Class: XII
SESSION : 2022-2023
SUBJECT: Chemistry
SAMPLE QUESTION PAPER - 13
with SOLUTION

MM: 70 **Time: 3 hours**

General Instructions:

Read the following instructions carefully.

a) There are **35** questions in this question paper with internal choice.
b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
c) SECTION B consists of 7 very short answer questions carrying 2 marks each.
d) SECTION C consists of 5 short answer questions carrying 3 marks each.
e) SECTION D consists of 2 case- based questions carrying 4 marks each.
f) SECTION E consists of 3 long answer questions carrying 5 marks each.
g) **All questions are compulsory.**
h) **Use of log tables and calculators is not allowed**

Section A

1. For the electrochemical cell, M|M^+|X^-|X, $E^\circ_{M^+/M}$ = 0.44 V and E°_{X/X^-} = 0.33 V. **[1]**
From this data, one can deduce that:

a) E°_{cell} = -0.77 V
b) E°_{cell} = 0.77 V
c) $M + X \longrightarrow M^+ + X^-$ is the spontaneous reaction
d) $M^+ + X^- \longrightarrow M + X$ is the spontaneous reaction

2. $R\,\text{Mg}\,X \xrightarrow[\text{(ii)}NH_4Cl]{(i)CH_3CN} (A) \xrightarrow[NH_4Cl]{R\text{MgX}} (B)$, (B) will be: **[1]**

a) 1° ROH
b) Alkene
c) 2° ROH
d) 3° ROH

3. Identify the final product in the reaction sequence **[1]**

$C_6H_{12}O_6(glucose) \xrightarrow{HCN} (A) \xrightarrow[H^+]{H_2O} (B) \xrightarrow[Red\ P]{HI} (C)$

a) n-hexane

b) n-heptane

c) β-methyl cyanohydrin

d) α-methyl glycoside

4. A mineral is called an ore if: **[1]**

a) a metal cannot be extracted from it

b) a metal can be extracted from it

c) a metal can be extracted profitably from it

d) metal present in the mineral is costly

5. An organic compound X is oxidized by using acidified $K_2Cr_2O_7$. The product obtained reacts with Phenyl hydrazine but does not answer the silver mirror test. The possible structure of X is: **[1]**

a) $(CH_3)_2CHOH$

b) None of these

c) CH_3CHO

d) CH_3CH_2OH

6. Ethylene glycol is added to water as antifreeze. It will **[1]**

a) Only decrease the freezing point of water

b) Only increase the boiling point of water

c) Increase the freezing point of water in winter and boiling point in summer

d) It is used to clean the radiator in car

7. In Clemmensen Reduction, carbonyl compound is treated with ________. **[1]**

a) Zinc amalgam + HCl
b) Zinc amalgam + nitric acid
c) Sodium amalgam + HNO_3
d) Sodium amalgam + HCl

8. Greater the value of KH, lower will be the **[1]**

a) Pressure
b) Solubility
c) Concentration
d) Temperature

9. Which of the following alkyl halides will undergo S_N1 reaction most readily? **[1]**

a) $(CH_3)_3C—I$
b) $(CH_3)_3C—F$
c) $(CH_3)_3C—Br$
d) $(CH_3)_3C—Cl$

10. The molar conductivity of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and 91 $ohm^{-1}\ cm^2\ mol^{-1}$ respectively. The molar conductivity of CH_3COOH at infinite dilution (Λ_m^∞) is: **[1]**

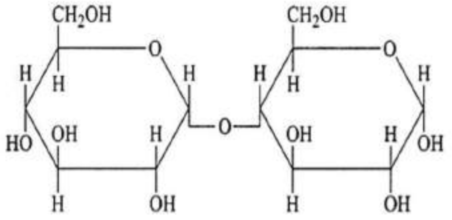
a) 698.28 $ohm^{-1}\ cm^2\ mol^{-1}$
b) 201.28 $ohm^{-1}\ cm^2\ mol^{-1}$
c) 390.71 $ohm^{-1}\ cm^2\ mol^{-1}$
d) 540.48 $ohm^{-1}\ cm^2\ mol^{-1}$

11. The electronic configuration of gadolinium (Atomic no. = 64) is: **[1]**

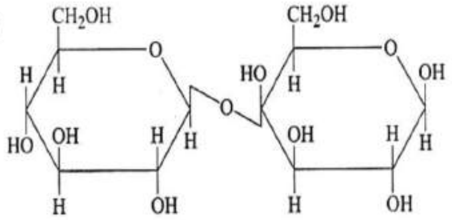
a) $[Xe]4f^6 5d^2 6d^2$
b) $[Xe]4f^7 5d^1 6s^2$
c) $[Xe]4f^3 5d5^6 s^2$
d) $[Xe]4f^8 5d^9 6s^2$

12. In disaccharides, if the reducing groups of monosaccharides, i.e., aldehydic or ketonic groups are bonded, these are non-reducing sugars. Which of the following disaccharide is a non-reducing sugar? **[1]**

a)



b)



