

# **TERM-2 SAMPLE PAPER**

## **CHEMISTRY**

*Time Allowed: 2 Hours*

*Maximum Marks: 35*

### **SECTION - A**

(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)

1. (A) Devise the correct cell representation for the given cell reaction?

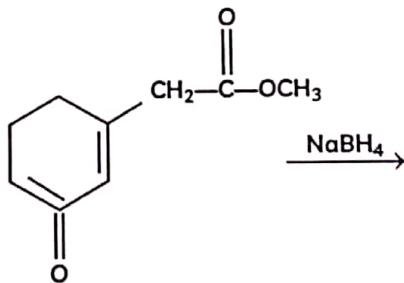


- (B) Why is it not possible to measure single electrode potential? 2

2. Answer the following questions- (any two)

- (A) You see a small packet inserted in a vitamin bottles or leather products, what is its role?  
(B) How is a delta created?  
(C) Critical temperatures of N<sub>2</sub>, SO<sub>2</sub> and CH<sub>4</sub> are 126, 230, 110K respectively. Arrange them in increasing order of adsorption on the surface of activated charcoal 2

3. (A) Give the product for:



- (B) Which among the following will undergo Cannizzaro reaction?

Benzaldehyde, Acetone, Formaldehyde 2

### **SECTION - B**

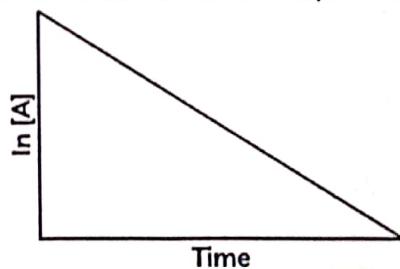
(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)

4. The electrical resistance of a column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is  $5.55 \times 10^3$  ohm. Calculate its resistivity, conductivity and molar conductivity. 3

5. The following graphs represents concentration of reactants versus time for a first-order reaction.

- (A) What is the value of slope and intercept?  
(B) Calculate the rate constant if the half-

life of a first-order reaction was found to be 10 min at a certain temperature.

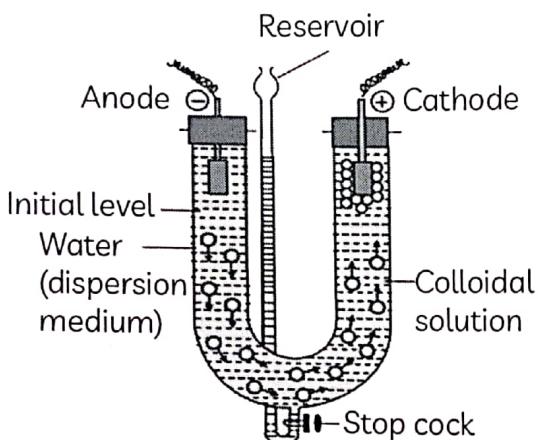


OR

Show that time required for 99% completion is twice the time required for the completion of 90% reaction.

3

6. Observe the experimental set up below and answer the following questions:



- (A) What happens when an electric current is passed through a colloidal solution?  
 (B) What will happen if this movement of particles is prevented?  
 (C) Name the process and write its one application.

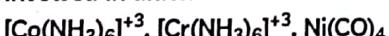
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7. Answer the following question:-

- (A) What is Tollen's reagent? Write one usefulness of this reagent.  
 (B) An organic compound A has the molecular formula  $C_8H_{16}O_2$ . It gets hydrolysed with dilute sulphuric acid and gives a carboxylic acid B and an alcohol C. Oxidation of C with chromic acid also produced B. C on dehydration reaction gives but-1-ene. Write equations for the reactions involved.

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8. Compare the following complexes with respect to structural shapes of units, magnetic behaviour and hybrid orbitals involved in units:



(At. nos. : Co = 27, Cr = 24, Ni = 28)

OR

What is meant by crystal field splitting energy? On the basis of crystal field theory, write the electronic configuration of  $d^4$  terms of  $t_{2g}$  and  $e_g$  in an octahedral field when

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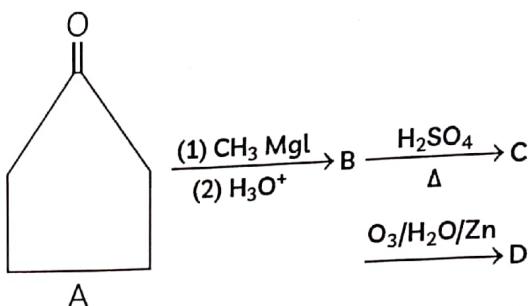
- (i)  $\Delta_0 > p$   
 (ii)  $\Delta_0 < p$

9. (A) What kind of isomerism is shown by  $[Cu(NH_3)_4][PtCl_4]$  and  $[Pt(NH_3)_4][CuCl_4]$ ?

(B) A coordination compound has the formula  $CoCl_3 \cdot 4NH_3$ . It does not liberate ammonia but forms a precipitate with  $AgNO_3$ . Write the structure and IUPAC name of the complex compound.

(C) State whether the following is a cationic or anionic complex  $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$

10. Identify compounds B, C and D



OR

Give suitable chemical reactions for the following:

- (A) Methanal gives methanol on catalytic hydrogenation in the presence of catalysts such as Ni, Pt or Pd.  
 (B) Methanal reacts with hydrogen cyanide to form methanal cyanohydrin.  
 (C) When methanal reacts with blue coloured Fehling's solution, red precipitates of cuprous oxide ( $Cu_2O$ ) are formed and the colour of Fehling's solution changes from blue to red.

11. Answer the following questions:-

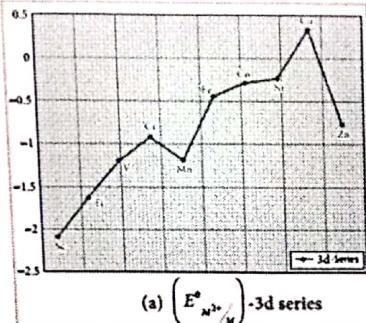
- (A) Write the formula of an oxo-anion of chromium (Cr) in which it shows the oxidation state equal to its group number.  
 (B) Why do transition elements exhibit higher enthalpies of atomization?  
 (C) Name the element showing the maximum number of oxidation states among the first series of transition metals from Sc (Z = 21) to Zn (Z = 30).

OR

The standard electrode potential for the  $M^{3+}/M^{2+}$  half-cell gives the relative stability between  $M^{3+}$  and  $M^{2+}$ . The reduction potential values are tabulated as below:

Reaction	Standard reduction potential (V)
$Ti^{3+} + e^- \rightarrow Ti^{2+}$	-0.37
$V^{3+} + e^- \rightarrow V^{2+}$	-0.26
$Cr^{3+} + e^- \rightarrow Cr^{2+}$	-0.41
$Mn^{3+} + e^- \rightarrow Mn^{2+}$	+1.51

$\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Mn}^{2+}$	+0.77
$\text{Co}^{3+} + \text{e}^- \rightarrow \text{Co}^{2+}$	+1.81



(A) What does the negative values for titanium, vanadium and chromium indicate?

(B) What does reduction potential of  $\text{Mn}^{3+}/\text{Mn}^{2+}$  indicate about the stability of these oxidation states?

(C) The  $E^\circ$  value for the  $\text{Mn}^{3+}/\text{Mn}^{2+}$  couple is much more positive than that for  $\text{Cr}^{3+}/\text{Cr}^{2+}$  couple or  $\text{Fe}^{3+}/\text{Fe}^{2+}$  couple.

3

## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

**12. Read the passage given below and answer the questions that follow:**

Amine, any member of a family of nitrogen-containing organic compounds that is derived, either in principle or in practice, from ammonia ( $\text{NH}_3$ ).

Naturally occurring amines include the alkaloids, which are present in certain plants; the catecholamine neurotransmitters (i.e., dopamine, epinephrine, and norepinephrine); and a local chemical mediator, histamine, that occurs in most animal tissues.

Most of the numerous methods for the preparation of amines may be broadly divided into two groups: (1) chemical reduction (replacement of oxygen with hydrogen atoms in the molecule) of members of several other classes of organic nitrogen compounds and (2) reactions of ammonia or amines with organic compounds.

Amines are classified as primary, secondary, or tertiary depending on whether one, two, or three of the hydrogen atoms of ammonia have been replaced by organic groups. In chemical notation these three classes are represented as  $\text{RNH}_2$ ,  $\text{R}_2\text{NH}$ , and  $\text{R}_3\text{N}$ , respectively. A fourth category consists of quaternary ammonium compounds, which are obtained by replacement of all four hydrogen

atoms of the ammonium ion,  $\text{NH}_4^+$ ; an anion is necessarily associated ( $\text{R}_4\text{N}^+\text{X}^-$ ). Amines are also classified as aliphatic, having only aliphatic groups attached, or aromatic, having one or more aryl groups attached. They may be open-chain, in which the nitrogen is not part of a ring, or cyclic, in which it is a member of a ring (generally aliphatic). The carbylamine reaction, also known as Hofmann's isocyanide test, is a chemical test for the detection of primary amines.

(A) Name two alkaloids present in neurotransmitters.

(B) Write the structure of n-methyl ethanamine.

(C) What are the two methods generally used for the preparation of amines?

(D) Write chemical equations for the following conversions:

(i) Nitrobenzene to benzoic acid.

(ii) Benzyl chloride to 2-phenylethanamine

OR

Account for the following :

(i) Primary amines ( $\text{R}-\text{NH}_2$ ) have higher boiling point than tertiary amines ( $\text{R}_3\text{N}$ ).

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

# **TERM-2**

# **SAMPLE PAPER**

## **CHEMISTRY**

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*Maximum Marks: 35*

### **SECTION - A**

(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)

1. (A) Arrange the following amines in order of decreasing basic strength—Ethylamine, ammonia, triethylamine.
- (B) Why aniline is acetylated first to prepare mono bromo derivative ?                                  2
2. If the half-life period of a first-order reaction in A is 2 minutes, how long will it take to reach 25% of its initial concentration?                                  2
3. Draw the structure of the alcohol that could be oxidized to each compound.  
(i) 2-propanone  
(ii) Cyclohexanone                                                  2

### **SECTION - B**

(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)

4. Using thermodynamic principles, explain:  
(A) Entropy has negative value for adsorption.  
(B) Adsorption is a exothermic process?  
(C) Relation between enthalpy and entropy at equilibrium .                                          3
5. The following table summarizes the oxidation states of the 3d series elements.

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu
				+7				
			+6	+6	+6			
			+5	+5	+5			
		+4	+4	+4	+4	+4	+4	
+3	+3	+3	+3	+3	+3	+3	+3	
	+2	+2	+2	+2	+2	+2	+2	+2

								+1
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Account for the following questions related to the above table:

- (A) Transition metals show variable oxidation state.
- (B) At the beginning of the series, +3 oxidation state is stable but towards the end +2 oxidation state is stable.
- (C) Mn has six different oxidation states from +2 to +7.

