

**NATIONAL ACADEMY FOR LEARNING  
BENGALURU  
2022 – 2023  
SECOND TERM EXAMINATION  
CHEMISTRY PAPER 1  
(THEORY)**

**Grade: 12 ISC  
Time: 3 hours**

**Maximum Marks: 70  
No. of Pages: 7**

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Candidates are allowed **additional 15 minutes** for **only** reading the Paper.

They must **not** start writing during this time.

This paper is divided into **four** sections – A, B, C and D.

Answer **all** questions.

**Section A** consists of **one** question **having sub-parts** of **one** mark each.

**Section B** consists of **ten** questions of **two** marks each.

**Section C** consists of **seven** questions of **three** marks each, and

**Section D** consists of **three** questions of **five** marks each.

**Internal choices have been provided in one question each in Section B, Section C and Section D.**

All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.

The intended marks for questions or parts of questions are given in brackets [ ].

Balanced equations must be given wherever possible and diagrams where they are helpful.

When solving numerical problems, all essential working must be shown.

In working out problems, use the following data:

Gas constant  $R = 1.987 \text{ cal deg}^{-1} \text{ mol}^{-1} = 8.314 \text{ JK}^{-1} \text{ mol}^{-1} = 0.0821 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$

$1 \text{ l atm} = 1 \text{ dm}^3 \text{ atm} = 101.3 \text{ J}$ . 1 Faraday = 96500 coulombs.

Avogadro's number =  $6.023 \times 10^{23}$

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**SECTION A – 14 MARKS**

**Question 1**

A. Fill in the blanks by choosing the appropriate word(s) from those given in the brackets:

**[4x1]**

[ bi, lone pair, diamagnetic, less, inversely, boiling point, melting point, directly, paramagnetic, basic, acidic, hydrogen, more, unsymmetrical, symmetrical, tri ]

- i. Aniline is \_\_\_\_ basic than ammonia whereas ethylamine is \_\_\_\_ basic than ammonia.
- ii. The elevation of the ..... of a solvent by the addition of a solute, is ..... proportional to the molality of the solution.
- iii. The transition metals show ..... character because of the presence of unpaired electrons and  $\text{Cu}^+$  is ..... because its electronic configuration is  $[\text{Ar}]3d^{10}$ .
- iv. A bidentate ligand is ..... if the two coordinating atoms are the same. Glycinato is a ..... dentate ligand.

B. Select and write the correct alternative from the choices given below:

[4x1]

- i. The property which does not depend on temperature is:
  - a. molarity
  - b. molality
  - c. normality
  - d. formality
- ii. Which of the following cells can convert chemical energy of  $H_2$  and  $O_2$  directly into electrical energy
  - a. Mercury cell
  - b. Daniel cell
  - c. fuel cell
  - d. Lead Storage cell
- iii. A catalyst:
  - a. always slows down a reaction
  - b. starts a reaction that does not occur in its absence
  - c. changes the relative concentration of the reactants and products equilibrium
  - d. changes the rate of the reaction
- iv. Benzaldehyde when heated with an alcoholic solution of potassium cyanide forms:
  - a. Benzyl alcohol
  - b. Benzoin
  - c. Hydrobenzamide
  - d. Benzoic acid.

C. Match the following:

[4x1]

Column I	Column II
i. Purine	a. Phenol
ii. Henry's law	b. aldose
iii. Coupling Test	c. solubility in aqueous solution
iv. Sucrose	d. DNA

D.

[2x1]

i. Assertion: Phenol is more reactive than benzene towards electrophilic substitution reaction.

Reason: In the case of phenol, the intermediate carbocation is more resonance stabilized.

- a. Both assertion and reason are true, and reason is the correct explanation of assertion.
- b. Both assertion and reason are true, but reason is not the correct explanation for assertion.
- c. Assertion is true but reason is false.
- d. Assertion is false but reason is true

ii. Assertion: D(+) Glucose is dextrorotatory in nature.

Reason: 'D' represents its dextrorotatory nature.

- a. Both assertion and reason are true, and reason is the correct explanation of assertion.
- b. Both assertion and reason are true, but reason is not the correct explanation for assertion.
- c. Assertion is true but reason is false.
- d. Assertion is false but reason is true

## SECTION B – 20 MARKS

### Question 2

[2]

How will the following be obtained? (Give chemical equation)

- i. Chlorobenzene to benzoic acid.
- ii. Ethanenitrile to chloroethane

### Question 3

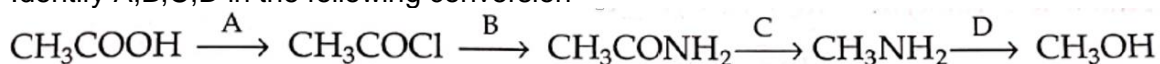
Give the structures of the optical isomers of the complex ion  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$

[2]

### Question 4

[2]

Identify A,B,C,D in the following conversion



[2]

### Question 5

Give reason for the following:

- i. Fe has higher melting point than Cu.
- ii.  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  is coloured while  $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$  is colourless.