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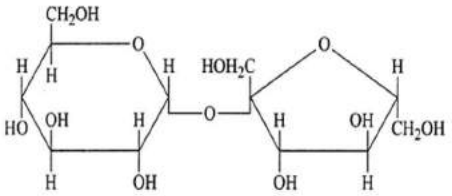
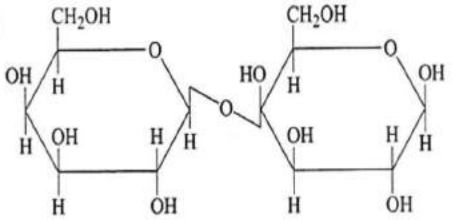


d)



13. The metabolism of hormones in human body is an example of **[1]**

a) Second order reaction

b) First order reaction

c) Pseudo first order reaction

d) Pseudo second order reaction

14. **Assertion (A):** Tertiary haloalkanes are more reactive than primary haloalkanes towards elimination reactions. **[1]**
Reason (R): The +I-effect of the alkyl groups weakens the C-X bond.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

15. An electric current of c ampere was passed through a solution of an electrolyte for t second depositing P g of metal M on the cathode. The equivalent weight E of the metal will be: **[1]**

a) $E = \frac{c\times t}{P\times 96500}$

b) $E = \frac{96500\times P}{c\times t}$

c) $E = \frac{c\times P}{t\times 96500}$

d) $E = \frac{c\times t\times 9650}{P}$

16. **Assertion:** When methanol is added to the water boiling point of water increases. **[1]**
Reason: When a volatile solute is added to a volatile solvent, elevation in boiling point is observed.

a) If both Assertion & Reason are true and the reason is the correct explanation of the assertion.

b) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion.

c) If Assertion is true statement but Reason is false.

d) If both Assertion and Reason are false statements.

17. **Assertion (A):** O-nitrophenol is a weaker acid than p-nitrophenol. **[1]**
Reason (R): Intramolecular hydrogen bonding makes ortho isomer weaker than para isomer.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

18. **Assertion (A):** Λ_m for weak electrolytes shows a sharp increase when the electrolytic solution is diluted. **[1]**
Reason (R): For weak electrolytes degree of dissociation increases with dilution of solution.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

19. How many geometrical isomers are possible in the following coordination entities? **[2]**
(a) $[Cr(C_2O_4)_3]^{3-}$(b) $[Co(NH_3)_3Cl_3]$

20. What is crystal field splitting energy? **[2]**

OR

Write the structural shape, magnetic behaviour and hybrid orbitals involved in $[Cr(NH_3)_6]^{3+}$ (Atomic no. of Co = 27, Cr = 24).

21. Draw the structures of 4-methyl pent-3-en-2-one **[2]**

OR

Write the reagents required in the following reactions :

i. $CH_2=CH-CH_2OH \xrightarrow{?} CH_2=CH-CHO$

ii. $CH_3-COOH \xrightarrow{?} CH_3-CONH_2$.

22. Using IUPAC norms, write the formulae for the following: **[2]**
i. Potassium trioxalatoaluminate (Ill)
ii. Dichlorido bis(ethane-1, 2-diamine) cobalt(Ill) ion

23. Determine the overall order of a reaction which has the rate law **[2]**
$R = k[A]^{5/2}[B]^{3/2}$

24. The melting points and solubility in water of amino acids are generally higher than that of the corresponding halo acids. Explain. **[2]**

25. Draw the structure of 4-methylpent-3-en-2-one. **[2]**

Section C

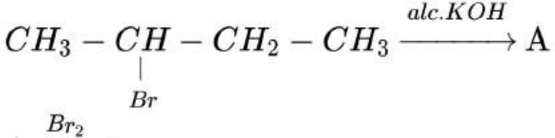
26. The following data were obtained during the first order thermal decomposition of SO_2CL_2 at a constant volume: **[3]**

$SO_2CI_2(g) \rightarrow SO_2(g) + CI_2(g)$

Experiment	Time	Total pressure/atm
1	0	0.4
2	100	0.7

Calculate the rate constant.
(Given, log 4 = 0.6021, log 2 = 0.3010)

27. Write the structural formula of the organic compounds A and B in the following sequence of reaction. **[3]**



$$CH_3 - \underset{\substack{| \\ Br}}{CH} - CH_2 - CH_3 \xrightarrow{alc.KOH} \text{A}$$

$$\text{A} \xrightarrow{Br_2} \text{B}$$

28. Describe the following: **[3]**
   i. Acetylation
   ii. Cannizzaro reaction
   iii. Cross aldol condensation
   iv. Decarboxylation

29. Define the following terms with a suitable example of each : **[3]**
   a. Anomers
   b. Denaturation of protein
   c. Essential amino acids

OR

An optically active amino acid (A) can exist in three forms depending on the pH of the medium. If the molecular formula of (A) is $C_3H_7NO_2$, write.

   i. Structure of compound (A) in aqueous medium. What are such ions called.
   ii. In which medium will the cationic form of compound (A) exist?
   iii. In alkaline medium, towards which electrode will the compound (A) migrate in electric field?