**OR**

Explain the trends in the properties of the members of the First series of transition elements:

- (A)  $E^\ominus (M^{2+}/M)$  value for copper is positive (+0.34V) in contrast to the other members of the series.

- (B)  $\text{Cr}^{2+}$  is reducing while  $\text{Mn}^{2+}$  is oxidising though both have  $d^4$  configuration.  
 (C) The oxidising power in the series increases in the order  $\text{VO}_2^+ < \text{Cr}_2\text{O}_7^{2-} < \text{MnO}_4^-$

6. Based on valence bond theory, explain the bonding in the coordination entity  $[\text{Co}(\text{NH}_3)_6]^{3+}$ . Also, comment on the geometry and spin of the given entity. (Atomic no. of Co = 27) 3

7. A metal complex having composition  $\text{Cr}(\text{NH}_3)_4\text{Cl}_2\text{Br}$  has been isolated in two forms A and B. The form A reacts with  $\text{AgNO}_3$  to give a white precipitate readily soluble in dilute aqueous ammonia, whereas B gives a pale-yellow precipitate soluble in concentrated ammonia

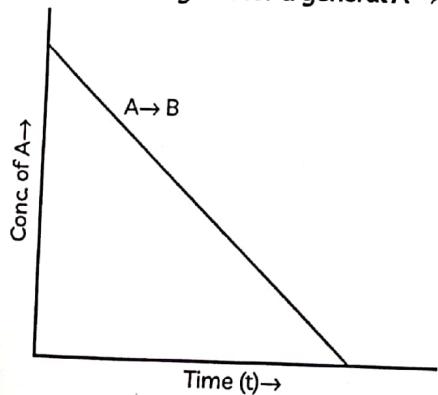
- (i) Write the formulae of isomer A and B  
 (ii) State the hybridisation of Cr in each of them.

OR

Give reason for each of the following:

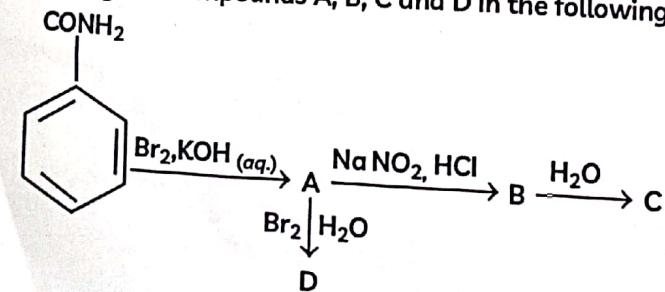
- (A)  $\text{Co}^{2+}$  is easily oxidised to  $\text{Co}^{3+}$  in presence of a strong ligand.  
 (B) CO is a stronger complexing reagent than  $\text{NH}_3$ .  
 (C) The molecular shape of  $\text{Ni}(\text{CO})_4$  is not the same as that of  $[\text{Ni}(\text{CN})_4]^{2-}$ . 3

8. The graphical representation of concentration of A Vs time is given for a general  $\text{A} \rightarrow \text{B}$ ,



- (A) Arrange the following in increasing order of their  $pK_a$  values:  
 (i)  $\text{C}_6\text{H}_5\text{NH}_2$ ,  $\text{C}_2\text{H}_5\text{NH}_2$ ,  $(\text{C}_2\text{H}_5)_2\text{NH}$ ,  $\text{NH}_3$

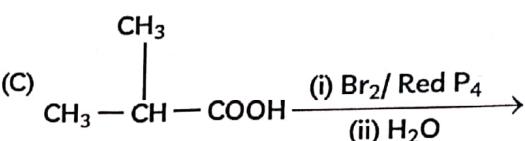
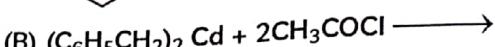
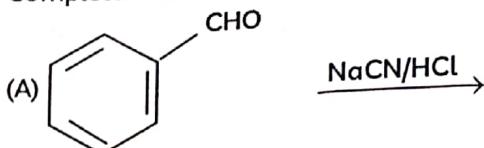
(B) Identify the compounds A, B, C and D in the following set of reactions –



The following questions :

- (a) What is the order of the reaction ?  
 (b) What is the slope of the curve ?  
 (c) State the units for the rate constant. 3

9. Complete the following reactions:



OR

Write chemical equations for the following reactions:

- (A) Propanone is treated with dilute  $\text{Ba}(\text{OH})_2$ .  
 (B) Acetophenone is treated with  $\text{Zn}(\text{Hg})/\text{Conc. HCl}$   
 (C) Benzoyl chloride is hydrogenated in presence of  $\text{Pd}/\text{BaSO}_4$ . 3

10. (A) Account for the following:

- (i)  $\text{Cl}-\text{CH}_2\text{COOH}$  is a stronger acid than  $\text{CH}_3\text{COOH}$ .  
 (ii) Carboxylic acids do not give reactions of the carbonyl group.  
 (B) Give simple chemical tests to distinguish Benzoic acid and Phenol. 3

11. (A) Aniline is a weaker base than cyclohexylamine. Give reason.

(B) Amino group in aniline is ortho and para directing, Then why does aniline on nitration give substantial amount of m-nitroaniline?

(C) There are two test tubes labelled A and B. Give suitable test to identify which test tube contains aniline and which contains methylamine.

OR

3

3

## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

12. Read the passage given below and answer the questions that follow - 5

Electrolysis, process by which electric current is passed through a substance to effect a chemical change. The process is carried out in an electrolytic cell, an apparatus consisting of positive and negative electrodes held apart and dipped into a solution containing positively and negatively charged ions. The substance to be transformed may form the electrode, may constitute the solution, or may be dissolved in the solution. Electric current (i.e., electrons) enters through the negatively charged electrode (cathode); components of the solution travel to this electrode, combine with the electrons, and are transformed (reduced). The products can be neutral elements or new molecules. Components of the solution also travel to the other electrode (anode), give up their electrons, and are transformed (oxidized) to neutral elements or new molecules.

Electrolysis is used extensively in metallurgical processes, such as in extraction (electrowinning) or purification (electrorefining) of metals from ores or compounds and in deposition of metals from solution (electroplating). Metallic sodium and chlorine gas are produced by the electrolysis of molten sodium chloride; electrolysis of an aqueous solution of sodium chloride yields sodium hydroxide and chlorine

gas. Hydrogen and oxygen are produced by the electrolysis of water.

Michael Faraday discovered in 1833 that there is always a simple relationship between the amount of substance produced or consumed at an electrode during electrolysis and the quantity of electrical charge  $Q$  which passes through the cell.

- (A) Name two metals which can be purified using electrolytic refining.  
(B) What are the electrolysis products of an aqueous solution of sodium chloride?  
(C) How much charge in terms of Faraday is required for the reduction of 1 mol of  $\text{Cu}^{2+}$  to Cu?  
(D) How many moles of mercury will be produced by electrolysing 1.0 M  $\text{Hg}(\text{NO}_3)_2$  solution with a current of 2.00 A for 3 hours? [ $\text{Hg}(\text{NO}_3)_2 = 200.6 \text{ g mol}^{-1}$ ].

OR

A steady current of 2 amperes was passed through two electrolytic cells X and Y connected in series containing electrolytes  $\text{FeSO}_4$  and  $\text{ZnSO}_4$  until 2.8 g of Fe deposited at the cathode of cell X. How long did the current flow?

(Molar mass: Fe = 56 g  $\text{mol}^{-1}$ , Zn = 65.3 g  $\text{mol}^{-1}$ , 1F = 96500 C  $\text{mol}^{-1}$ )

# TERM-2 SAMPLE PAPER

## CHEMISTRY

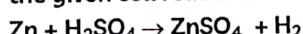
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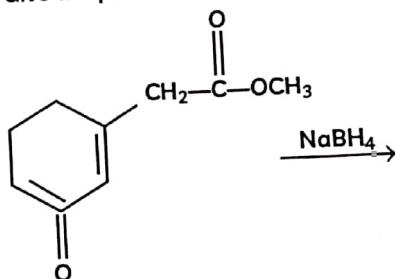


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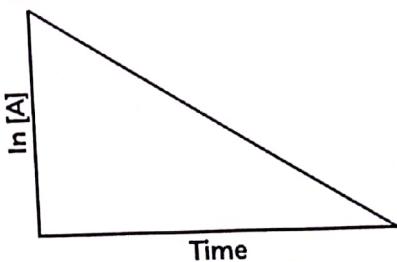
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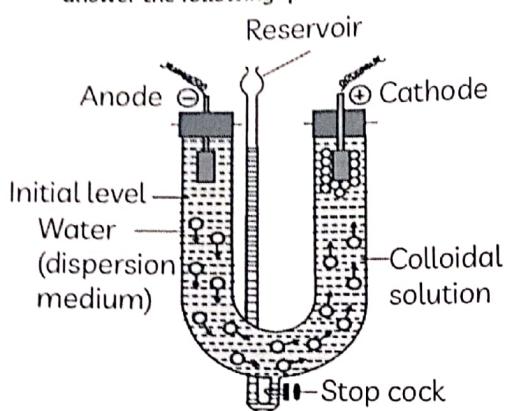


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Show that time required for 99% completion is twice the time required for the completion of 90% reaction.

