Sample Paper 15
Class XII 2023-24
Chemistry

Time: 3 Hours   **Max. Marks: 70**

General Instructions:
1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

SECTION-A

Directions (Q. Nos. 1-16) : The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Oxidation number of Ni in $\left[\text{Ni}(\text{C}_2\text{O}_4)_3\right]^{4-}$ is

(a) 3   (b) 4

(c) 2   (d) 6

2. An ester is boiled with KOH. The product is cooled and acidified with concentrated HCl. A white crystalline acid separates. The ester is

(a) Methyl acetate   (b) Ethyl acetate

(c) Ethyl formate   (d) Ethyl benzoate

3. Several blocks of magnesium are fixed to the bottom of a ship to

(a) make the ship lighter

(b) prevent action of water and salt

(c) prevent puncturing by under-sea rocks

(d) keep away the sharks

4. In respect of the equation $k = Ae^{-E_a/RT}$ in chemical kinetics, which of the following statements is correct?
   (a) A is adsorption factor
   (b) E_a is energy of activation
   (c) R is Rydberg's constant
   (d) k is equilibrium constant

5. Diethyl ether on heating with conc. HI gives two moles of
   (a) ethanol
   (b) iodoform
   (c) ethyl iodide
   (d) methyl iodide

6. Which of the following forms colourless compound ?
   (a) Sc^{3+}
   (b) V^{3+}
   (c) Ti^{3+}
   (d) Cr^{3+}

7. Which one is a colligative property ?
   (a) boiling point
   (b) vapour pressure
   (c) osmotic pressure
   (d) freezing point

8. Consider the following sequence of reactions:

   $\text{Compound}\,[A] \xrightarrow{\text{Reduction}}$

   $[B] \xrightarrow{HNO_2} CH_3CH_2OH$

   The compound [A] is:
   (a) CH_3CH_2CN
   (b) CH_3NO_2
   (c) CH_3NC
   (d) CH_3CN

9. When glucose reacts with bromine water, the main product is
   (a) gluconic acid
   (b) glyceraldehyde
   (c) saccharic acid
   (d) acetic acid

10. Which of the following is the use of electrolysis?
    (a) Electro-refining
    (b) Electroplating
    (c) Both (a) and (b)
    (d) None of these

11. Chloropicrin is
    (a) $C_2H_5C(NO)_5SH$
    (b) CCl_3CHO
    (c) CCl_3NO_2
    (d) CCl_3NO_3

12. The molecular weight of benzoic acid in benzene as determined by depression in freezing point method corresponds to:

 (a) ionization of benzoic acid.

 (b) dimerization of benzoic acid.

 (c) trimerizatin of benzoic acid.

 (d) solvationof benzoic acid.

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13.   **Assertion :** KCl, NaCl and NH_4Cl cannot be used in the salt bridge of a cell containing silver.
   Reason : A salt bridge contains concentrated solution of an inert electrolyte like KCl, KNO_3, K_2SO_4 or solidified solution of such an electrolyte in agar-agar and gelatine.

 (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

 (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

 (c) Assertion is correct but Reason is incorrect.

 (d) Both the Assertion and Reason are incorrect.

14.   **Assertion :** Members of $4d$ and $5d$ series of transition elements have nearly same atomic radii.
   Reason : Atomic and ionic radii for transition elements are smaller than their corresponding s-block elements.

 (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

 (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

 (c) Assertion is correct but Reason is incorrect.

 (d) Both the Assertion and Reason are incorrect.

15.   **Assertion :** AgCl dissolves in NH_4OH solution.
   Reason : Due to formation of a complex.

 (a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

 (b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

 (c) Assertion is correct but Reason is incorrect.

 (d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Nitration of aniline can be conveniently done by protecting the amino group by acetylation.

    Reason : Acetylation increases the electron-density in the benzene ring.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. No. 17-21) : This section contains 5 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

17. Write down the half cell reaction and cell reaction for the Daniel cell.

$Zn(s) \,|\, Zn^{+2}(aq.)\,(1M) \,||\, Cu^{+2}(aq.)\,(1M) \,|\, Cu(s)$

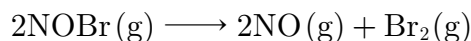**18.** What is denaturation of alcohol?

19. Write two main functions of carbohydrates in plants.

20. How will rate of a reaction change when $[A]_0$ is doubled and tripled for

1. zero order reaction.

2. second order reaction ?

or

State the order with respect to each reactant and overall order for the following reaction −

$$2NOBr(g) \longrightarrow 2NO(g) + Br_2(g)$$

$Rate = k[NOBr]^2$

What are the units of rate constant ?

21. Why is it not possible to measure the single electrode potential ?

Continue on next page......

SECTION-C

Directions (Q. No. 22-28) : This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

22. Why aldehydes are more reactive than ketones ?

23. What are the fuel cells? How are they different from galvanic cells? Give the construction of H_2, O_2 fuel cell?

24. For M^{2+}/M and M^{3+}/M^{2+} systems, $E°$ values for some metals are as follows :

$$Cr^{2+}/Cr = -0.9 \text{ V}$$

$$Cr^{3+}/Cr^{2+} = -0.4 \text{ V}$$

$$Mn^{2+}/Mn = -1.2 \text{ V}$$

$$Mn^{3+}/Mn^{2+} = +1.5 \text{ V}$$

$$Fe^{2+}/Fe = -0.4 \text{ V}$$

$$Fe^{3+}/Fe^{2+} = +0.8 \text{ V}$$

Use this data to comment upon:
1. the stability of Fe^{3+} in acid solution as compared to that of Cr^{3+} and Mn^{3+}.
2. the ease with which iron can be oxidised as compared to a similar process for either chromium or manganese metal.