30. Write the reaction and the conditions involved in the conversion of: **[3]**
   i. Propane to 1-propanol
   ii. Phenol to salicylic acid

Section D

31. **Read the text carefully and answer the questions:** **[4]**

In order to overcome the scarcity of drinking water in a remote village in Gujarat, Arnav and Aariv two young entrepreneurs still in their high school, have developed a unique water purifier that is capable of converting sea water into drinking water. It works on the principle of concentration difference between two solutions.

(i) Name the phenomenon/process based on which this product is made?

(ii) How difference in concentration of solutions help in converting sea water into drinking water?

(iii) What arrangement they must have created in their product to covert sea water into drinking water?

OR

Equimolar solutions of NaCl and glucose are not isotonic. Why?

32. **Read the text carefully and answer the questions:** **[4]**

The f-block consists of elements in which 4f and 5f orbitals are progressively filled. They are placed in a separate panel at the bottom of the periodic table. The names transition metals and inner transition metals are often used to refer to the elements of d-and f-blocks respectively. The d–block occupies the large middle section of the periodic table flanked between s and p blocks in the periodic table. In general, the electronic configuration of the outer orbitals of these elements is $(n - 1)d^{1-10}ns^{1-2}$. The electronic configurations of outer orbitals of Zn, Cd, Hg and Cn are represented by the general formula $(n - 1)d^{10}ns^{2}$. The transition metals and their compounds also exhibit catalytic property and paramagnetic behaviour. Transition metal also forms an alloy. An alloy is a blend of metals prepared by mixing the components. Alloys may be homogeneous solid solutions in which the atoms of one metal are distributed randomly among the atoms of the other.

(i) Transition metals form alloys. Justify?

(ii) Why do transition elements exhibit higher enthalpies of atomization?

(iii) Transition metals and many of their compounds show paramagnetic behaviour. Give reason.

OR

Transition metals and their many compounds act as good catalyst. Give reason.

Section E

33. i. Give reasons: **[5]**

a. Although – NH_2 group is o/p directing in electrophilic substitution reactions, yet aniline, on nitration gives good yield of m-nitroaniline.

b. $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.

c. Ammonolysis of alkyl halides is not a good method to prepare pure primary amines.

ii. Distinguish between the following:

a. $CH_3CH_2NH_2$ and $(CH_3CH_2)_2$ NH

b. Aniline and CH_3NH_2

OR

How will you convert

i. Ethanoic acid into methanamine

ii. Hexanenitrile into 1-aminopentane

iii. Ethanamine into methanamine

iv. Nitromethane into dimethylamine

v. Propanoic acid into ethanoic acid

34. Answer the following questions: **[5]**

(i) The rate of reaction$X \to Y$ becomes 8 times when the concentration of the reactant X is doubled. Write the rate law of the reaction.

(ii) Write the IUPAC name of $K_3[Fe(C_2O_4)_3]$.

(iii) How is toluene obtained from phenol?

(iv) Write the structure of the given compound:N- Ethyl -2- pentanamine.

(v) The second and third rows of transition elements resemble each other much more than they resemble the first row. Explain why?

35. Two students use same stock solution of $ZnSO_4$ and a solution of $CuSO_4$. The e.m.f. of one cell is 0.03 V higher than the other. The concetration of $CuSO_4$ in the cells with higher e.m.f. value is 0.5 M. Find out the concentration of $CuSO_4$ in the other cell. (2.303 RT/F = 0.06) **[5]**

OR

a. State two advantages of H_2O fuel cell over ordinary cell.

b. Silver is electro deposited on a metallic vessel of total surface area 900 cm^2 by passing a current of 0.5 amp for two hours.
Calculate the thickness of silver deposited.

[Given : Density of silver = 10.9g cm^{-3} Atomic mass of silver = 108 u
1 F = 96500 C mol^{-1}]

SOLUTION

Section A

1. **(d)** $M^+ + X^- \longrightarrow M + X$ is the spontaneous reaction

   Explanation: $E^\circ_{M^+/M} = 0.44$ V; $E^\circ_{X/X^-} = 0.33$ V

   E°_{RP} for M > E°_{RP} for X

   Thus, $M^+ + e \longrightarrow M$

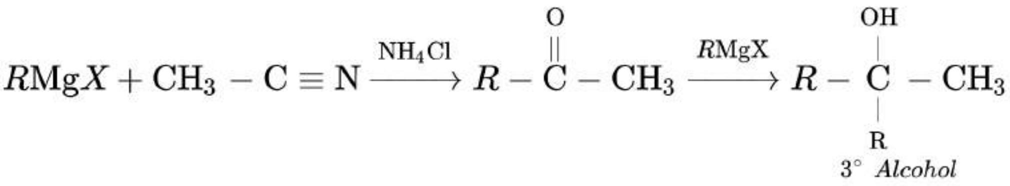
   $X^- \longrightarrow X + e$

   $\therefore M^+ + X^- \longrightarrow M + X$

   $E^\circ_{\text{cell}} = E^\circ_{OP_X} + E^\circ_{RP_M} = -0.33 + 0.44 = 0.11$ V

2. **(d)** 3° ROH

   Explanation:



$$RMgX + CH_3 - C \equiv N \xrightarrow{NH_4Cl} R - \overset{\overset{O}{\|}}{C} - CH_3 \xrightarrow{RMgX} R - \underset{\underset{R}{|}}{\overset{\overset{OH}{|}}{C}} - CH_3$$

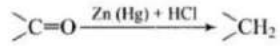
3° *Alcohol*

3. **(b)** n-heptane

   Explanation: n-heptane
4. **(c)** a metal can be extracted profitably from it

   Explanation: a metal can be extracted profitably from it
5. **(a)** $(CH_3)_2CHOH$

   Explanation: Secondary alcohol on oxidation forms ketone which reacts with hydrazine bus doesn't gives a silver mirror test.