- (B) A coordination compound has the formula  $\text{CoCl}_3 \cdot 4\text{NH}_3$ . It does not liberate ammonia but forms a precipitate with  $\text{AgNO}_3$ . Write the structure and IUPAC name of the complex compound.
- (C) State whether the following is a cationic or anionic complex  $[\text{Co}(\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2)_3]_2(\text{SO}_4)_3$

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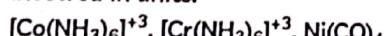
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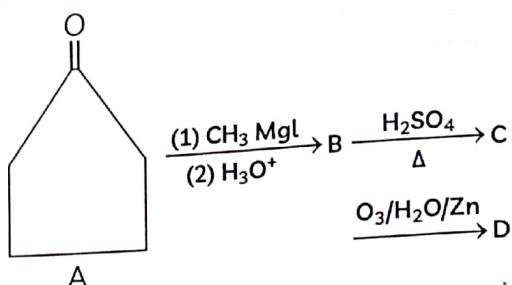
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10. Identify compounds B, C and D



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Give suitable chemical reactions for the following:

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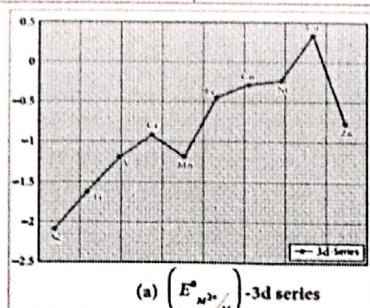
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- (A) What does the negative values for titanium, vanadium and chromium indicate?
- (B) What does reduction potential of  $\text{Mn}^{3+}/\text{Mn}^{2+}$  indicate about the stability of these oxidation states?
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## SECTION - C

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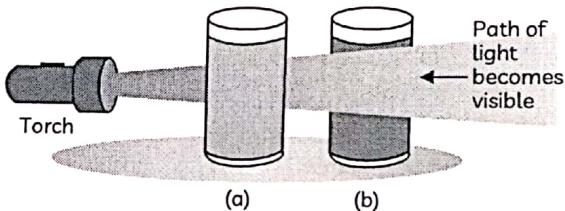
### SECTION - A

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1. (A) Hydrazones of aldehydes and ketones are not prepared in highly acidic medium.  
(B) Benzaldehyde gives a positive test with Tollens reagent but not with Fehlings solution. 2
2. Rate constant  $k$  for a first order reaction has been found to be  $2.54 \times 10^{-3} \text{ sec}^{-1}$ . Calculate its  $\frac{3}{4}$  th life. ( $\log 4 = 0.6020$ )  
OR

The rate constant for a reaction of zero order is  $A$  is  $0.0030 \text{ mol L}^{-1} \text{ s}^{-1}$ . How long will it take for the initial concentration of  $A$  to fall from  $0.10 \text{ M}$  to  $0.075 \text{ M}$ ? 2

3.



Observe the two solutions (a) and (b), solution (b) scatters light while solution (a) does not. What do you conclude about the nature of the two solutions? 2

### SECTION - B

(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)

4. Answer the following questions:
  - How may methyl bromide be preferentially converted to methyl isocyanide?
  - Arrange the following compounds in increasing order of solubility in water:  
 $C_6H_5NH_2$ ,  $(C_2H_5)_2NH$ ,  $C_2H_5NH_2$
  - Why is an alkylamine more basic than ammonia? 3
5. (A) On the basis of crystal field theory, write the electronic configuration for  $d^4$  ion if  $\Delta_0 < P$ .
6. Give reason for the following:
  - Sky appears blue
  - Colloidal medicines are more effective
  - Alum is used in purification of water

OR

Give factors governing colour of colloidal solutions. 3

7. Explain the following observations giving an appropriate reason for each:

- (A) The enthalpies of atomization of transition elements are quite high.
- (B) There occurs much more frequent metal-metal bonding in compounds of heavy transition metals (i.e.) 3<sup>rd</sup> series.
- (C) Mn<sup>2+</sup> is much more resistant than Fe<sup>2+</sup> towards oxidation.

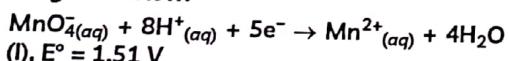
OR

Observe the table below:

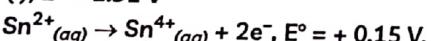
oxidation state	Sc	Ti	V	Cr	Mn	Fe	Cu	Ni	Zn
+1				d <sup>1</sup>	d <sup>5</sup>	d <sup>6</sup>	d <sup>7</sup>	d <sup>8</sup>	d <sup>10</sup>
+2		d <sup>2</sup>	d <sup>3</sup>	d <sup>4</sup>	d <sup>5</sup>	d <sup>6</sup>	d <sup>7</sup>	d <sup>8</sup>	d <sup>10</sup>
+3	d <sup>0</sup>	d <sup>1</sup>	d <sup>2</sup>	d <sup>3</sup>	d <sup>4</sup>	d <sup>5</sup>	d <sup>6</sup>		
+4		d <sup>0</sup>	d <sup>1</sup>		d <sup>3</sup>				
+5			d <sup>0</sup>						
+6				d <sup>0</sup>					
+7					d <sup>0</sup>				

- (A) How is the variability in oxidation states of transition metals different from that of the non transition metals? Illustrate with examples.
- (B) What may be the stable oxidation state of the transition element with the following d electron configurations in the ground state of their atoms: 3d<sup>3</sup>, 3d<sup>5</sup>, 3d<sup>8</sup> and 3d<sup>4</sup>?

8. Two half-reactions of an electrochemical cell are given below:



$$(I), E^\circ = 1.51 \text{ V}$$



Build a redox reaction equation from the two half-reactions and calculate the cell potential from the standard potentials also predict if the reaction is reactant or product favoured.

OR

Conductivity of 0.00250 M acetic acid is  $8.00 \times 10^{-5} \text{ S cm}^{-1}$ . Calculate its molar conductivity. If  $\Lambda_0$  for acetic acid is 300.0 S

## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

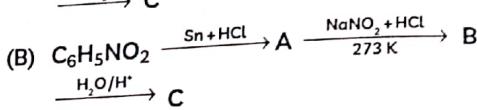
12. Read the passage given below and answer the questions that follow:

Functional groups related to the carbonyl group include the -CHO group of an aldehyde, the -CO- group of a ketone, the -CO<sub>2</sub>H group of a carboxylic acid, and the -CO<sub>2</sub>R group of an ester. The carbonyl group, a carbon-

cm<sup>2</sup> mol<sup>-1</sup>, what is its dissociation constant?

3

9. Give the structure of A, B and C in the following reactions:



OR

How will you convert the following:

(A) Nitrobenzene into aniline

(B) Ethanoic acid into methanamine

(C) Aniline into N-phenylethanamide

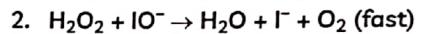
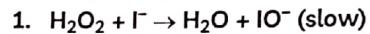
(Write the chemical equations involved)

3

10. For a reaction



The proposed mechanism is as given below:



(i) Write rate law for the reaction.

(ii) Write the overall order of reaction.

(iii) Out of steps (1) and (2), which one is rate-determining step?

3

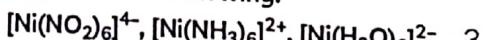
11. (A) Give one chemical test as evidence to show that [Co(NH<sub>3</sub>)<sub>5</sub>Cl] SO<sub>4</sub> and [Co(NH<sub>3</sub>)<sub>5</sub>(SO<sub>4</sub>)Cl] are ionisation isomers.

(B) [NiCl<sub>4</sub>]<sup>2-</sup> is paramagnetic while [Ni(CO)<sub>4</sub>] is diamagnetic, though both are tetrahedral. Why? (Atomic number of Ni = 28)

OR

(A) Draw figure to show the splitting of d orbitals in an octahedral crystal field.

(B) What will be the correct order for the wavelengths of absorption in the visible region for the following:



3

oxygen double bond, is the key structure in these classes of organic molecules: Aldehydes contain at least one hydrogen atom attached to the carbonyl carbon atom, ketones contain two carbon groups attached to the carbonyl carbon atom, carboxylic acids contain a hydroxyl group attached to the carbonyl

carbon atom, and esters contain an oxygen atom attached to another carbon group connected to the carbonyl carbon atom. All of these compounds contain oxidized carbon atoms relative to the carbon atom of an alcohol group.

Aldehydes and ketones are commonly used in nature in conjunction with other functional groups. They are mainly present in microorganisms or plants and substances such as cinnamaldehyde (cinnamon bark), vanillin (vanilla bean), Citra (lemongrass), helminthosporium (a fungal toxin), carvone (spearmint and caraway), camphor (camphor trees).

For the manufacture of acetic acid and pyridine derivatives, acetaldehyde is used to a great degree.

In perfumes, beauty products, and colourants, benzaldehyde is used. It is applied and often

used as a bee repellent to give almond flavour to food items.

Acetone is used in the kitchen as a nail polish remover and paint thinner.

It is used for chemical peeling and acne procedures in medicine.

- (A) Name two naturally occurring aldehydes with their sources.
- (B) How are ketones and aldehydes different?
- (C) Write one use each of benzaldehyde and propanone.
- (D) Explain the mechanism of a nucleophilic attack on the carbonyl group of an aldehyde or a ketone.

OR

Aldehydes are more reactive than ketones towards nucleophilic reagents.

5

Explain.

# TERM-2 SAMPLE PAPER

## CHEMISTRY

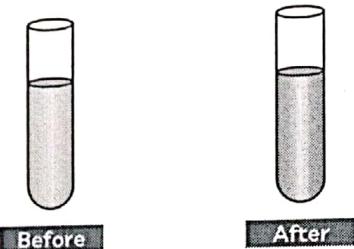
Maximum Marks: 35

Time Allowed: 2 Hours

### SECTION - A

(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)

1. Express the relation among cell constant, resistance of the solution in the cell and conductivity of the solution. How is molar conductivity of a solution related to its conductivity? 2
2. Study the change below after addition of Tollen's reagent to the test tube and report the kind of compound present in the test tube ? 2



3. Write short notes on the following - (any two)  
(A) Gabriel phthalimide synthesis  
(B) Hoffmann's bromamide degradation  
(C) Carbyl amine reaction 2

### SECTION - B

(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)

4. (A) Give simple tests to distinguish between the following pairs of compounds :  
(i) Pentan-2-one and Pentan-3-one  
(ii) Benzaldehyde and Acetophenone  
(B) There are two - NH<sub>2</sub> groups in semicarbazide. However, only one such group is involved in the formation of semicarbazones. Why? 3
5. A copper-silver cell is set up. The copper ion concentration in it is 0.10 M. The concentration of silver ion is not known. The

cell potential is measured 0.422 V. Determine the concentration of silver ion in the cell.

Given :  $E^\circ_{Ag^+/Ag} = + 0.80\text{ V}$ ,  $E^\circ_{Cu^{2+}/Cu} = + 0.34\text{ V}$ .  
OR

A current was passed for 5 hours through two electrolytic cells connected in series. The first cell contains AuCl<sub>3</sub> and second cell CuSO<sub>4</sub> solution. If 9.85 g of gold was deposited in the first cell, what amount of copper gets deposited in the second cell? Also calculate magnitude of current in ampere.

Given: Atomic mass of Au = 197 amu and Cu = 63.5 amu

3

6. Give reasons for the following :

- (A) pK<sub>b</sub> value for aniline is more than that for methylamine.
- (B) Ethylamine is soluble in water whereas aniline is not soluble in water.
- (C) Primary amines have higher boiling points than tertiary amines.

OR

Three test tubes labelled as A, B and C contain three types of amines i.e., primary, secondary and tertiary. Describe a method which can be used for the identification of the amines. Also write chemical equations of the reaction involved.

3

7. Show that in case of first order reaction, the time required for 99.9% completion is

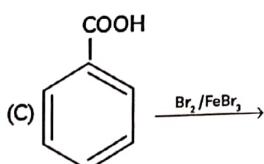
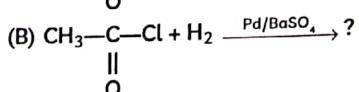
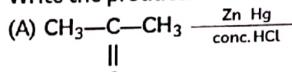
nearly ten times the time required for half completion of the reaction.

