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| CLASS : XII | MAX. MARKS : 70 |
| DATE : 19.09.2022 | TIME Allowed : 3 hours |

**General Instructions:**

(a)  There are 33 questions in this question paper. All questions are compulsory.

(b)  Section A: Q. No. 1 to 16 are objective type questions, Q. No. 1 and 2 are passage-based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.

(c)  Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.

(d)  Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.

(e)  Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.

(f)  There is no overall choice. However, internal choices have been provided.

(g)  Use of calculators and log tables is not permitted.

## SECTION – A [OBJECTIVE TYPE]

1. **Read the passage given below and answer the following questions.     (1×4=4)**

   Grignard reagents are versatile organometallic compounds. The carbon-magnesium bond in Grignard reagent is covalent but highly polar whereas the magnesium-halogen bond is essentially ionic. They are highly reactive and react with any source of proton to give hydrocarbon. It is therefore necessary to protect Grignard reagent from moisture. The hydrocarbon part of the Grignard reagent acts as a source of carbanion. Due to this Grignard reagents undergo nucleophilic addition to carbonyl compounds forming addition products which upon hydrolysis give alcohols.

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

   **(i)**  **In the following reaction B is**

   $$CH_3 - CH_2Br \xrightarrow[\text{dry ether}]{Mg} A \xrightarrow{CH_3OH} B$$
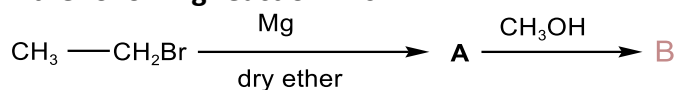
   (a) $CH_3-CH_2-O-CH_3$          (b) $CH_4$

   (c) $CH_3-CH_2-OH$          (d) $CH_3-CH_3$

   **(ii)**  **Treatment of ethyl magnesium bromide with formaldehyde followed by hydrolysis give**

   (a) Butan-1-ol          (b) propan-1-ol

   (c) Propan-2-ol          (d) ethanol

   **(iii)**  **Which of the following on treatment with methyl magnesium bromide followed by hydrolysis gives 2-methylbutan-2-ol?**

   (a) Propanone          (b) Butanal
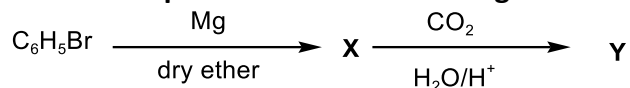
   (c) Pentanal          (d) Butan-2-one

   **(iv)**  **In the following reaction Y is**

   $$CH_3 - CH_2OH \xrightarrow[PCC]{(O)} X \xrightarrow[H_2O]{+CH_3CH_2MgBr} Y$$
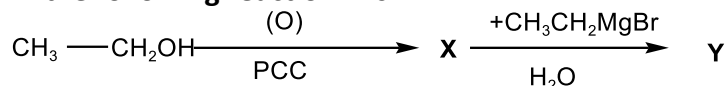
   (a) $CH_3-CH_2-OH$          (b) $CH_3-CH_2-CH_2-CH_2-OH$

   (b) $CH_3-CH_2-CH(OH)-CH_3$          (d) $CH_3-CH_2-CH_2-CO-CH_3$

   OR

   **Predict the product Y of the following reaction:**

   $$C_6H_5Br \xrightarrow[\text{dry ether}]{Mg} X \xrightarrow[H_2O/H^+]{CO_2} Y$$

   (a) $C_6H_6$          (b) $C_6H_5OH$

   (c) $C_6H_5CHO$          (d) $C_6H_5COOH$

2. **Read the passage given below and answer the following questions.** **(1×4=4)**

The overall balanced chemical equation does not tell much about how a reaction actually takes place. In many cases, it represents the sum of a series of simple reactions which are called elementary reactions (or elementary steps). The sequence of elementary reactions which lead to the product formation is called the reaction mechanism. Such reactions are also called complex reactions. For example, the reaction:

$2NO(g) + 2H_2(g) \longrightarrow N_2(g) + 2H_2O(g)$ occurs as

(i) $2NO(g) + H_2(g) \longrightarrow N_2(g) + 2H_2O_2(g)$ ……………………. (slow)

(ii) $H_2O_2(g) + H_2(g) \longrightarrow N_2(g) + 2H_2O(g)$ ……………………… (fast)
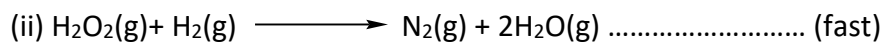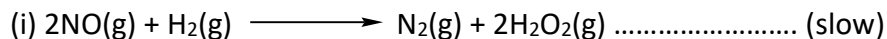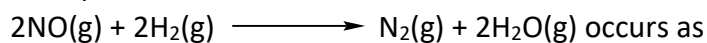
In these reactions, some of the steps will be very fast while others will be slow. If one step takes place much more slowly than all the other steps, it will definitely control the overall rate of reaction.