6. **(c)** Increase the freezing point of water in winter and boiling point in summer
Explanation: Adding ethylene glycol to water reduces the freezing point of water. Water freezes at temperatures much less than 0 degrees Celsius when ethylene glycol is added to it. It is used as an anti-freeze. This practice was mostly practised in older radiators in cold weather conditions.
Another aspect of using glycols is that they have a higher boiling point(197 deg C) as compared to water. Hence, they don't get vapourised easily inside the radiator. They also have a higher specific heat capacity for which they are capable of transferring more heat from the engine as compared to water.
7. **(a)** Zinc amalgam + HCl
Explanation:
Clemmensen reduction is used to convert the carbonyl group(aldehyde or ketone) to CH_2 group as follows


Zinc amalgam and HCl act as a reagent in this reaction.
8. **(b)** Solubility
Explanation: $P_{gas} = K_H \times X_{gas.} \quad X_{gas}$
is measure of solubility of gas.
9. **(a)** $(CH_3)_3C—I$
Explanation: S_N1 reactions are generally carried out mainly in polar protic solvents (like H_2O) and they follow first-order kinetics. This means that the rate of reaction depends only on one reactant. This reaction favours tertiary alkyl halides because of the high stability of the formed carbocation. The carbocation forms when the molecule is polarized in water to form a carbocation and halide ion attacked by the nucleophile. The reactivity of the halides are R–I> R–Br>R–Cl>>R–F. Hence, $(CH_3)_3C—I$ will undergo the reaction most readily.

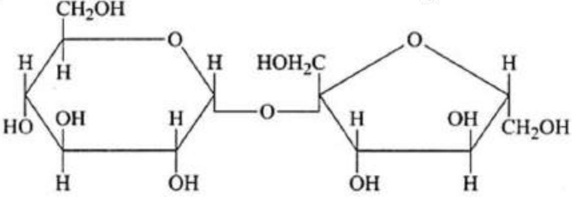
10. **(c)** 390.71 $ohm^{-1}\ cm^2\ mol^{-1}$

Explanation: $\Lambda^{\circ}_{CH_3COOH} = \Lambda^{\circ}_{CH_3COONa} + \Lambda^{\circ}_{HCl} - \Lambda^{\circ}_{NaCl}$

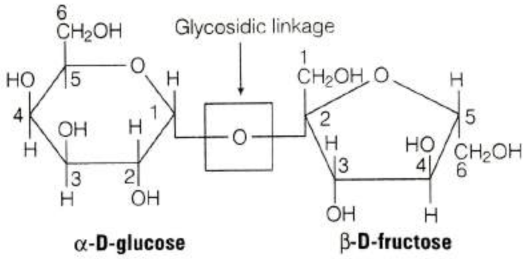
11. **(b)** $[Xe]4f^7 5d^1 6s^2$

Explanation: Half-filled and fully-filled orbitals are more stable.

12. **(c)**



Explanation:



This structure represents sucrose in which $\alpha-$D glucose and $\beta-$D fructose is attached to each other by C_1-C_2 glycosidic linkage. Since reducing groups of glucose and fructose are involved in glycosidic bond formation, this is considered as a non-reducing sugar.

13. **(c)** Pseudo first order reaction

Explanation: It is a pseudo-first-order reaction. Pseudo means false. It appears to be a second-order reaction but actually, it is a first-order reaction.

14. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: Due to steric hindrance, tertiary haloalkanes do not prefer to undergo substitution but instead undergo elimination.

15. **(b)** E = $\frac{96500 \times P}{c \times t}$

Explanation: W = $\frac{E \times i \times t}{96500}$

$\therefore$ P = $\frac{E \times c \times t}{96500}$ or E = $\frac{96500 \times P}{c \times t}$

16. **(d)** If both Assertion and Reason are false statements.

Explanation: Elevation of boiling-point describes that the boiling point of a liquid (a solvent) will be higher when another compound is added to it, meaning that a solution has a higher boiling point than a pure solvent.

This happens whenever a non-volatile solute, such as a salt, is added to a pure solvent, such as water.

When methanol is added to water, the boiling point of water decreases.

When a more volatile solute is added to the volatile solvent vapour pressure of solvent increases due to an elevation in boiling point colligative property.

17. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: O-nitrophenol contains intramolecular hydrogen bonding between hydrogen of hydroxyl group and oxygen of nitro group. Due to this the hydrogen atom of hydroxyl group is firmly attached to molecule and cannot be easily lost. Such intramolecular hydrogen bonding is not present in p-nitrophenol. Thus, p-Nitrophenol is a stronger acid than o-nitrophenol. This is also supported by pK_a

values. The pK_a of p-nitrophenol is 7.1 which is lower than that of o-nitrophenol ($pK_a = 7.2$). Stronger acid has a lower pK_a value.

18. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: Weak electrolytes dissociate partially in the concentrated solution. On dilution, their degree of dissociation increases hence their Λ_m value increases sharply.

Section B

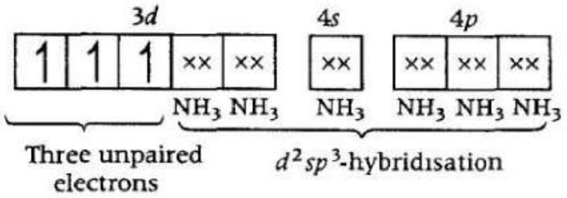
19. (a) (Nil) (b) Two (tac and mer)

20. The difference of energy between two sets of d-orbitals after splitting is called crystal field splitting energy or crystal field stabilizing energy (CFSE).

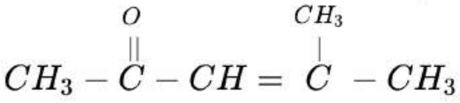
OR

$[Cr(NH_3)_6]^{3+}$: In it, Cr is present as Cr^{3+}. Outer electronic configuration of Cr^{3+} = $3d^3 4s^0$

$[Cr(NH_3)_6]^{3+}$ =



So, it has octahedral geometry and paramagnetic nature.

21. 

$CH_3 - \overset{\overset{O}{||}}{C} - CH = \overset{\overset{CH_3}{|}}{C} - CH_3$

OR

i. $CH_2 = CH - CH_2OH \xrightarrow[CH_2Cl_2]{PCC} CH_2 = CH - CHO$

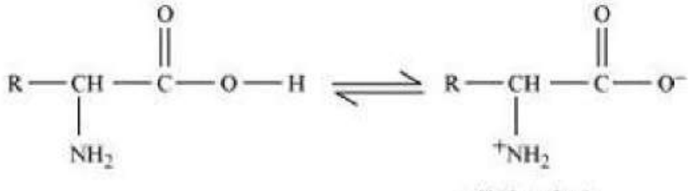
Here, PCC is Pyridinium chlorochromate, a 1 : 2 complex of chromium trioxide pyridine ($CrO_3 \cdot 2C_5H_5N$) which only oxidises OH group and not the = bond.

ii. $CH_3 - COOH \xrightarrow[-H_2O]{NH_3/heat} CH_3 - CONH_2$

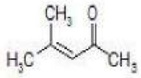
22. i. Potassium trioxolatoaluminate(III)
$K_3[Al(C_2O_4)_3]$
ii. Dichloridobis(ethane-1, 2-diamine)cobalt (III)
$[CoCl_2(en)_2]^+$

23. $Rate = k[A]^x[B]^y$
Order = $x + y$
so, order = $\frac{5}{2}+\frac{3}{2}= 4$.
i.e; reaction is fourth order reaction.

24. Both acidic (carboxyl) as well as basic (amino) groups are present in the same molecule of amino acids. In aqueous solutions, the carboxyl group can lose a proton and the amino group can accept a proton, thus giving rise to a dipolar ion known as a zwitter ion.



Due to this dipolar behaviour, they have strong electrostatic interactions within them and with water. But halo-acids do not exhibit such dipolar behaviour.
For this reason, the melting points and the solubility of amino acids in water is higher than those of the corresponding halo-acids.

25. 

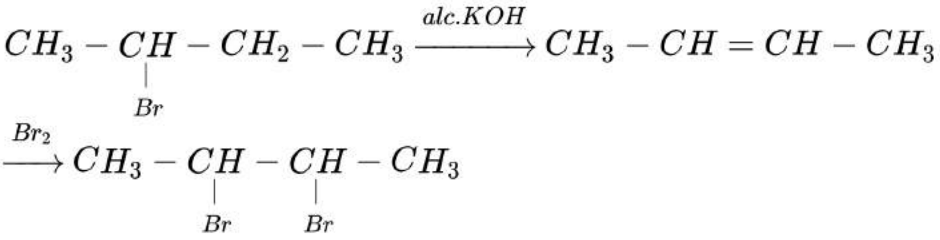
Section C

26. $SO_2CI_2(g) \rightarrow SO_2(g) + CI_2(g)$

Initial pressure	p_i	0	0
After time, t	$p_i - p$	p	p

Total pressure after time t,
i.e. $p_t = p_i - p + p + p = p_i + p$
$\Rightarrow p = p_t - p_i$

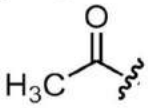
Thus, $a = p_i$ and $a - x = p_i - p = p_i - (p_t - p_i)$
$= p_i - p_t + p_i = 2p_i - p_i$
Substituting the values of a and (a - x) in equation,
$k = \frac{2303}{t} \log \frac{a}{a-x}$
$k = \frac{2303}{t} \log \frac{p_1}{(2p_t - p_t)}$
Calculating rate constant (k), when t = 100s
Given, $P_t = 04$ atm and e, = 0.7 atm
Then, $k = \frac{2303}{100} \log \frac{p_t}{(2p_t - p_t)}$
$= \frac{2303}{100} \log \frac{0.4}{(2 \times 0.4 - 0.7)}$
$= \frac{2.303}{100} \log \frac{0.4}{0.1} = \frac{2.303}{100} \log 4$
$= \frac{2303}{100} \times 06021 = 0.01387 = 1.387 \times 10^{-2} s^{-1}$