3

8. An organic compound with molecular formula C<sub>9</sub>H<sub>10</sub>O forms 2, 4, - DNP derivative, reduces Tollen's reagent and undergoes Cannizzaro's reaction. On vigorous oxidation it gives 1, 2-benzene-di- carboxylic acid. Identify the compound.

OR

Write the products of the following reactions:



3

Elements	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
$\Delta_1^{\circ}\text{H}^\circ \parallel$	1235	1309	1414	1592	1509	1561	1644	1752	1988	1734
$\Delta_1^{\circ}\text{H}^\circ \parallel\parallel$	2393	2657	2833	2990	3266	2962	3243	3462	3556	3829

Observe the table and give reasons for the following trends:

- (A) The second ionization enthalpy values of Cr and Cu are unusually high.
- (B) The second ionization enthalpy of Zn is comparatively low.
- (C) The third ionization enthalpy of Mn and Zn are unusually high.

3

10. Explain the following terms with help of one example of each:

- (A) Ambidentate ligands
- (B) Spectra chemical series
- (C) Heteroleptic complexes

3

11. (A) Describe the general trends in the following properties of the first series (3d) of the transition elements :

- (i) Number of oxidation states exhibited
- (ii) Formation of oxometal ions

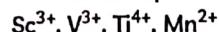
(B) The transition metals and many of their compounds act as good catalysts. Give reason.

OR

(A) Assign reasons for the following:

- (i) Copper(I) ion is not known to exist in aqueous solutions.
- (ii) Both O<sub>2</sub> and F<sub>2</sub> stabilize high oxidation states of transition metals but the ability of oxygen to do so exceeds that of fluorine.

(B) Which of the following cations are coloured in aqueous solutions and why?



(At. Nos. Sc = 21, V = 23, Ti = 22, Mn = 25)

3

## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

12. Read the passage given below and answer the questions that follow:

Colloids occupy an intermediate place between [particulate] suspensions and solutions, both in terms of their observable properties

and particle size. In a sense, they bridge the microscopic and the macroscopic. As such, they possess some of the properties of both, which makes colloidal matter highly adaptable to specific uses and functions. Colloid science is

central to biology, food science and numerous consumer products.

Colloidal dispersions appear to be homogeneous, and the colloidal particles they contain are small enough (generally between 1-1000 nm) to exhibit Brownian motion, cannot be separated by filtration, and do not readily settle out. But these dispersions are inherently unstable and under certain circumstances, most colloidal dispersions can be "broken" and will "flocculate" or settle out.

Particles composed of ionic or ionizable substances usually have surface charges due to adsorption of an ion (usually an anion) from the solution, or to selective loss of one kinds of ion from the crystal surface. For example,  $\text{Ag}^+$  ions on the surface of a silver iodide crystal go into solution more readily than the  $\text{Br}^-$  ions, leaving a negatively - charged surface.

Charged colloidal particles will attract an excess of oppositely - charged counter-ions to their vicinity from the bulk solution, forming

a localized "cloud" of compensating charge around each particle. The entire assembly is called an electric double layer. Electric double layers of one kind or another exist at all phase boundaries, but those associated with colloids are especially important.

- (A) What is the size of colloidal particles?
- (B) Name the property of colloidal solutions due to which their particles do not settle down.
- (C) What is the cause of charge on colloidal particles?
- (D) How is the electrical double layer formed in colloidal solutions? What is the other name given to the double layer?

OR

How is electrokinetic potential is produced between the two layers of charges? Write the term used for this potential.

5

# TERM-2 SAMPLE PAPER

## CHEMISTRY

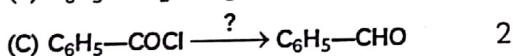
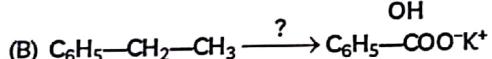
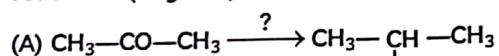
Maximum Marks: 35

Time Allowed: 2 Hours

### SECTION - A

(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)

1. Name the reagents used in the following reactions: (Any two)



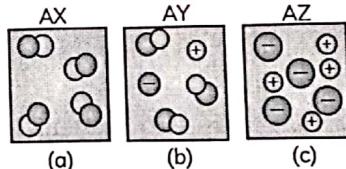
2. Give reason

(A) Boiling point of methyl amine is  $60^\circ\text{C}$  while that of trimethyl amine is  $30^\circ\text{C}$ .

State reason for this difference in boiling point.

- (B) Why does Aniline not react with dilNaOH? 2

3. Identify which of the following AX, AY or AZ indicates a strong, weak or a non electrolyte. 2



### SECTION - B

(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)

4. (A) Identify the Coordination complex which contain Cyanide as the ligand and Iron as the central metal atom. This complex is used to identify both  $\text{Cu}^{2+}$  and  $\text{Fe}^{3+}$  cation during salt analysis.  
(B) While  $\text{NH}_3$  is a strong ligand but  $\text{NH}_4^+$  is not. Explain.  
(C) Select bidentate of didentate ligand from the following? 3  
 $\text{CO, SCN}^-, \text{CH}_3\text{COO}^-, \text{C}_2\text{O}_4^{2-}$

5. Answer the following question:

- (A) Bleeding due to a small cut is stopped by applying alum.

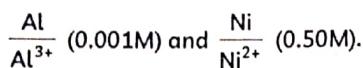
(B) You must have observed at sunset an orange colour develops in the sky. Why is it so?

(C) Why is Chemisorption called activated absorption? 3

6. (A) Name the cell that drives a nonspontaneous redox reaction through the application of electrical energy with the help of a suitable example  
(B) How much electricity in Faraday is required to produce  
(i) 80g of Ca from molten  $\text{CaCl}_2$ ?  
(ii) 54g of Al from molten  $\text{Al}_2\text{O}_3$ ?

OR

A voltaic cell is set up at 25°C with the following half cells:



Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential. 3

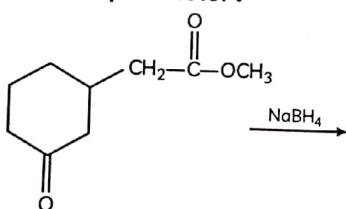
7. Account for the following -

- (A) Which metal in the first transition series (3d series) exhibits +1 oxidation state most frequently and why?  
(B) Which of the following cations are coloured in aqueous solutions and why?  
 $\text{SC}^{3+}$ ,  $\text{V}^{3+}$ ,  $\text{Ti}^{4+}$ ,  $\text{Mn}^{2+}$ .  
(At. nos. Sc = 21, V = 23, Ti = 22, Mn = 25)  
(C) The transition metals (with the exception of Zn, Cd and Hg) are hard and have high melting and boiling points. In Zn, Cd and Hg, all the electrons in d-subshell are paired. Hence, the metallic bonds present in them are weak

3

8. Answer the following questions-

- (A) Give the product for :

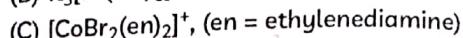
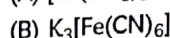
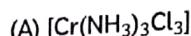


- (B) Which among the following will undergo Cannizaro reaction ?

Benzaldehyde , acetone , formaldehyde

- (C) Iodoform reaction is obtained when methyl ketones react with hypoiodite not with iodine. Why? 3

9. Write the IUPAC names of the following coordination compounds:



OR

(A) Write the formulae for the following coordination compounds:

(i) Tetraammineaquachloridocobalt (III) chloride

(ii) Potassium tetracyanonickelate (II)

(B) Write the hybridization of the complex  $[\text{NiCl}_4]^{2-}$ . (Atomic number of Ni = 28) 3

10. Write the structures of the main product when acetone ( $\text{CH}_3-\text{CO}-\text{CH}_3$ ) reacts with the following reagents.

(A)  $\text{Zn}-\text{Hg}/\text{Conc. HCl}$

(B)  $\text{H}_2\text{N}-\text{NHCONH}_2/\text{H}^+$

(C)  $\text{CH}_3\text{MgBr}$  and then  $\text{H}_3\text{O}^+$

OR

An organic compound (A) (molecular formula  $\text{C}_8\text{H}_{16}\text{O}_2$ ) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid also produced (B). On dehydration (C) gives but-1-ene. Write the equations for the reactions involved. 3

11. Write the chemical equations involved when aniline is treated with the following reagents:

(i)  $\text{Br}_2$  water

(ii)  $\text{CHCl}_3 + \text{KOH}$

(iii)  $\text{HCl}$

OR

Explain giving suitable reason:

(i) Aniline does not undergo Friedel-Crafts reaction.

(ii) p-methylaniline is more basic than p-nitroaniline.

(iii) Acetylation of  $-\text{NH}_2$  group is done in aniline before preparing its ortho and para compounds.

3

## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

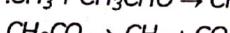
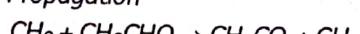
12. Read the passage given below and answer the questions that follow:

Reaction 1

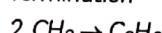
Initiation



Propagation



Termination



Reaction 2

Decomposition of acetaldehyde is an example of fractional order reaction because the order of the reaction is a fractional value.

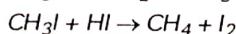
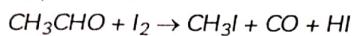
It can be a whole number or a fraction. It can be noted that when the order of reaction

is a fraction, the reaction is generally a chain reaction or follows some other complex mechanism. An example of a chemical reaction with a fractional reaction order is the pyrolysis of acetaldehyde.

The rate of decomposition of acetaldehyde into methane and CO in the presence of  $I_2$  at 800 K follows the rate law:

$$\text{Rate} = k[\text{CH}_3\text{CHO}][I_2]$$

The decomposition is believed to go by a two-step mechanism:



(A) Which of the two steps is a slower one?

(B) Explain why order cannot be determined by a balanced chemical equation.

(C) Give one example of fractional order reaction.

(D) A reaction is of first order in reactant A and of second order in reactant B. How is the rate of this reaction affected when -

(i) the concentration of B alone is increased to three times.

(ii) the concentrations of A as well as B are doubled?