25. Explain why propanol has higher boiling point than that of the hydrocarbon, butane?

26. Describe method of nitration of benzene.

27. What are Carbohydrates ? Give the classification of carbohydrates.

or

(i) What are vitamins?

(ii) How are vitamins classified? Name the vitamin responsible for coagulation of blood?

28. Give the IUPAC names of the following:
(i) $Cl - CH_2C \equiv C - CH_2 - Br$
(ii) $CH_3CH_2CH(CH_3)CH(C_2H_5)Cl$

SECTION-D

Directions (Q. No. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The stability of complex in solution refers to degree of association between the two species involved in the state of equilibrium. The magnitude of the equilibrium constant (stability or formation) for the association, quantitatively expresses the stability. If complex is formed in steps then the stepwise and overall stability constant is related as follows—

$$\beta_n = k_1 \times k_2 \times k_3 \times k_4 ... k_n$$

The addition of four amine groups to copper shows a pattern found for most formation constants, in which the successive stability constant decreases. The instability constant or the dissociation constant of coordination compound is defined as reciprocal of formation constant β_4.

Table : Stability Constants of Some Complexes

	Complex	Stability Constant (β)
1.	$[Cu(NH_3)_4]^{2+}$	4.5×10^{11}
2.	$[Cu(CN)_4]^{2-}$	2.0×10^{27}
3.	$[Ag(NH_3)_2]^{+}$	1.6×10^{7}
4.	$[Co(NH_3)_6]^{3+}$	5.0×10^{33}
5.	$[Ag(CN_2)^{-}$	5.4×10^{18}
6.	$[Ni(NH_3)_6]^{2+}$	6.1×10^{18}
7.	$[Ni(en)_3]^{2+}$	4.6×10^{18}
8.	$[Fe(CN)_6]^{3-}$	1.2×10^{31}
9.	$[Fe\ (CN)_6]^{4-}$	1.8×10^{6}
10.	$[Cd(NH_3)_4]^{2+}$	1.0×10^{7}

According to the given paragraph, answer the following questions :

(a)   Why is stability constants of cyanides are higher than complexes with NH_3 as a ligand?

(b)   Which of the complexes given in table is least stable? Why?

(c)   (i) Why is $[Fe(CN)_6]^{3-}$ is more stable than $[Fe(CN)_6]^{4-}$?

     (ii) Why is $[Ag(NH_3)_2]^{+}$ is less stable than $[Cu(NH_3)_4]^{2+}$?

or

(d)   Calculate the overall complex dissociation equilibrium constant for the $[Cu(NH_3)_4]^{2+}$ ion, given that for this complex $\beta_4 = 2.0 \times 10^{13}$.

or

(d)   K(Dissociation constant) $= \dfrac{1}{\beta_4} = \dfrac{1}{2.0 \times 10^{13}} = 5 \times 10^{-13}$

30.   The vapour pressure of solvent is lowered by the presence of non-volatile solute and this lowering of vapour pressure is governed by Raoult's law, according to which 'the relative lowering of vapour pressure of the solvent over a solution is equal to mole fraction of solute present in the solution. However in a binary solution if both components are volatile then another form of Raoult's law is used. The partial vapour pressure of each component is directly proportional to their mole fractions and $p_{total} = p_1^0 x_1 + p_2^0 x_2$. Solutions which obey Raoult's law over the entire range of concentration are called ideal solutions. Two types of deviations from Raoult's law are observed, positive and negative by non-ideal solution depending upon interaction between the components. Azeotropes are formed due to very large deviations from Raoult's law.

Read the passage and answer the following questions:

(a)   What type of solution is formed by ethanol and water?

(b)   What type of solution is formed by benzene and toluene?

(c)   The vapour pressure of pure 'A' and 'B' are 450 mm and 700 mm Hg respectively at 350 K. What are the mole fraction of 'A' and 'B' in vapour phase, if total pressure on mixing is 600 mm.

or

(d)   Calculate the mass of solute (non-volatile) with molar mass 40 g/mol which must be dissolved in 114 g octane to reduce its vapour pressure to 80%.

SECTION-E

Directions (Q. No. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.
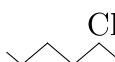
31.   Write chemical reactions of following :

1.   Phenol with zinc dust.

2.   Electrophilic aromatic substitution of phenol.

32.   State the Explain :

1.   Raoult's law for volatile solute.

2.   Raoult's law for non-volatile solute.

or

Give the difference between ideal and non-ideal solutions.

33. In the following pairs of halogen compounds which compound undergo faster S_N1 reaction ?

(i)   and

(ii)   and
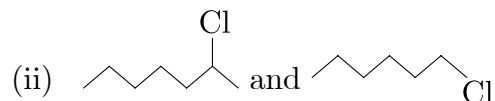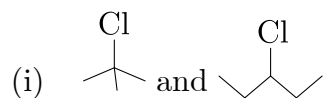
Since 2° carbocation are more stable than 1° carbocation therefore will react faster in S_N1 reaction.

<div align="center">or</div>

Write the following reaction :

(i)   Friedel-Crafts acylation.

(ii) Wurtz-Fitting reaction.

(iii) Dow's process.

(iv) Ullmann biaryl synthesis.

□□□□□□