. In this sample, what fraction of metal ions are Fe^{2+}? What type of non-stoichiometric defect is present in this sample?

OR

How would you account for the following :

(a) Frenkel defects are not found in alkali metal halides?

(b) Schottky defects lower the density of related solids?

23. (i) How is the magnetic moment of a species related to the number of unpaired electrons?

(ii) Calculate the magnetic moment of a divalent ion in aqueous solution if its atomic number is 25.

24. What happens when ethanol is heated with concentrated sulphuric acid at 453 K? Explain the mechanism of this reaction.

OR

(i) Convert propan-2-one into tertiary butyl alcohol.

(ii) Arrange H_2O, *R*OH and CH ≡ CH in the increasing order of acidity.

25. State differences between the following pairs :

(i) α-Helix structure and β-pleated sheet structure.

(ii) Primary and secondary structures of proteins.

SECTION - C

Q. No. 26-30 are short answer type II carrying 3 marks each.

26. (a) Plot a curve between $t_{1/2}$ and $[A]_0$ for the first order reaction.

(b) With the help of an example explain what is meant by pseudo first order reaction.

OR

(a) Define the following :

(i) Rate constant. (ii) Energy of activation.

(b) If the rate constant of a reaction is $k = 3 \times 10^{-4} s^{-1}$, then identify the order of the reaction.

27. Give an explanation for each of the following observations :

(i) *d*-block elements exhibit more oxidation states than *f*-block elements.

(ii) The d^1 configuration is very unstable in ions.

(iii) Zr and Hf have almost similar atomic radii.

OR

Describe the general characteristics of the transition elements with special reference to their tendency to

(i) exhibit paramagnetism (ii) form complex compounds

(iii) their catalytic behaviour.

28. (a) Heptane and octane form ideal solution. At 373 K, the vapour pressure of the two liquid components are 105.2 kPa and 46.8 kPa respectively. What will be the vapour pressure of a mixture of 26.0 g of heptane and 35.0 g of octane?

(b) Give an example of a material used for making semipermeable membrane for carrying out reverse osmosis.

29. (a) SF_6 is not easily hydrolysed though thermodynamically it should be. Why?

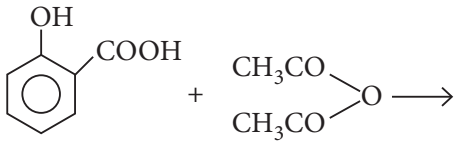
(b) Structures of xenon fluorides cannot be explained by valence bond approach. Explain?

(c) Draw the structure of H_2SO_5.

30. (a) Mention a chemical property in which methanoic acid differs from acetic acid.

(b) Complete the following reactions :

(i) $(CH_3)_2CO \xrightarrow{LiAlH_4}$

(ii) 

SECTION - D

Q. No. 31-33 are long answer type carrying 5 marks each.

31. (a) The $E°$ values in respect of electrodes of chromium ($Z = 24$), manganese ($Z = 25$) and iron ($Z = 26$) are : $Cr^{3+}/Cr^{2+} = -0.4$ V ; $Mn^{3+}/Mn^{2+} = +1.5$ V ; $Fe^{3+}/Fe^{2+} = 0.8$ V.

On the basis of the above information compare the feasibilities of further oxidation of their + 2 oxidation states.

(b) (i) The measured resistance of a conductance cell containing 7.5×10^{-3} M solution of KCl at 25 °C was 1005 ohm. (cell constant = 1.25 cm^{-1}).

Calculate specific conductance and molar conductance of the solution

(ii) Mention few applications of electrochemical series.

OR

(a) Calculate the cell emf and ΔG for the cell reaction for the following cell :

$Zn_{(s)} \mid Zn^{2+}$ (0.0004 M) || Cd^{2+} (0.2 M) $\mid Cd_{(s)}$

$E°$ values at 25°C : $Zn^{2+}/Zn = -0.763$ V; $Cd^{2+}/Cd = -0.403$ V; $F = 96500$ C mol^{-1};

$R = 8.314$ J K^{-1} mol^{-1}.

(b) If $E°$ for copper electrode is 0.34 V, how will you calculate its emf value when the solution in contact with it is 0.1 M in copper ions? How does emf for copper electrode change when concentration of Cu^{2+} ions in the solution is decreased?

32. Account for the following :

(a) Aqueous solution of methylamine reacts with iron (III) chloride to precipitate iron (III) hydroxide.

(b) The boiling points of amines are lower than those of corresponding alcohols.

(c) *p*-Methoxyaniline is a stronger base than aniline but *p*-nitroaniline is a weaker base than aniline. Give reason.

(d) Nitro compounds have higher boiling points than the hydrocarbons having almost the same molecular mass.

(e) Methylamine solution in water reacts with ferric chloride solution to give a precipitate of ferric hydroxide.

OR

(a) Give plausible explanation for each of the following :

(i) There are two —NH_2 groups in semicarbazide. However only one is involved in the formation of semicarbazones.

(ii) Ammonolysis of alkyl halides does not give corresponding amine in pure state.

(iii) Aniline does not undergo Friedel–Crafts reaction.

(b) What happens when

(i) aniline is treated with benzaldehyde

(ii) a mixture of alcohol and ammonia is passed over heated aluminium oxide as catalyst?

33. Explain why :

(i) $[Cr(NH_3)_6]^{3+}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic.

(ii) A solution of $[Ni(H_2O)_6]^{2+}$ is green but $[Ni(CN)_4]^{2-}$ is colourless.

(iii) The low spin tetrahedral complexes are rarely observed.

OR

(i) The hexaaquomanganese (II) ion contains five unpaired electrons while hexacyano ion contains only one unpaired electron. Explain using crystal field theory.

(ii) For Mn^{3+} ion, the electron pairing energy P is 28000 cm^{-1}, Δ_o values for the complexes $[Mn(H_2O)_6]^{3+}$ and $[Mn(CN)_6]^{3-}$ are 21000 cm^{-1} and 38500 cm^{-1} respectively. Do these complexes have high spin or low spin complexes? Also write the configurations corresponding to these states.

(iii) Low spin octahedral complexes of nickel are not known. Explain.