**Question 6****[2]**

What happens when (Give balanced chemical equations only):

- ethanol is warmed with iodine and an aqueous solution of  $\text{Na}_2\text{CO}_3$ ?
- silver salt of fatty acids are refluxed with  $\text{Br}_2$  in  $\text{CCl}_4$ ?

**Question 7****[2]**

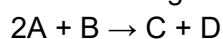
At  $25^\circ\text{C}$ , 3g of a solute A in 100 ml of an aqueous solution gave an osmotic pressure of 2.5 atm. What is the nature of the solute (associated or dissociated) if its normal molar mass is 246?

**Question 8****[2]**

At 300 K, a first order reaction is 50% complete in 20 minutes. At 350 K, the same reaction is 50% complete in 5 minutes. Calculate the activation energy of reaction.

**OR**

The following results have been obtained during the kinetic studies of the reaction:



Experiment	A/ mol L <sup>-1</sup>	B/ mol L <sup>-1</sup>	Initial rate of formation of D/mol L <sup>-1</sup> min <sup>-1</sup>
I	0.1	0.1	$6.0 \times 10^{-3}$
II	0.3	0.2	$7.2 \times 10^{-2}$
III	0.3	0.4	$2.88 \times 10^{-1}$
IV	0.4	0.1	$2.40 \times 10^{-2}$

Determine the rate law and the rate constant for the reaction.

**Question 9****[2]**

What is Heisenberg's test? Give the balanced equation for the reaction.

**Question 10****[2]**

- Complete the following reaction of an alkene:



- Give the equation for the oxidation of propan-1-ol with alkaline solution.

**Question 11****[2]**

- What is isoelectric point?
- Name the vitamins whose deficiency will cause night blindness and scurvy.

**SECTION C- 21 MARKS****Question 12****[3]**

- A cell is constructed by dipping a zinc rod in 0.1 M zinc nitrate solution and a lead rod in 0.2 M lead nitrate solution.

$$E^\circ \text{Pb}^{2+}/\text{Pb} = -0.13 \text{ V and } E^\circ \text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$$

- Write the spontaneous cell reaction.
  - Calculate standard emf and emf of the cell.
- Consider the electrochemical cell:

$\text{Zn (s)}/\text{Zn}^{2+} \text{ (aq)}/\text{Cu}^{2+} \text{ (aq)}/\text{Cu}$ . It has an electrical potential of 1.1V when concentration of  $\text{Zn}^{2+}$  and  $\text{Cu}^{2+}$  ions is unity. State the direction of flow of electrons and also specify if zinc and copper are deposited or dissolved at their respective electrodes, when

- an external opposite potential of 0.8 V is applied.
- an external opposite potential of 1.1 V is applied.
- an external opposite potential of 1.4 V is applied.

**Question 13****[3]**

From the following conductivities at infinite dilution, calculate  $\Lambda^\circ m$  for  $\text{NH}_4\text{OH}$ .

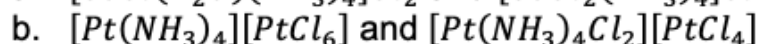
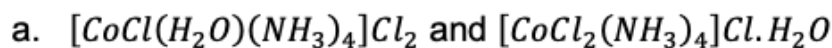
$$\Lambda_m^\circ \text{ for } \text{Ba(OH)}_2 = 457.6 \, \Omega^{-1} \text{ mol}^{-1}$$

$$\Lambda_m^\circ \text{ for } \text{BaCl}_2 = 240.6 \, \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$$

$$\Lambda_m^\circ \text{ for } \text{NH}_4\text{Cl} = 129.8 \, \Omega^{-1} \text{ mol}^{-1}$$

**Question 14****[3]**

- Write the IUPAC name of  $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$ .
- Name the type of isomerism shown by the following pairs of compounds:

**Question 15****[3]**

Accomplish the following conversions:

- aniline to p-aminoazobenzene
- Benzene to meta-bromoaniline
- Nitrobenzene to aniline

**Question 16**

Give reasons for the following:

[3]

- i. Zinc, cadmium and mercury are generally not considered as transition metals.
- ii.  $\text{Sc}^{+3}$  salts are diamagnetic.
- iii.  $\text{Ti}^{+3}$  salts are coloured whereas  $\text{Ti}^{+4}$  salts are white.