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

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

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

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

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

(i) **Assertion** : Reactions of higher order are rare.

   **Reason** : The chances of simultaneous collision of three or more molecules are extremely small.

(ii) **Assertion** : The order of the reaction between NO and $H_2$ is three.

   **Reason** : Order of reaction is given by first slow step reaction.

(iii) **Assertion** : For a complex reaction, order and molecularity are not same.

   **Reason** : Order of reaction can never be zero.

OR

   **Assertion** : The rate law for the above reaction is given as:

   rate = $k[NO]^2[H_2]$

   **Reason** : Molecularity of first step is three.

(iv) **Assertion** : Order of a reaction can be zero or fractional.

   **Reason** : Molecularity of a reaction cannot be zero but can be fractional.

*Following questions (q. No. 3-11) are Multiple Choice Questions carrying 1 mark each:*

3. **An unripe mango placed in a concentrated salt solution to prepare pickle, shrivels because**

   (a) It gains water due to osmosis
   (b) It loses water due to reverse osmosis

   (c) It gains water due to reverse osmosis
   (d) It loses water due to osmosis

4. **Which one of the following amino acids can be synthesized in the body?**

   (a) Lysine     (b) Valine

   (c) Isoleucine (d) Alanine

OR

**DNA and RNA contain four bases each. Which of the following bases is not present in RNA?**

   (a) Adenine          (b) Uracil

   (c)Thymine          d) Cytosine

5. **Write the IUPAC name of $(CH_3)_3C-CH_2Br$**

   (a) 1- Bromo-2,2-dimethylpropane   (b) 2,2-Dimethyl-1-bromopropane

   (c) 1-Bromo-2-methylbutae          (d) 1-Methyl-2-bromobutane

6. **The conversion of an alkyl halide into an alcohol by aqueous NaOH is classified as**
    (a) A dehydrohalogenation reaction (b) A substitution reaction
    (c) An addition reaction (d) A dehydration reaction
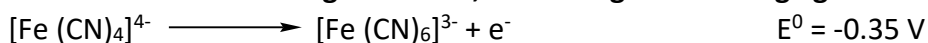
    **OR**

    **Chlorobenzene is formed by the reaction of chlorine with benzene in the presence of AlCl₃. Which of the following species attacks the benzene ring in this reaction?**
    (a) $Cl^-$ (b) $Cl^+$
    (c) $AlCl_3$ (d) $[AlCl_4]^{4-}$

7. **4 L of 0.02 M aqueous solution of NaCl was diluted by adding one litre of water. The molality of the resultant solution is ----------**
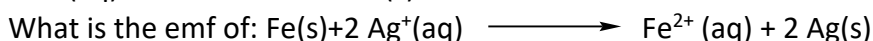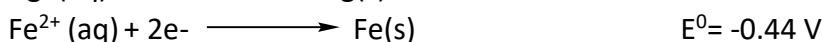    (a) 0.004 (b) 0.008
    (c) 0.012 (d) 0.016

8. **On the basis of following $E^0$ values, the strongest oxidizing agent is**

    $[Fe (CN)_4]^{4-} \longrightarrow [Fe (CN)_6]^{3-} + e^-$ $E^0 = -0.35$ V

    $Fe^{2+} \longrightarrow Fe^{3+} + e^-$ $E^0 = -0.77$ V

    (a) $Fe^{2+}$ (b) $Fe^{3+}$ (c) $[Fe (CN)_6]^3$ (d) $[Fe (CN)_4]^{4-}$

    **OR**

    $Ag^+ (aq) + e- \longrightarrow Ag(s)$ $E^0 = +0.80$ V
    $Fe^{2+} (aq) + 2e- \longrightarrow Fe(s)$ $E^0 = -0.44$ V
    What is the emf of: $Fe(s) + 2 Ag^+(aq) \longrightarrow Fe^{2+} (aq) + 2 Ag(s)$
    (a) 1.16 V (b) 1.24 V
    (c) 2.04 V (d) -1.16 V