OR

A reaction is of second order with respect to a reactant. How is the rate of reaction affected if the concentration of the reactant is reduced to half? What is the unit of rate constant for such a reaction? 5

# TERM-2 SAMPLE PAPER

## CHEMISTRY

Time Allowed: 2 Hours

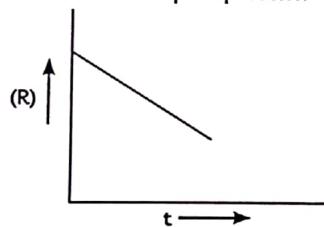
Maximum Marks: 35

### SECTION - A

(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)

1. Study the change of concentration of reactant with respect to time as depicted in the graphical representation below:

- (A) Predict the order of the reaction  
(B) What does the slope represent? 2



2. Arrange the following compounds in increasing order of their property as indicated. (Any two)

- (A)  $\text{CH}_3\text{COCH}_3$ ,  $\text{C}_6\text{H}_5\text{—CO—C}_6\text{H}_5$ ,  $\text{CH}_3\text{CHO}$   
(Reactivity towards nucleophilic addition reactions)

- (B)  $\text{Cl—CH}_2\text{—COOH}$ ,  $\text{Cl—CH}_2\text{—COOH}$ ,  
 $\text{CCl}_3\text{—COOH}$  (acidic character)

- (C)  $\text{C}_2\text{H}_5\text{OH}$ ,  $\text{CH}_3\text{CHO}$ ,  $\text{CH}_3\text{COOH}$  (Boiling points) 2

3. Answer the following questions.

- (A) What feature of their structure makes aldehydes easier to oxidize than Ketones?

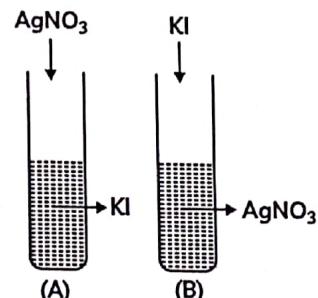
- (B) How does the carbon-to-oxygen bond of aldehydes and ketones differ from the carbon-to-carbon bond of alkenes? 2

### SECTION - B

(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)

4. Draw diagram to show splitting of d – orbital in octahedral crystal field. Explain the two patterns of filling  $d^4$  in octahedral crystal Field. 3

5. A colloidal solution of  $\text{AgI}$  is prepared by two methods.



- (A) What is the charge on AgI colloidal method.  
 (B) Give the reason for origin of change.  
 (C) What is zeta potential? 3
6. A first order reaction takes 10 minutes for 25% decomposition. Calculate  $t_{1/2}$  for the reaction. (Given:  $\log 2 = 0.3010$ ,  $\log 3 = 0.4771$ ,  $\log 4 = 0.6021$ ).

OR

Consider the reaction

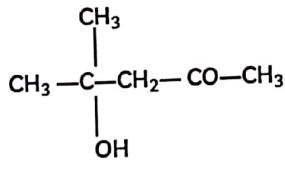


Following results were obtained in experiments designed to study the rate of reaction:

Exp. No	Initial concentration ( $\text{mol L}^{-1}$ )		Initial rate of formation [D] ( $\text{M/Min}$ )
	[A]	[B]	
1	0.10	0.10	$1.5 \times 10^{-3}$
2	0.20	0.20	$3.0 \times 10^{-3}$
3	0.20	0.40	$6.0 \times 10^{-3}$

- (A) Write the rate law for the reaction.  
 (B) Calculate the value of rate constant for the reaction. 3

7. (A) Describe the mechanism of the addition of Grignard reagent to the carbonyl group of compound to form an adduct which on hydrolysis yields an alcohol.  
 (B) Write the IUPAC name of the compound.



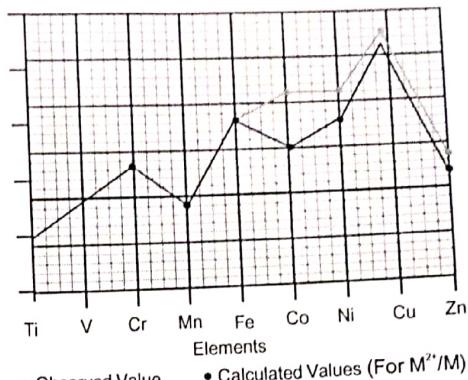
OR

- (A) Illustrate the following name reactions:  
 (i) Hell-Volhard-Zelinsky reaction.  
 (ii) Wolff-Kishner reduction reaction  
 (B) Write the structural formula of 1-phenylpentan-1-one. 3

8. State Reasons:

- (A) Aniline is a weaker base than cyclohexylamine.  
 (B) It is difficult to prepare pure amines by ammonolysis of alkyl halides.  
 (C) Electrophilic substitution in aromatic amines takes place more readily than benzene. 3

9. Observe the graph and answer the questions that follow:



- (A) Which transition metal of 3d series has positive  $E^\circ(M^{2+}/M)$  value and why?  
 (B)  $E^\circ$  value for the  $\text{Mn}^{3+}/\text{Mn}^{2+}$  couple is positive (+1.5 V) whereas that of  $\text{Cr}^{+3}/\text{Cr}^{+2}$  is negative (-0.4 V). Why?  
 (C)  $E^\circ$  values are not regular for first row transition elements? 3

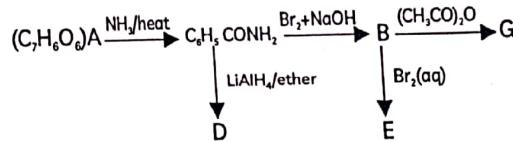
10. What is the lanthanoid contraction? What are its causes and consequences?

OR

Explain the following:

- (A) Copper (I) ion is not stable in an aqueous solution.  
 (B) Generally there is an increase in density of elements from titanium ( $Z = 22$ ) to copper ( $Z = 29$ ) in the first series of transition elements.  
 (C) Transition metals in general act as good catalysts. 3

11. An aromatic compound 'A' of molecular formula  $\text{C}_7\text{H}_6\text{O}_2$  undergoes a series of reactions as shown below. Write the structures of A, B, C, D and E in the following reactions.



OR

How will you convert the following -

- (A) Aniline to chlorobenzene  
 (B) Ethanoic acid to methanamine  
 (C) Methyl chloride to ethanamine 3

## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

12. Read the passage given below and answer the questions that follow:

The potential of each electrode is known as electrode potential. Standard electrode potential is the potential when concentration of each species taking part in electrocde reaction is unity and the reaction is taking place at 298 K. By convention, the standard electrode potential of hydrogen (SHE) is 0.0 V. The electrode potential value for each electrode process is a measure of relative tendency of the active species in the process to remain in the oxidised/reduced form. The negative electrode potential means that the redox couple is stronger reducing agent than  $H^+/H_2$  couple. A positive electrode potential means that the redox couple is a weaker reducing agent than the  $H^+/H_2$  couple. Metals

which have higher positive value of standard reduction potential form the oxides of greater thermal stability.

- (A) What is meant by reference electrode?  
(B) Platinum is used in the standard hydrogen electrode. Give reason.  
(C) Explain the term Standard electrode potential.  
(D) Calculate the emf of the following cell at 298 K:  $Fe(s) \mid Fe^{2+} (0.001 M) \parallel H^+ (1M) \mid H_2(g) (1\ bar), Pt_{(s)}$  (Given  $E^\circ_{cell} = +0.44V$ )

OR

Calculate the potential of hydrogen electrode in contact with a solution whose pH is 10.

5

# **TERM-2 SAMPLE PAPER**

## **CHEMISTRY**

*Time Allowed: 2 Hours*

*Maximum Marks: 35*

### **SECTION - A**

*(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)*

1. What is meant by the following terms?  
(i) Cyanohydrin  
(ii) Acetal 2
2. Arrange the following as instructed:  
(Any two)  
(A) In an increasing order of basic strength  
 $\text{CH}_6\text{H}_5\text{NH}_2$ ,  $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$   $(\text{C}_2\text{H}_6)_2\text{NH}$  and  
 $\text{CH}_3\text{NH}_2$ .
3. What is meant by rate of a reaction?  
Differentiate between average rate and  
instantaneous rate of a reaction. 2

### **SECTION - B**

*(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)*

4. Write the IUPAC names of the following coordination compounds:  
(i)  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$   
(ii)  $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$   
(iii)  $\text{K}_3[\text{Fe}(\text{CN})_6]$   
**OR**  
Explain different types of ligands with one example of each. 3
  5. The conductivity of  $0.001 \text{ mol L}^{-1}$  solution of  $\text{CH}_3\text{COOH}$  is  $3.905 \times 10^{-5} \text{ S cm}^{-1}$ . Calculate its molar conductivity and degree of dissociation ( $\alpha$ ).  
Given:  $\lambda^0(\text{H}^+) = 349.6 \text{ S cm}^2 \text{ mol}^{-1}$  and  $\lambda^0(\text{CH}_3\text{COO}^-) = 40.9 \text{ S cm}^2 \text{ mol}^{-1}$  3
  6. A first order gas phase reaction :  $\text{A}_2\text{B}_{2(g)} \rightarrow 2\text{A}_{(g)} + 2\text{B}_{(g)}$  at the temperature  $400^\circ\text{C}$
- has the rate constant  $k = 2.0 \times 10^{-4} \text{ sec}^{-1}$ . What percentage of  $\text{A}_2\text{B}_2$  is decomposed on heating for 900 seconds? (Antilog 0.0781 = 1.197).
- OR**
- The thermal decomposition of  $\text{HCO}_2\text{H}$  is a first order reaction with a rate constant of  $2.4 \times 10^{-3} \text{ s}^{-1}$  at a certain temperature. Calculate how long will it take for three-fourths of initial quantity of  $\text{HCOOH}$  to decompose. ( $\log 0.25 = -0.6021$ ) 3
7. (A) Write the electronic configuration of  $\text{Ce}^{3+}$  ion, and calculate the magnetic moment on the basis of 'spin-only' formula. [Atomic No. of Ce = 58]  
(B) Account for the following:

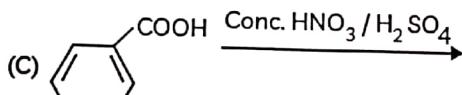
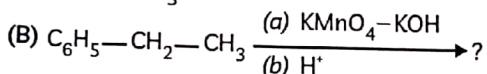
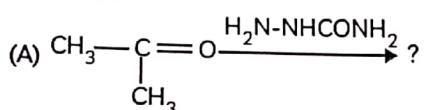
- (i) The enthalpies of atomisation of the transition metals are high.  
(ii) The lowest oxide of a transition metal is basic, the highest is amphoteric/ acidic. 3

8. (A) Arrange the following complex ions in increasing order of crystal field splitting energy ( $\Delta_o$ ):  
 $[\text{Cr}(\text{Cl})_6]^{3-}$ ,  $[\text{Cr}(\text{CN})_6]^{3-}$ ,  $[\text{Cr}(\text{NH}_3)_6]^{3+}$ .

(B) Why do compounds having similar geometry have different magnetic moments?