OR

b. Complete the following equations:

- i.  $2\text{MnO}_4^{2-} + 5\text{SO}_3^{2-} + 6\text{H}^+ \rightarrow$
- ii.  $2\text{CrO}_4^{2-} + 2\text{H}^+ \rightarrow$
- iii.  $4\text{FeCr}_2\text{O}_4 + 8\text{Na}_2\text{CO}_3 + 7\text{O}_2 \rightarrow$

**Question 17**

[3]

For the coordination complex ion  $[\text{Co}(\text{NH}_3)_6]^{3+}$ :

- i. Give the IUPAC name of the complex ion.
- ii. What is the oxidation number of cobalt in the complex ion?
- iii. State the type of hybridization of the complex ion.
- iv. State the magnetic behaviour of the complex ion. (Atomic number of Co = 27)

**Question 18**

[3]

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 produced (B). (C) on dehydration gives but-1-ene. Write equations for the reactions involved.

**SECTION D - 15 MARKS****Question 19**

[5]

- i. The time required for 10% completion of a first-order reaction at 298K is equal to that required for its 25% completion at 308K. If the pre-exponential factor for the reaction is  $3.56 \times 10^9 \text{ s}^{-1}$ , calculate its rate constant at 318K and also the energy of activation.
- ii. Time required to decompose  $\text{SO}_2\text{Cl}_2$  to half of its initial amount is 60 minutes. If the decompose is a first order reaction, calculate the rate constant of the reaction.

**Question 20**

[5]

- i. The conductivity of 0.2M solution of KCl at 298K is 0.0248S/cm. Calculate its molar conductivity.
- ii. How much charge is required for the conversion of 1 mole of  $\text{Al}^{3+}$  to Al?
- iii. The resistance of a conductivity cell containing 0.001M KCl solution at 298K is 1500 ohm. What is the cell constant if the conductivity of 0.001MKCl solution at 298K is  $0.146 \times 10^{-3} \text{ S/cm}$ ?
- iv. State Faraday's first law of electrolysis.

OR

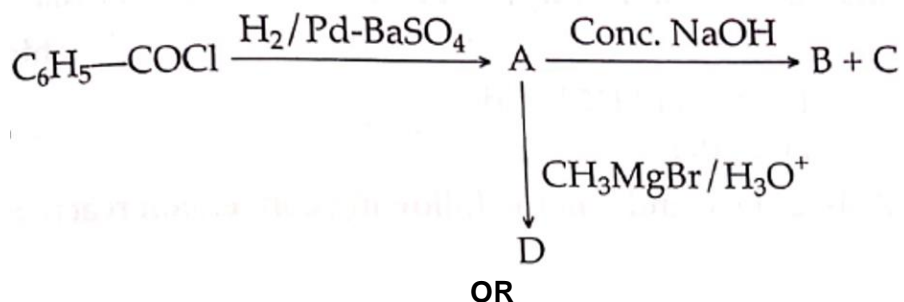
- i. The specific conductance of 0.01M solution of acetic acid at 298K is  $1.65 \times 10^{-4} \text{ ohm}^{-1} \text{cm}^{-1}$ . The molar conductance at infinite dilution for  $\text{H}^+$  ion and acetate ion are  $349 \text{ cm}^2/\text{ohm mol}$  and  $40.9 \text{ cm}^2/\text{ohm mol}$  respectively. Calculate:
- the molar conductance of the solution
  - degree of dissociation of acetic acid
- ii. Calculate the emf of the following cell reaction at 298K.  
 $\text{Mg(s)} + \text{Cu}^{+2}(0.0001\text{M}) \rightarrow \text{Mg}^{+2}(0.001\text{M}) + \text{Cu(s)}$ .  $E^\circ$  of the cell is 2.71V.

**Question 21**

**[5]**

- i. Give the balanced chemical equations for the following:
- Benzaldehyde is treated with hydrogen cyanide.
  - Acetaldehyde is treated with phenyl hydrazine.
  - Acetone is treated with phosphorus pentachloride.

- ii. Write the structure of A,B,C & D in the following reaction.



- i. Write a short note on:
- Clemmensen's reduction
  - Wolff-Kishner reduction
  - Cannizzaro's reaction
- ii. Distinguish between the following:
- Acetone and Phenol
  - Acetaldehyde and benzaldehyde

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