9. **On oxidation with a mild oxidizing agent like $Br_2 / H_2O$ the glucose is oxidized to**
    (a) Saccharic acid (b) Glucaric acid
    (c) Gluconic acid (d) Valeric acid

10. **In cold countries glycol in added to water in car radiators during winter. It results in**
    (a) Lowering in boiling point (b) reducing the viscosity
    (c) reducing the specific heat (d) lowering in freezing point

11. **Which among MeX, $RCH_2 X$, $R_2 CHX$, $R_3CX$ is most reactive towards $SN^1$ reaction?**
    (a) MeX (b) $RCH_2X$
    (c) $R_2CHX$ (d) $R_3CX$

*In the following questions (Q. No. 12 to 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.*

    (a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
    (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
    (c) Assertion is correct statement but reason is wrong statement.
    (d) Assertion is wrong statement but reason is correct statement.

12.     **Assertion**    : For measuring resistance of and ionic solution and AC source is used.
        **Reason**       : concentration of ionic solution will change if DC source is used.

13.     **Assertion**    : Rate constants determined from Arrhenius equation are fairly accurate for simple as well as complex molecules.
        **Reason**       : Reactant molecules undergo chemical change irrespective of

their orientation during collision.

14. **Assertion** : KCN reacts with methyl chloride to give methyl isocyanide.
    **Reason** : $CN^-$ is an ambident nucleophile.

OR

**Assertion** : In monohaloarenes, further electrophilic substitution occurs at ortho and para positions.
**Reason** : Halogen atom is a ring deactivator.

15. **Assertion** : Albumin is a globular protein.
    **Reason** : Polypeptide chain coils around to give a straight chain.

16. **Assertion** : The boiling point of ethanol is higher than methoxymethane.
    **Reason** : There is intramolecular hydrogen bonding in ethanol.

## SECTION – B

*The following questions, Q. No. 17 to 25 are Short Answer Type I and carry 2 mark each*

17. (i) Benzyl chloride is highly reactive towards the $S_N1$ reaction. Give reason.
    (ii) Arrange the following in the increasing ease towards nucleophilic substitution reactions. 4-nitrochlorobenzene; chlorobenzene; 2,4,6-trinitrochlorobenzene; 2,4-dinitrochlorobenzene.

OR

(i) Why iodoform has appreciable antiseptic property?
(ii) Convert benzene to 4-Bromonitrobenzene.

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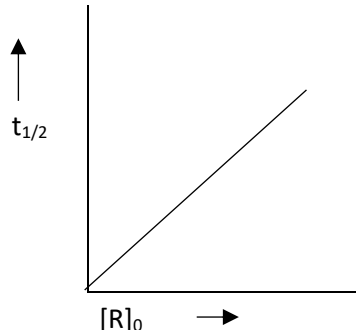    (Given molar mass of octane = 114 g $mol^{-1}$)

19. Define order of reaction. Predict the order of reaction in the given graphs:

(i)

$t_{1/2}$ ↑

$[R]_0$ →

(ii)

$t_{1/2}$ ↑

$[R]_0$ →
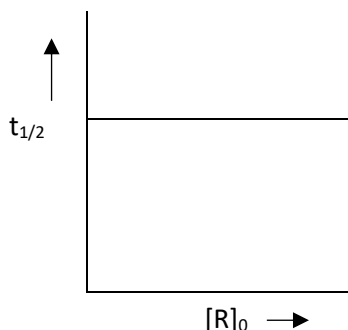
Where $[R]_0$ is the initial concentration of reactant and $t_{1/2}$ is half-life.

OR

(i) For the assumed reaction $X_2 + 3Y_2 \longrightarrow 2XY_3$, write the rate of equation in terms of rate of disappearance of $Y_2$.
(ii) For the reaction $A \longrightarrow B$, the rate of reaction becomes three times when the concentration of A is increased by nine times. What is the order of reaction?

20. Identify and indicate chirality if any in the following molecules
    (a) Identify chiral in $CH_3CHOHCH_2CH_3$ and $CH_3CHOHCH_3$.
    (b) Write the structure of 2,3 – Diethylphenol

OR

Write the chemical reaction equations to illustrate the following reactions:
(a) William synthesis  (b) Riemer-Tiemann reaction

**21.** (i) What type of linkage is present in nucleic acid?

(ii) If the bases in one strand of DNA have the sequence......ATGCTTCA......, then what is the sequence of bases in complimentary strand?