27. 

$$CH_3 - \underset{\underset{Br}{|}}{CH} - CH_2 - CH_3 \xrightarrow{alc.KOH} CH_3 - CH = CH - CH_3 \xrightarrow{Br_2} CH_3 - \underset{\underset{Br}{|}}{CH} - \underset{\underset{Br}{|}}{CH} - CH_3$$

28. i. **Acetylation:** Acetylation simply involves the addition of an acetyl group to a compound. An acetyl group is made up of a carbonyl group, or carbon double

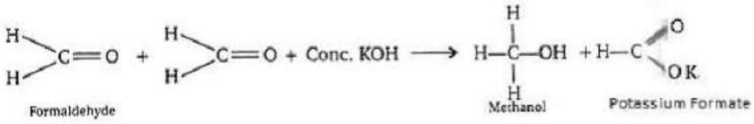
bonded to oxygen, with a methyl group (-CH_3) on the end. The part of the acetyl group that's attached to the compound is often represented with 'R'.



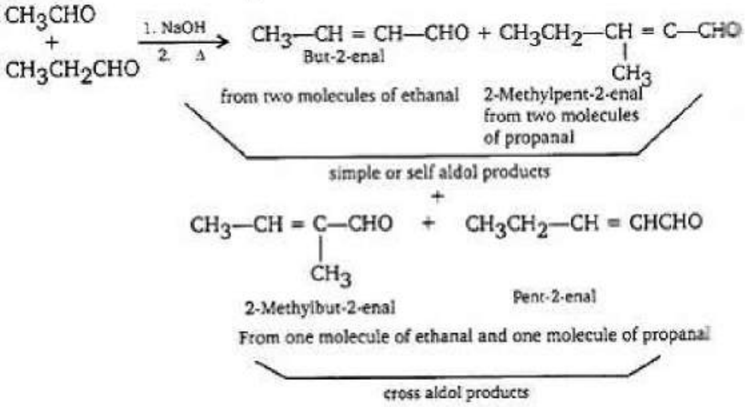
Example:

$$\underset{\text{Acetyl chloride}}{CH_3COCl} + \underset{\text{ethyl alcohol}}{CH_3CH_2OH} \xrightarrow{Pyridine} \underset{\text{ethyl acetate}}{CH_3COOC_2H_5} + HCl$$

ii. **Cannizzaro reaction:** Aldehydes which do not have an alpha-hydrogen atom, undergo self oxidation and reduction (disproportionation) reaction on treatment with concentrated alkali. In this reaction, one molecule of the aldehyde is reduced to alcohol while another is oxidized to carboxylic acid salt.



iii. **Cross aldol condensation:** When aldol condensation is carried out between two different aldehydes and / or ketones, it is called cross aldol condensation. If both of them contain alpha-hydrogen atoms, it gives a mixture of four products. This is illustrated below by aldol reaction of a mixture of ethanal and propanal.



iv. **Decarboxylation:** Carboxylic acids lose carbon dioxide to form hydrocarbon when their sodium salts are heated with soda lime (NaOH and CaO in the ratio of 3 : 1). This reaction is known as decarboxylation.

$$R-COONa \xrightarrow[Heat]{NaOH\ and\ CaO} R-H+Na_2CO_3$$

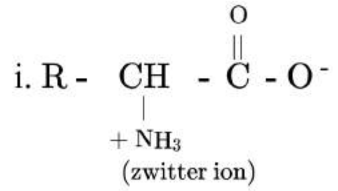
29. a. **Anomers:** These are the hemi-acetal forms of glucose which differ in the configuration at C_1 of hydroxyl group.

e.g.- α -glucose and β-glucose.

b. **Denaturation of proteins:** When native protein is subjected to change in temperature and pH, then it loses its biological activity.
e.g.- Curdling of milk.

c. **Essential amino acids:** The amino acid which do not get synthesised by our body are called essential amino acid.
e.g.-Valine.

OR



i. $R-\underset{\overset{|}{^{+}NH_3}}{CH}-\overset{\overset{O}{||}}{C}-O^{-}$

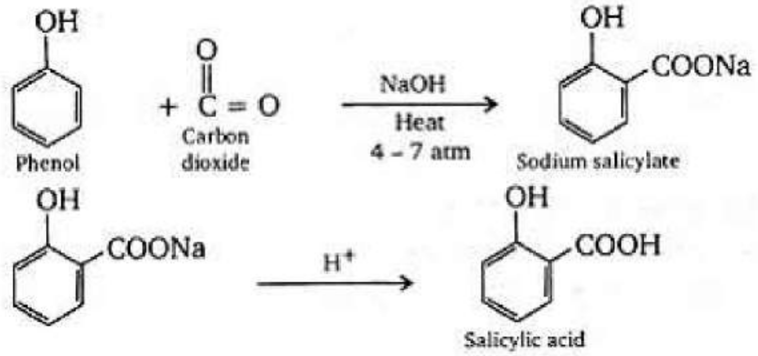
(zwitter ion)

ii. acidic

iii. anode

30. i. $CH_3CH = CH_2 \xrightarrow[\text{(ii) } H_2O_2 / OH]{\text{(i) } R_2H_2} \underset{\text{1 - Propanol}}{CH_3CH_2CH_2OH}$

ii.