(C) Name the type of isomerism when ambidentate ligands are attached to a central metal ion. Give one example this isomerism. 3

9. Predict the products in the following reactions:



OR

Two moles of compound (A) on treatment with a strong base gives two compounds (B) and (C). The compound (B) on dehydrogenation with Cu gives (A) while

acidification of (C) gives carboxylic acid (D) having molecular formula  $\text{CH}_2\text{O}_2$ . Identify (A) to (D). 3

10. How would you account for the following:

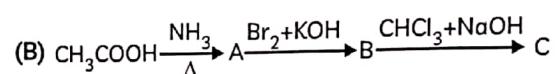
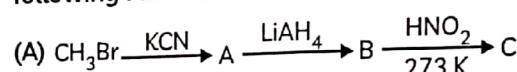
(A) Electrophilic substitution in case of aromatic amines takes place more readily than benzene.

(B) Ethanamide is a weaker base than ethanamine.

(C) It is difficult to prepare pure amines by ammonolysis of alkyl halides. 3

OR

Give the structures of A, B and C in the following reactions:



11. Answer the following questions –

(A) Benzaldehyde can be obtained from benzal chloride. Write reactions for obtaining benzal chloride and then benzaldehyde from it.

(B) Name the electrophile produced in the reaction of benzene with benzoyl chloride in the presence of anhydrous  $\text{AlCl}_3$ . Name the reaction also.

(C) Give the structure of the following compound -

4-Nitro Propiophenone 3

## SECTION - C

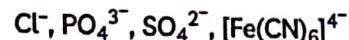
(Section C-Question No 12 is case-based question carrying 5 marks.)

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

*Hardy Schulze rule states that the precipitating effect of an ion on dispersed phase of opposite charge increases with the valency of the ion. The higher the valency of the flocculating ion, the greater is its precipitating power. Thus, for the precipitation of  $\text{As}_2\text{S}_3$  sol (-ve sol) the precipitating power of  $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$  and  $\text{Na}^+$  ion is of the order  $\text{Al}^{3+} > \text{Na}^{2+} > \text{Na}^+$ . Similarly, for precipitating  $\text{Fe(OH)}_3$  sol (+ ve sol) the precipitating power of  $[\text{Fe}(\text{CN})_6]^{3-}, \text{SO}_4^{2-}$  and  $\text{Cl}^-$  is of the order,  $[\text{Fe}(\text{CN})_6]^{3-} > \text{SO}_4^{2-} > \text{Cl}^-$ . The minimum concentration of an electrolyte in million per litre required to cause precipitation of a sol in 2 hours is called flocculation value.*

The smaller the flocculation value, the higher will be the coagulating power of the ion. The minimum mass of the protective colloid (lyophilic colloid) in milligrams that must be added to 10 ml. of a standard red gold sol so that no coagulation occurs when 1 ml. of 10%  $\text{NaCl}$  solution is rapidly added to it is called the gold number of the protective colloid.

(A) Arrange the following ions in the increasing order of their flocculation value:



(B) What is gold number?

(C) State Hardy Schulze rule.

(D) (i) Out of  $\text{AlCl}_3$  and  $\text{KCl}$ , which is more

effective in causing coagulation of a negative sol and why?

- (ii) What happens when an electrolyte is added to a hydrated ferric oxide sol in water and why?

OR

Explain the following:

- (i) Deltas are formed when river and sea water meet.
- (ii) Artificial rain is caused by spraying salt over clouds. 5

# **TERM-2 SAMPLE PAPER**

## **CHEMISTRY**

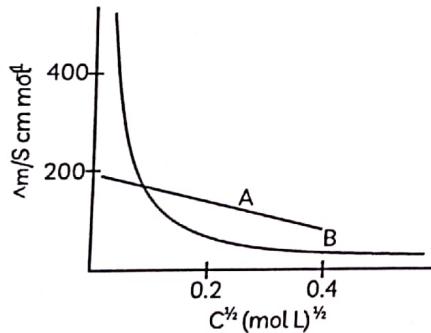
*Time Allowed: 2 Hours*

*Maximum Marks: 35*

### **SECTION - A**

*(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)*

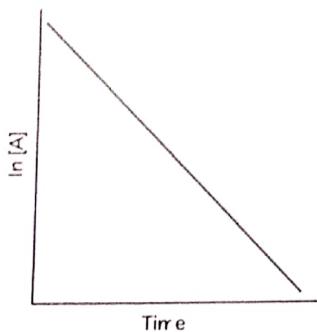
- 1.** Explain what is observed:  
(A) When a beam of light is passed through a colloidal solution.  
(B) Electric current is passed through solution. 2
- 2.** Observe the above graph and explain the variation of conductivity with concentration for strong and weak electrolyte. 2
- 3.** Carry out the following conversions: (Any two)  
(A) Methyl chloride to Acetic acid  
(B) Benzene to benzoic acid  
(C) Ethanol to Acetone. 2



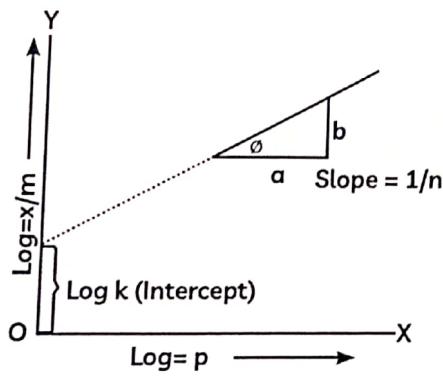
### **SECTION - B**

*(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)*

- 4.** (A) Calculate the rate of the reaction for the rate law  $-d[A]/dt = K [A].[B]^2$ , when the concentration of A and B are 0.1 M and 0.02 M respectively and  $K = 5.1 \times 10^{-3} \text{ L}^2 \text{ s}^{-1} \text{ mol}^{-2}$ .  
  
(B) What is the order of the reaction for the graph given below, What does the slope depict for a graph between  $\ln [A]$  and time. 3



5. (A) Differentiate between physical and Chemical Adsorption.  
 (B) What does the following graph depict about adsorption.



OR

Give reason for the following:

- (A) Finely divided substances are more effective as adsorbents.  
 (B) Lyophilic colloids are also called reversible sols.  
 (C) AgI sol, formed after  $\text{AgNO}_3$  reacts with  $\text{KI}$ , is negatively charged. 3

6. (A) Give any two differences between double salts and complexes?  
 (B) Explain how  $[\text{FeF}_6]^{3-}$  is paramagnetic outer orbital complex. 3

7. (A) What is the role of pyridine in the acylation reaction of amines?  
 (B) Why is  $\text{NH}_2$  group of aniline acetylated before carrying out nitration? Explain with the help of reactions.

OR

Predict the product for the reaction of:

- (A) Aniline with bromine in non-polar solvent such as  $\text{CS}_2$ .  
 (B)  $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$  reacts with  $\text{HNO}_2$   
 (C) Reduction of nitriles with  $\text{LiAlH}_4$  3

8. (A) Decide giving reason which one of the following pairs exhibits the property indicated:  
 (i)  $\text{Sc}^{3+}$  or  $\text{Cr}^{3+}$  (exhibits paramagnetism)

- (ii)  $\text{V}$  or  $\text{Mn}$  (exhibits more number of oxidation states)  
 (iii)  $\text{V}^{4+}$  or  $\text{V}^{5+}$  (exhibits colour) 3

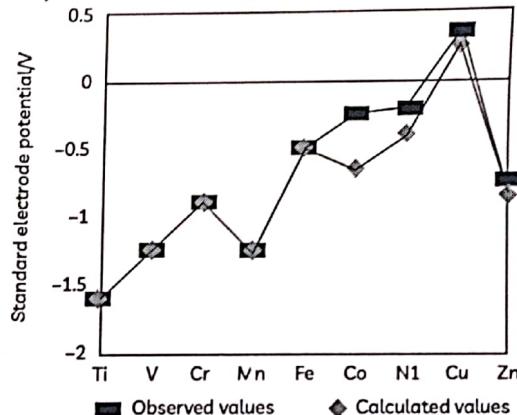
9. Account for the following observations:  
 (A)  $pK_b$  value for aniline is more than that for methylamine.  
 (B) Methylamine in water reacts with ferric chloride to precipitate ferric hydroxide  
 (C) Aniline does not undergo Friedel-Craft's reaction. 3

10. Give reasons for the following:

- (A) Transition elements act as catalysts  
 (B) It is difficult to obtain oxidation state greater than two for Copper.  
 (C)  $\text{CrO}$  is basic but  $\text{Cr}_2\text{O}_3$  is amphoteric.

OR

Observed and calculated values for the standard electrode potentials of elements from Ti to Zn in the first reactivity series are depicted in following figure:



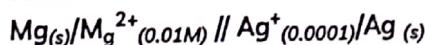
Explain the following observations:

- (A) The general trend towards less negative  $E^\circ$  values across the series  
 (B) The unique behaviour of Copper  
 (C) More negative  $E^\circ$  values of Mn and Zn 3

11. A 0.25 M KOH solution offered a resistance of 31.6 ohms in a conductivity cell at 298 K. If the cell constant of the conductivity cell is  $0.367\text{cm}^{-1}$ , find out the specific and molar conductance of the potassium hydroxide solution.

OR

Calculate emf and  $\Delta G$  for the following reaction at 298 K:



$$\text{Given } E^\circ (\text{Mg}^{2+}/\text{Mg}) = -2.37 \text{ V};$$

$$E^\circ (\text{Ag}^+/\text{Ag}) = +0.80 \text{ V}$$

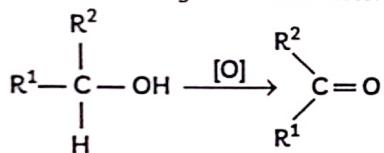
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## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

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

Oxidation of alcohols to aldehydes is partial oxidation; aldehydes are further oxidized to carboxylic acids. Conditions required for making aldehydes are heat and distillation. In aldehyde formation, the temperature of the reaction should be kept above the boiling point of the aldehyde and below the boiling point of the alcohol. Reagents useful for the transformation of primary alcohols to aldehydes are normally also suitable for the oxidation of secondary alcohols to ketones.



$[\text{O}]$  = chromium-based reagent, activated DMSO, hypervalent iodide compound, TPAP or TEMPO

$\text{R}^1$  = alkyl or aryl substituent

$\text{R}^2$  = hydrogen, alkyl or aryl substituent

- (A) Name the reagent which can be used to oxidise an alcohol to a ketone.  
(B) Write the aldehyde and the ketone formed by the oxidation of propan-1-ol and propan-2-ol respectively.  
(C) Propanal can be oxidized easily than propanone. Give reason.  
(D) Give simple chemical tests to distinguish between the following pairs of compounds.