**22.** Calculate the emf of the cell in which the following reaction takes place:

$$Ni(s) + 2Ag^+ (0.002 \text{ M}) \longrightarrow Ni^{2+} (0.160 \text{ M}) + 2Ag(s)$$
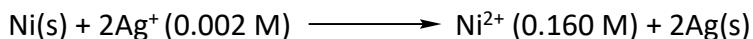
(Given that $E^0_{cell}$ = 1.05 V, log $4\times10^4$=4.6021, log $2\times10^4$=4.3010)

**23.** Write the formula of main product formed in the following chemical reactions

(i) $CH_3Br + AgF \xrightarrow{\Delta}$

(ii) $CH_3CH_2Br + NaI \xrightarrow{\text{Dry acetone}}$

**24.** (i) Give one example each for essential and non-essential amino acid.

(ii) Amino acid shows amphoteric behaviour. Why?

**25.** Following are the graphs for vapour pressures of the two-component system as a function of composition. Answer the following questions.
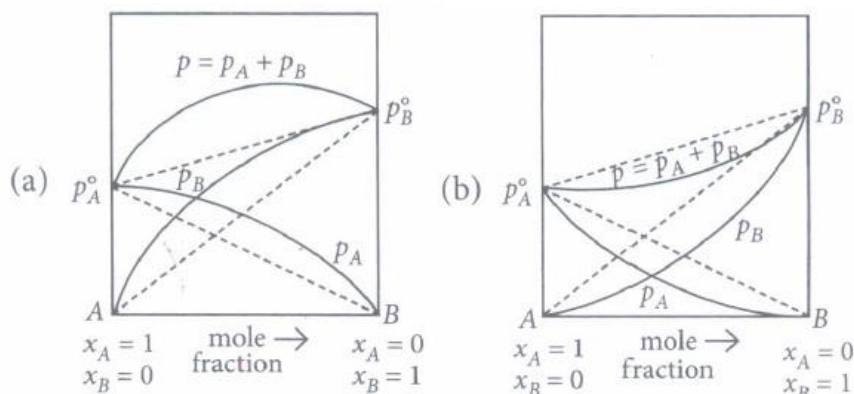


(i) What type of deviations are shown in Fig (a) and (b)?

(ii) Give one example of solution showing deviation as in Fig (b)?

## SECTION – C

*Q. No. 26 to 30 are Short Answer Type II and carry 3 marks each*

**26.** Mention three such facts /reactions about glucose which cannot be explained by its open-end structure. What is meant by pyranose structure of glucose?

**OR**

What happens when D-glucose is treated with the following reagents?

(i) HI    (ii) Bromine    (iii) $HNO_3$.

**27.** (i) State Kohlrausch law of independent migration of ions.

(ii) Calculate $\Lambda^0_m$ for acetic acid.

Given that $\Lambda^0_m$(HCL) = 426 S cm$^2$ mol$^{-1}$

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

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

**OR**

(i) Catalysts have no effects on the equilibrium constant. Why?

(ii) The rate of a reaction increases four times when the temperature changes from 300 k to 320 K. Calculate the energy of activation of reaction, assuming that it does not change with temperature. (Given R = 8.314 J K$^{-1}$ mol$^{-1}$, log 4 = 0.6021, log 2 = 0.3010)

**28.** (i) A doctor advised a person suffering from high blood pressure to take less quantity of common salt. Why?

(ii) Calculate the boiling point of a solution containing 0.61 g of benzoic acid in 5 g of $CS_2$. Assuming 84% dimerisation of acid, the boiling point and $K_b$ of $CS_2$ are 46.2°C and 2.3 K kg mol$^{-1}$ respectively.

**29.** (i) Complete following reaction equation:



(i) $Br_2$/Heat
(ii) UV light
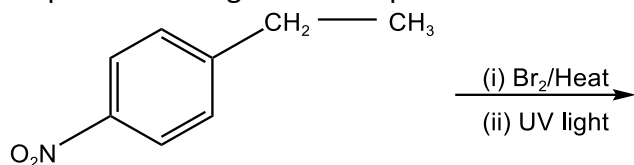
(ii) How will you distinguish between the following pairs of compounds:
   (a) Chloroform and carbon tetrachloride. (b) Benzyl chloride and chlorobenzene.