Section D

31. **Read the text carefully and answer the questions:**

In order to overcome the scarcity of drinking water in a remote village in Gujarat, Arnav and Aariv two young entrepreneurs still in their high school, have developed a unique water purifier that is capable of converting sea water into drinking water. It works on the principle of concentration difference between two solutions.

(i) The product is based on the phenomenon of Reverse Osmosis between solutions of two different concentration.

(ii) When solutions of two different concentration are separated by a semipermeable membrane and excess pressure is applied on the solution of higher concentration, solvent flow from higher concentration to lower concentration. This is called Reverse Osmosis and same can be used to treat seawater and convert into drinking water.

(iii)Following arrangement must have been made:

i. Use of a semipermeable membrane.

ii. Separate Compartment having seawater and Drinking Water separated by semipermeable membrane.

iii. Excess pressure applied in compartment having sea water.

OR

NaCl is an electrolyte and gets dissociated to two ions (Na^+ and Cl^-) and exerts almost double osmotic pressure than glucose which is a non-electrolyte and does not dissociate.

32. **Read the text carefully and answer the questions:**

The f-block consists of elements in which 4f and 5f orbitals are progressively filled. They are placed in a separate panel at the bottom of the periodic table. The names transition metals and inner transition metals are often used to refer to the elements of d-and f-blocks respectively. The d–block occupies the large middle section of the periodic table flanked between s and p blocks in the periodic table. In general, the electronic configuration of the outer orbitals of these elements is $(n-1)d^{1-10}ns^{1-2}$. The electronic configurations of outer orbitals of Zn, Cd, Hg and Cn are represented by the general formula $(n-1)d^{10}ns^2$. The transition metals and their compounds also exhibit catalytic property and paramagnetic behaviour. Transition metal also forms an alloy. An alloy is a blend of metals prepared by mixing the components. Alloys may be homogeneous solid solutions in which the atoms of one metal are distributed randomly among the atoms of the other.

(i) The transition metals are quite similar in size and, therefore, the atoms of one metal can substitute the atoms of other metal in its crystal lattice. Thus, on cooling a mixture solution of two or more transition metals, solid alloys are formed.

(ii) The high enthalpies of atomization are due to a large number of unpaired electrons in their atoms. Therefore, they have stronger interatomic interactions and hence, stronger bonding between atoms.

(iii)Transition elements and many of their compounds are paramagnetic, i.e., they are weakly attracted by a magnetic field. This is due to the presence of unpaired electrons in atoms, ions or molecules. The paramagnetic character increases as the number of unpaired electrons increases.

OR

a. The ability of transition metal ion to pass easily from one oxidation state to another and thus providing a new path to reaction with lower activation energy.

b. The surface of transition metal acts as very good adsorbent and thus provides increased concentration of reactants on their surface causing the reaction to occur.

Section E

33. i. a. Nitration is carried out in acidic medium. In an acidic medium, aniline is protonated to form the anilinium ion which is meta directing. That is why besides the ortho and para derivatives, a substantial amount of meta derivative (m-nitroaniline) is also formed.

b. $(CH_3)_2NH$ is a secondary amine and $(CH_3)_3N$ is a tertiary amine. Tertiary amine due to the presence of three alkyl groups is more hindered than secondary amine which has only two alkyl groups attached to it. Therefore formation of ammonium ion is easier in secondary amine than the tertiary amine. Therefore, it makes secondary amine less basic than the tertiary amine.

c. The ammonolysis of alkyl halide leads to the formation of the mixture of primary, secondary and tertiary amine along with the formation of quaternary salt. It is very difficult to separate pure primary amine from this mixture.

ii. a.

Test	**$CH_3CH_2NH_2$**	**$(CH_3CH_2)_2NH$**
Carbylamine test (add chloroform and alcoholic KOH to both the compounds separately in a test tube)	Forms a foul-smelling compound (gives positive test)	No reaction take place (gives negative test)

b.