- (i) Propanal and Propanone  
(ii) Ethanal and Propanal

OR

How will you prepare the following compounds starting with benzene:

- (i) Benzaldehyde  
(ii) Acetophenone

5

# TERM-2 SAMPLE PAPER

## CHEMISTRY

Time Allowed: 2 Hours

Maximum Marks: 35

### SECTION - A

(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)

1. Calculate  $\lambda_m^0$  for acetic acid -

Given that  $\lambda_m^0(\text{HCl}) = 426 \text{ S cm}^2 \text{ mol}^{-1}$

$\lambda_m^0(\text{NaCl}) = 126 \text{ S cm}^2 \text{ mol}^{-1}$

$\lambda_m^0(\text{CH}_3\text{COONa}) = 91 \text{ S cm}^2 \text{ mol}^{-1}$

2

(B) Rate law

(C) Elementary reaction

2

2. Define the following terms - (Any two)

(A) Order of a reaction

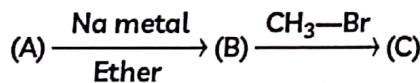
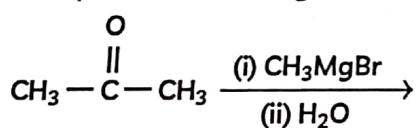
3. What products will be formed on reaction of propanal with 2-methyl propanal in the presence of NaOH? Write the name of the reaction also.

2

### SECTION - B

(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)

4. Complete the following reaction sequence:

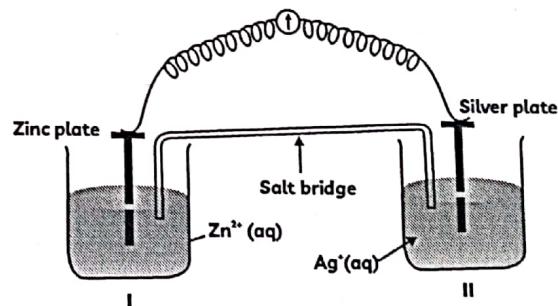


OR

Compound 'A' was prepared by oxidation of compound 'B' with alkaline KMnO<sub>4</sub>. Compound 'A' on reduction with lithium aluminium hydride gets converted back to compound 'B'. When compound 'A' is heated with compound 'B' in the presence of H<sub>2</sub>SO<sub>4</sub> it produces fruity smell of compound 'C' to which family the compounds 'A', 'B' and 'C' belong to?

3

5. Observe the diagram given below and answer the questions that follow:



- (A) Redraw the diagram to show the direction of flow of current.  
(B) Write the reactions taking place at anode and cathode.  
(C) Construct the Nernst equation for the given Electro chemical cell.

3

6. For the reaction:  $2A + B \rightarrow A_2B$  the rate =  $k[A]^2$  with  $k = 2.0 \times 10^{-6} \text{ mol}^{-2} \text{ L}^2 \text{ s}^{-1}$ . Calculate the initial rate of the reaction when  $[A] = 0.1 \text{ mol L}^{-1}$ ,  $[B] = 0.2 \text{ mol L}^{-1}$ . Calculate the rate of reaction after  $[A]$  is reduced to 0.06 mol  $\text{L}^{-1}$ .

OR

The decomposition of  $\text{NH}_3$  on platinum surface is zero order. What are the rates of production of  $\text{N}_2$  and  $\text{H}_2$  if  $k = 2.5 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$ ?

7. What happens when: 3

- (A) A colloidal solution undergoes persistent dialysis.  
 (B) River water meets sea water.  
 (C) Alum is applied on cuts during bleeding

OR

Answer the following questions:

- (A) Why is it important to have clean surface in surface studies?  
 (B) Why is chemisorption referred to as activated adsorption?  
 (C) What type of solutions are formed on dissolving different concentrations of soap in water? 3

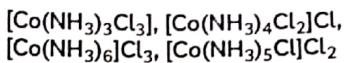
8. (A) Out of the following elements, identify the element which does not exhibit a variable oxidation state?

Chromium (Cr), Cobalt (Co), Zinc (Zn)

- (B) Calculate the magnetic moment of  $\text{Cu}^{2+}$  ( $Z = 29$ ) on the basis of "spin-only" formula.

- (C) Out of Fe and Cu, which one would exhibit higher melting point? 3

9. (A) Arrange the following complexes in the increasing order of conductivity of their solution:



- (B) On the basis of crystal field theory explain why Co (III) forms paramagnetic octahedral complex with weak field ligands whereas it forms diamagnetic octahedral complex with strong field ligands. 3

10. Using crystal field theory, draw energy level diagram and write electronic configuration of the central metal ion of  $[\text{Co}(\text{H}_2\text{O})]^{2+}$ :

OR

Using valence bond theory, explain the following in relation to the complex  $[\text{Mn}(\text{CN})_6]^{3-}$ :

- (i) Type of hybridisation.  
 (ii) Inner or outer orbital complex.  
 (iii) Magnetic behaviour. 3

11. (A) Alkenes ( $>\text{C}=\text{C}<$ ) and carbonyl compounds ( $>\text{C}=\text{O}$ ), both contain a  $\pi$  bond but alkenes show electrophilic addition reactions whereas carbonyl compounds show nucleophilic addition reactions. Explain.

- (B) Why is there a large difference in the boiling points of butanal and butan-1-ol? 3

## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

12. Read the following passage and answer the questions that follow - 5

Amines are classified as primary, secondary and tertiary amines. Primary amines cannot be obtained by ammonolysis of alkyl halide because we will get mixture of  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  amines. Cyanides, on reduction give primary amines where as isocyanides on reduction give secondary amines. Nitro compounds, on reduction also give primary amines. Primary amines react with  $\text{CHCl}_3$  and  $\text{KOH}$  to form foul smelling isocyanide. They react with  $\text{HNO}_2$  and liberate  $\text{N}_2$  gas. They react with Hinsberg's reagent to form salt soluble in  $\text{KOH}$ . Secondary amine form yellow oily compounds with  $\text{HNO}_2$  and salt formed with  $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$  is insoluble in  $\text{KOH}$ .  $3^\circ$  amines form salt soluble in water with  $\text{HNO}_2$  but does not react with  $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ .

- (A) Name two reducing agents which can be used to prepare primary amines from nitro compounds.

- (B) Write the isomer of  $\text{C}_3\text{H}_9\text{N}$  which does not react with Hinsberg's reagent.

- (C) Primary amines cannot be prepared by ammonolysis of alkyl halides. Give reason.

- (D) Write structures along with the IUPAC names:

- (i) the amide which gives propanamine by Hoffmann bromamide reaction.  
 (ii) the amine produced by the Hoffmann degradation of benzamide.

OR

- (i) What is the product when  $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$  reacts with  $\text{HNO}_2$ ?

- (ii) Why does ethanol have higher boiling point than ethanamine?

# **TERM-2 SAMPLE PAPER**

## **CHEMISTRY**

*Time Allowed: 2 Hours*

*Maximum Marks: 35*

### **SECTION - A**

*(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)*

- 1.** Define the following terms – (Any two):  
(A) Molar conductivity  
(B) Inert electrolyte in salt bridge  
(C) Cell constant 2
- 2.** Aldol condensation of a ketone in the presence of a dilute alkali gives 4-Hydroxy – 4 – methyl pentan – 2 – one. Write the structure of the ketone and its IUPAC name. 2
- 3.** Give reasons for the following:  
(A) Iodoform is obtained when methyl ketones react with hypoiodite but not with iodide.  
(B) Hydrazones of aldehydes and ketones are not prepared in highly acidic medium. 2

### **SECTION - B**

*(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)*

- 4.** Write the products formed when ethanal reacts with the following reagents:  
(i)  $\text{CH}_3\text{MgBr}$  and then  $\text{H}_3\text{O}^+$   
(ii) Zn-Hg/conc. HCl  
(iii)  $\text{C}_6\text{H}_5\text{CHO}$  in the presence of dilute NaOH  
**OR**  
Write the chemical equations to illustrate each of the following name reactions:  
(i) Rosenmund reduction  
(ii) Cannizzaro reaction  
(iii) Hell-Volhard-Zelinsky reaction 3
- 5.** Answer the following questions –  
(A) Why is the third ionisation energy of Manganese ( $Z = 25$ ) is unexpectedly high?  
(B) Silver (Ag) has completely filled d-orbitals ( $4d^{10}$ ) in its ground state. How can you say that it is a transition element?  
(C) Mention the name of the element among lanthanoids known to exhibit a +4 oxidation state. 3
- 6.** For the first-row transition metals the enthalpy of atomisation values are:

	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
$\Delta_a H^\circ/\text{KJ mol}^{-1}$	326	473	515	397	281	416	425	430	339	26

Assign reason for the following:

- Transition elements have higher values of enthalpies of atomisation.
- The enthalpy of atomisation of zinc is the lowest in 3d-series.
- Transition metals have high melting points.

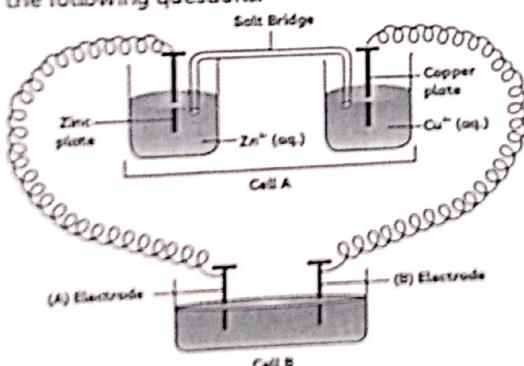
OR

Answer the following questions:

- Explain briefly how +2 state becomes more and more stable in the first half of the first row transition elements with increasing atomic number?
- In what way is the electronic configuration of the transition elements different from that of the non-transition elements? 3

- (a) A chelating agent has two or more than two donor atoms to bind to a single metal ion. Give one example of such type of ligand. Write its structure also.  
 (B) What kind of isomerism exists between  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  (violet) and  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{H}_2\text{O}$  (greyish-green)?  
 (C) Why are low spin tetrahedral complexes not formed? 3

- Consider the following figure and answer the following questions.



- Cell 'A' has  $E_{\text{cell}} = 2 \text{ V}$  and cell 'B' has  $E_{\text{cell}} = 1.1 \text{ V}$  which of the two cells 'A' or 'B' will act as an electrolytic cell. Which electrode reactions will occur in this cell?  
 (B) If cell 'A' has  $E_{\text{cell}} = 0.5 \text{ V}$  and cell 'B' has  $E_{\text{cell}} = 1.1 \text{ V}$ , what will be the reactions at anode and cathode?

## SECTION - C

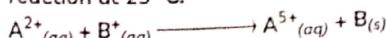
(Section C-Question No 12 is case-based question carrying 5 marks.)