**30.** Define van't Hoff's factor. What possible values will it have if the solute molecules undergo association in solution? How is degree of dissociation and degree of association calculated from van't Hoff factor?

## SECTION - D
*Q. No. 31 to 33 are Long Answer Type and carrying 5 marks each*

**31.** (i) How many moles of mercury will be produced by electrolyzing 1.0 M Hg $(NO_3)_2$ **(3+2)**
   solution with a current of 2.00 A for 3 hours?
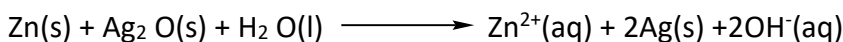
(ii) Give reasons:
   (a) Electrolysis of NaBr and NaI gives $Br_2$ and $I_2$ respectively while that of NaF gives $O_2$ instead of $F_2$.
   (b) Conductivity of an electrolyte solution decreases with the decrease in Concentration.
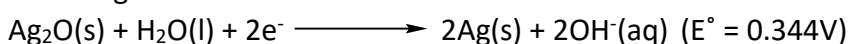
### OR

(i) What is a fuel cell? What is its main advantage? **(2+3)**
(ii) What are the reactions occurring at the cathode and anode of a Leclanche cell?
(iii) In the button cell widely used for watches and other devices, the following reaction takes place:
$Zn(s) + Ag_2 O(s) + H_2 O(l) \longrightarrow Zn^{2+}(aq) + 2Ag(s) + 2OH^-(aq)$
Give the cell representation and determine the value of $K_c$ for the above reaction using the following data:
$Ag_2O(s) + H_2O(l) + 2e^- \longrightarrow 2Ag(s) + 2OH^-(aq)$ $(E° = 0.344V)$
$Zn^{2+}(aq) + 2e^- \longrightarrow Zn(s)$ $(E° = -0.76V)$

**32.** (i) Give reasons for the following: **(2+3)**
   (a) The C–O–H bond angle in alcohols is slightly less than tetrahedral angle (109°28).
   (b) $(CH_3)_3$ C–O–$CH_3$ on reaction with HI gives $(CH_3)_3$C–I and $CH_3$–OH as the main products and not $(CH_3)_3$C–OH and $CH_3$–I

(ii) How do you convert the following:
   (a) Phenol to anisole
   (b) Propan-2-ol to 2-methylpropan-2-ol
   (c) Aniline to phenol

### OR

(i) Give one chemical test to distinguish between the following: **(2+3)**
   (a) Phenol and 1-propanol
   (b) Ethanol and dimethyl ether

(ii) An aromatic compound 'A' on treatment $CHCl_3$/KOH gives two compounds 'B' and 'C'. Both B and C give the same product 'D' when distilled with zinc dust. Oxidation of D gives 'E' having molecular formula $C_7H_6O_2$. The sodium salt E on heating with soda lime gives F which may also be obtained by distilling A with zinc dust. Identify A to F.

**33.** (i) Define rate law. **(1+4)**

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

$$2A + B \longrightarrow C + D$$
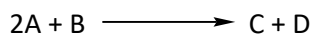
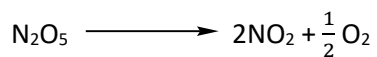| Experiment | [A]/mol $L^{-1}$ | [B]/mol $L^{-1}$ | Initial rate of formation of D/ mol $L^{-1}$ $min^{-1}$ |
|---|---|---|---|
| I | 0.1 | 0.1 | $6.0 \times 10^{-3}$ |
| II | 0.3 | 0.2 | $7.2 \times 10^{-2}$ |
| III | 0.3 | 0.4 | $2.88 \times 10^{-1}$ |
| IV | 0.4 | 0.1 | $2.40 \times 10^{-2}$ |

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

**OR**

(i) Define rate constant of a reaction. **(1+2+2)**

(ii) Following data are obtained for reaction:

$$N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2$$

| t/s | 0 | 300 | 600 |
|---|---|---|---|
| [$N_2O_5$]/mol $L^{-1}$ | $1.6 \times 10^{-2}$ | $0.8 \times 10^{-2}$ | $0.4 \times 10^{-2}$ |

(a) Show that if follows first order reaction.

(b) Calculate the half-life.

(Given log 2 = 0.3010, log 4 = 0.6021)