Azo dye Test	**Aniline**	**Methyl Amine (CH_3NH_2)**
Add a small amount of nitrous acid with aq. HCl	Forms a yellow coloured dye (gives positive test)	No dye is formed(gives negative test)

OR

i. $\underset{Ethanoic\ acid}{CH_3COOH} \xrightarrow[-SO_2,\ -HCl]{SOCl_2} CH_3COCl \xrightarrow{NH_3(excess)} CH_3CONH_2$
$\xrightarrow[Hoffmann\ bromamide\ reaction]{Br_2,\ KOH} \underset{Methanamine}{CH_3NH_2}$

ii. $\underset{Hexanenitrile}{CH_3(CH_2)_4CN} \xrightarrow[Hydrolysis]{H_3O^+} CH_3(CH_2)_4COOH \xrightarrow{SOCl_2} CH_3(CH_2)_4COCl$
$\xrightarrow{NH_3(excess)} CH_3(CH2)_4CONH_2 \xrightarrow[Hoffmann\ bromamide\ reaction]{Br_2,\ KOH} \underset{1-Aminopen\ tan\ e}{CH_3(CH_2)_4NH_2}$

iii. $\underset{Ethanamine}{CH_3CH_2NH_2} \xrightarrow{HONO} CH_3CH_2OH \xrightarrow[Oxidation]{K_2Cr_2O_7,\ H^+} CH_3CHO \xrightarrow[Oxidation]{K_2Cr_2O_7,\ H^+}$
CH_3COOH

iv. $\underset{Nitromethane}{CH_3NO_2} \xrightarrow[Reduction]{Sn,\ HCl} CH_3NH_2 \xrightarrow[\triangle]{CHCl_3,\ KOH} CH_3NC \xrightarrow[Reduction]{Na,\ C_2H_5OH} \underset{Dimethylamine}{CH_3NHCH_3}$

v. $\underset{Propanoic\ acid}{CH_3CH_2COOH} \xrightarrow{NH_3} CH_3CH_2COONH_4 \xrightarrow{\triangle} CH_3CH_2CONH_2 \xrightarrow[Hoffmann\ bromamide\ reaction]{Br_2,\ KOH}$

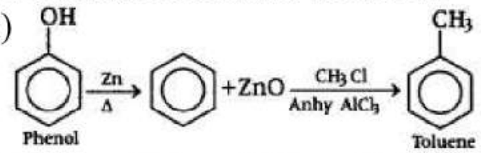
$CH_3CH_2NH_2 \xrightarrow{HONO} CH_3CH_2OH \xrightarrow[Oxidation]{K_2Cr_2O_7,\ H^+} \underset{Ethanoic\ acid}{CH_3CHO} \xrightarrow[Oxidation]{K_2Cr_2O_7,\ H^+}$
$\underset{Ethanoic\ acid}{CH_3COOH}$

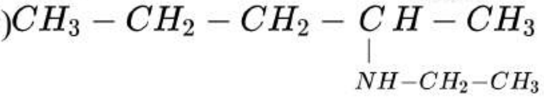
34. Answer the following questions:

(i) $\frac{dx}{dt} = K[X]^3$

(ii) Potassium trioxalato ferrate III

(iii)



(iv)

$CH_3 - CH_2 - CH_2 - \underset{NH-CH_2-CH_3}{\underset{|}{C}}H - CH_3$

(v) Due to lanthanide contraction (filling of 4f before 5d orbital) , the atomic radii of the second and third row transition elements are almost same. Therefore, they resemble each other much more as compared to first row elements.

35. The two cells may be represented as:

Zn | Zn^{2+} (conc = C) || Cu^{2+} (C=?) | Cu EMF = E_1 (say)

Zn | Zn^{2+} (conc = C) || Cu^{2+} (C=0.5 M) | Cu EMF = E_2 (say)

E_2 - E_1 = 0.03 V (Given)

The cell reaction is

$Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu(s)$

For n = 2, Nernst equation is

$E_{cell} = E^{\ominus}{}_{cell} - \frac{2.303RT}{nF}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$

$E_{cell} = E^{\ominus}{}_{cell} - \frac{2.303RT}{2F}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$

$= E^{\ominus}{}_{cell} - \frac{0.0591}{2}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$

$\therefore E_1 = E^{\ominus}{}_{cell} - \frac{0.0591}{2}\log\frac{C}{[Cu^{2+}]}$

and $E_2 = E^{\ominus}{}_{cell} - \frac{0.0591}{2}\log\frac{C}{0.5}$

$\therefore E_2 - E_1 = \frac{0.0591}{2}\left\{\log\left(\frac{C}{Cu^{2+}}\right) - \log\left(\frac{C}{0.5}\right)\right\}$

$0.03 = 0.02955\log\frac{0.5}{Cu^{2+}}$

or $\log\frac{0.5}{Cu^{2+}} = \frac{0.03}{0.02955}$

or $\log\frac{0.5}{Cu^{2+}} = 1.015$

$\frac{0.5}{Cu^{2+}} = 10^{1.015}$

$\therefore [Cu^{2+}] = \frac{0.5}{10^{1.015}} = 0.0483mol\ L^{-1}$

OR

a. i. It is highly efficient and do not produce pollution.

ii. The H_2O produced can be used by astronauts for drinking purpose.

b. We have, mass(m) deposited is

$m = Z \times I \times t$

$m = \frac{108}{96500} \times 0.5 \times 2 \times 60 \times 60$

$= \frac{108\times5}{965\times10} \times 2 \times 6 \times 6$= 4.03 g

$4.03g = V \times d$

$4.03g = V \times 10.5gcm^{-3}$

V = Area × Thickness

$V = \frac{4.03}{10.5}$

$\frac{4.03}{10.5} = 900cm^2\times$ thickness

Thickness $= \frac{0.338cm^3}{900cm^2}$

$= 4.26 \times 10^{-4}cm$