- Read the passage given below and answer the following questions:

Number of molecules which must collide simultaneously to give product is called molecularity. It is equal to sum of coefficient

OR

Calculate  $E^{\circ}_{\text{cell}}$  and  $\Delta_r G^{\circ}$  for the following reaction at 25 °C:



Given  $K_c = 10^{10}$ ,  $1F = 96500 \text{ C mol}^{-1}$

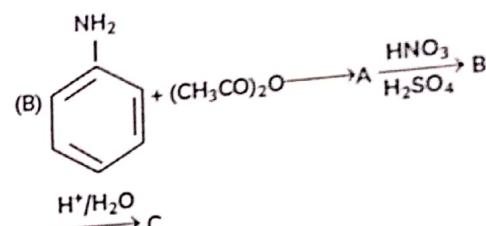
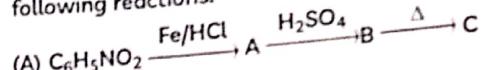
3

- (A) Why is  $\text{Fe(OH)}_3$  colloid positively charged, when prepared by adding  $\text{FeCl}_3$  to hot water?

(B) On the basis of Hardy-Schulze rule, explain why the coagulating power of phosphate is higher than chloride?

(C) Why does leather get hardened after tanning? 3

- Identify the missing reagent/product in the following reactions:



OR

An organic compound A ( $\text{C}_2\text{H}_3\text{N}$ ) is used as a solvent of choice for many organic reactions because it is not reactive in mild acidic and basic conditions. Compound A on treatment with  $\text{Ni}/\text{H}_2$  forms B. When B is treated with nitrous acid at 273 K, ethanol is obtained. When B is warmed with chloroform and  $\text{NaOH}$ , a foul-smelling compound C formed. Identify A, B and C. Write all the chemical reactions involved. 3

- Account for the following -

- Aniline cannot be prepared by Gabriel phthalimide synthesis.
- The C-N-C bond angle in trimethyl amine is  $108^\circ$ .
- The  $\text{pK}_b$  value of benzeneamine is 9.33 while that of ammonia is 4.75. 3

of reactants present in stoichiometric chemical equation.

For reaction,  $m_1\text{A} + m_2\text{B} \rightarrow \text{product}$

$$\text{Molecularity} = [m_1 + m_2]$$

In complex reaction each step has its own molecularity which is equal to the sum of coefficients of reactants present in a particular step. Molecularity is a theoretical property. Its value is any whole number. Number of concentration terms on which rate of reaction depends is called order of reaction or sum of powers of concentration terms present in the rate equation is called order of reaction.

If rate equation of reaction is:

$$\text{Rate} = k \times C_A^{m_1} \cdot C_B^{m_2}$$

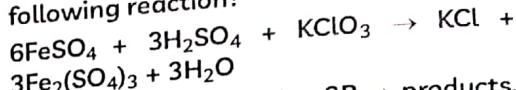
Then order of reaction =  $m_1 + m_2$

In simple reaction, order and molecularity are same.

In complex reaction, order of slowest step is the order of over all reaction. This step is known as rate determining step. Order is an experimental property. Its value may be zero, fractional or negative.

(A) Write two differences between order and molecularity of a reaction?

(B) What will be the molecularity of the following reaction?



(C) The rate of reaction,  $\text{A} + 2\text{B} \rightarrow \text{products}$ , is given by  $-\frac{d[\text{A}]}{dt} = k[\text{A}] [\text{B}]^2$ . If B is present in large excess, what will be the order of the reaction?

(D) The rate of a certain reaction is given by, rate =  $k [\text{H}^+]^n$ . The rate increases 100 times when the pH changes from 3 to 1. What will be the order (n) of the reaction?

OR

In a chemical reaction  $\text{A} + 2\text{B} \rightarrow \text{products}$ , when concentration of A is doubled, rate of the reaction becomes 4 times and concentration of B alone is doubled rate continues to be the same. What will be the order of the reaction? 5

# TERM-2 SAMPLE PAPER

## CHEMISTRY

Time Allowed: 2 Hours

Maximum Marks: 35

### SECTION - A

(Section A-Question No 1 to 3 are very short answer questions carrying 2 marks each.)

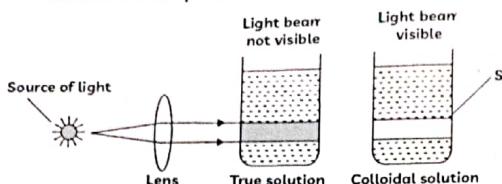
1. Arrange the following compounds in increasing order of their property as indicated – (Any two)  
(A)  $\text{CH}_3\text{CHO}$ ,  $\text{C}_6\text{H}_5\text{CHO}$ ,  $\text{HCHO}$  (reactivity towards nucleophilic addition reaction).  
(B) 2,4-dinitrobenzoic acid, 4-methoxybenzoic acid, 4 nitrobenzoic acid (acidic character).  
(C)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ ,  $\text{CH}_3\text{OCH}_2\text{CH}_3$ ,  $\text{CH}_3\text{CH}_2\text{CHO}$ ,  $\text{CH}_3\text{COCH}_3$ ,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  (boiling point) 2
2. Why do amines act as nucleophiles? Give example of a reaction in which methylamine acts as a nucleophile. 2
3. (A) In the expression of rate of reaction in terms of reactants, what is the significance of negative sign?  
(B) What is the use of integrated rate equation? 2

### SECTION - B

(Section B-Question No 4 to 11 are short answer questions carrying 3 marks each.)

4. (A) What may be the stable oxidation state of the transition element with the following  $d$  electron configurations in the ground state of their atoms:  $3d^3$  and  $3d^4$ ?  
(B) What are interstitial compounds? Why are such compounds well known for transition metals? 3
  5. When liquid 'A' is treated with a freshly prepared ammoniacal silver nitrate solution, it gives bright silver mirror. The liquid forms a white crystalline solid on treatment with sodium hydrogen sulphite. Liquid 'B' also forms a white crystalline solid with sodium hydrogen sulphite but it does not give test with ammoniacal silver nitrate. Which of the two liquids is aldehyde? Write the chemical equations of these reactions also.
- OR
- Complete the following equation and write the structures of A, B, C, D, E, and F.
- $$\begin{array}{c} \text{P/Br}_2 \xrightarrow{\hspace{2cm}} \text{CH}_3\text{CH}_2\text{CH}_2\text{Br} \xrightarrow{\substack{\text{alc.KOH} \\ \text{Br}_2/\text{CCl}_4}} \text{B} \\ \xrightarrow{\hspace{2cm}} \text{C} \\ \text{F} \leftarrow \xrightleftharpoons[\substack{\text{dil.H}_2\text{SO}_4 \\ \text{NaNH}_2}]{\substack{\text{NH}_2\text{OH/H}^+ \\ \text{Hg}^{2+}}} \text{E} \leftarrow \xrightleftharpoons{\substack{\text{alc.KOH} \\ \text{NaNH}_2}} \text{D} \end{array} \quad 3$$
6. (A) Differentiate between the following with the help of one example of each  
(i) Homoleptic and Heterolytic Complexes  
(ii) Double salt and a complex  
(B) What is the coordination number of Fe in  $[\text{Fe}(\text{EDTA})]^{3+}$ ? 3
  7. (A) How does the precipitation of colloidal smoke takes place in Cottrell precipitator?

- (B) Observe the following diagram and answer the questions that follow -



- (i) Name the property which is shown by the colloidal solution.  
 (ii) Explain the reason for the property shown by colloidal solution. 3

8. Write the structures of the following compounds.

- (A)  $\alpha$ -Methoxypropionaldehyde  
 (B) 3-Hydroxybutanal  
 (C) 2-Hydroxycyclopentanecarbaldehyde 3

9. (A) Why does acetylation of  $-\text{NH}_2$  group of aniline reduce its activating effect?  
 (B) What is the product when  $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$  reacts with  $\text{HNO}_2$ ?  
 (C) What is the structure and IUPAC name of the compound, allyl amine?

OR

How will you convert the following:

- (A) Nitrobenzene into aniline  
 (B) Ethanoic acid into methanamine  
 (C) Aniline into N-phenylethanamide 3

10. For the complex  $[\text{Fe}(\text{en})_2\text{Cl}_2]$ , Cl, (en = ethylene diamine), identify:

- (A) the oxidation number of iron,  
 (B) the hybrid orbitals and the shape of the complex,

## SECTION - C

(Section C-Question No 12 is case-based question carrying 5 marks.)

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

All chemical reactions involve interaction of atoms and molecules. A large number of atoms/molecules are present in a few grams of any chemical compound varying with their atomic/molecular masses. To handle such large number conveniently, the mole concept was introduced. All electrochemical cell reactions are also based on mole concept. For example, a 4.0 molar aqueous solution of  $\text{NaCl}$  is prepared and 500 mL of this solution is electrolysed. This leads to the evolution of chlorine gas at one of the electrode. The amount of products formed can be calculated by using mole concept.

- (C) the magnetic behaviour of the complex,  
 OR

- (A) What type of isomerism is shown by the complex  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$ ?  
 (B) Why a solution of  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  is green while a solution of  $[\text{Ni}(\text{CN})_4]^{2-}$  is colourless? (At. no. of Ni = 28)  
 (C) Write the IUPAC name of the following complex:  $[\text{Co}(\text{NH}_3)_5(\text{CO}_3)]\text{Cl}$ . 3

11. For the reaction  $\text{A} + \text{B} \rightarrow \text{products}$ , the following initial rates were obtained at various given initial concentrations:

[A] mol / L	[B] mol / L	Initial rate M/s
1) 0.1	0.1	0.05
2) 0.2	0.1	0.10
3) 0.1	0.2	0.05

Determine the half-life period.

OR

The following data were obtained during the first order thermal decomposition of  $\text{SO}_2\text{Cl}_2$  at a constant volume:



Experiment	Time/s <sub>-1</sub>	Total Pressure/atm
1	0	0.4
2	100	0.7

Calculate the rate constant.

(Given:  $\log 4 = 0.6021$ ,  $\log 2 = 0.3010$ ) 3

- (A) How many moles of chlorine gas will be evolved from the reaction given in the above passage?  
 (B) In electrolysis of aqueous  $\text{NaCl}$  solution when Pt electrode is taken, then which will the products formed at cathode and anode?  
 (C) What will be number of moles of electrons exchanged during electrolysis of aqueous solution of  $\text{NaCl}$ ?  
 (D) Calculate the time to deposit 1.5 g of silver at cathode when a current of 1.5 A was passed through the solution of  $\text{AgNO}_3$ . (Molar mass of Ag = 108 g mol<sup>-1</sup>, 1 F = 96500 C mol<sup>-1</sup>).  
 OR

How many electrons flow through a metallic wire if a current of 0.5 A is passed for 2 hours? (Given: 1 F = 96,500 C mol<sup>-1</sup>) 5