Q. No. 2 (i)

→ **Removing Temporary Hardness by Boiling.**

Temporary hardness can be removed by boiling. In this process the hydrogen carbonates are converted into insoluble carbonates. So the Ca^{+2} and Mg^{+2} ions causing hardness are eventually removed as carbonates $CaCO_3$ and $MgCO_3$, which leaves water soft.

Reaction :-

$$M^{+2}(HCO_3)_2 \xrightarrow[\text{Boiling}]{H_2O} M^{+2}CO_3^{-2} + CO_2 + H_2O$$

where $M^+ = Ca^{+2}$ or Mg^{+2}

↑ Removing Temporary hardness ↑ by Boiling is to expensive to be done at a large scale.

.....

Q. No. 2 (ii)

Reaction :-

$$H_2O + HCl \longrightarrow H_3O^+ + Cl^-$$

H_2O is a Bronsted base because its accepts proton(H^+) and we know that Bronsted Theory demands bases to be proton acceptor. H_2O gains proton and becomes a hydronium ion (H_3O^+).

HCl as Acid :-

HCl is a Bronsted acid because it donates proton (H^+). It looses its proton and donates it to water - Thus itself becomes a negatively charged ion ~~hydro~~x chloride (Cl^-)

Q. No. 2 (iii)

$$H_2O + HCl \rightarrow H_3O^+ + Cl^{-2}$$

→ **H_2O as Base:-**

H_2O is Bronsted **Base** because it accepts protons (H^+). It is a proton acceptor and it forms a positively charged hydronium ion. (H_3O^+).

→ **HCl as Acid:-**

HCl is Bronsted **Acid** because it donates its protons and becomes a negatively charged Cl^- ion. It donates protons, therefore it is an acid.

.....

Q. No. 2 (iv)

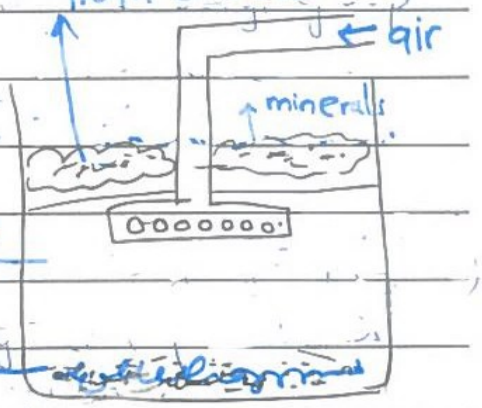
Identifying Acid Base and Salt:-

NaOH	H_2SO_4	NaCl
It is a "BASE". It contains OH^- group and in hydrolysis it liberates OH^- ions. So it act as a base	It is an "ACID" It contains $2H^+$ group. It hydrolyses in water and produces H^+ ions. So it is	It is a salt. Its name is Sodium Chloride. It is formed by replacement of H^+ ions in the acid. It contains Na^+ metal in first part and Cl^- which is negative part of acid

Q. No. 2 (v)

- **Concentration of Ore by Floatation:-**

This process requires the pulverized ore to be dipped in a tank containing an **oil-detergent** mixture and the mineral particles are wetted by the water and the silicate slag remains dry and settles at the bottom. The mineral particles appear on the surface of the tank and appear along with froth bubbles and from here mineral particles are skimmed off.



Concentration by Floatation.

Q. No. 2 (vi)

(a) It is an (alkene). There exists a double bond between 2 carbon atoms. (C = C).

(b) It is containing functional group of **carboxylic acid**. It contains hydrogen atom bonded with one side of carboxyl group.

(c) It is an **aldehyde**. The carbonyl group given is attached with allyl radical and a hydrogen atom on one side.

Q. No. 2 (vii)

Forward Reaction	Reverse Reaction
Microscopic Characteristics.	
• Forward Reaction always proceeds from left to right	• Reverse Reaction proceeds from right to left.
• Reactants form products.	• Products form Reactants
• Rate is ~~fastest~~ in beginning and eventually slows down.	• Rate is zero in beginning and eventually increases

Example :- ($N_2 + 3H_2 \rightleftharpoons 2NH_3$)

Forward Reaction	Reverse Reaction :-
$N_2 + 3H_2 \longrightarrow 2NH_3$	$2NH_3 \longrightarrow N_2 + 3H_2$

.....

Q. No. 2 (viii)

Properties of Water :-

- Pure Water has a pH 7 and is neutral.

1. ~~Pure~~ Water Boils at 100°C and freezes 0°C
2. It has high heat of vapourization
3. It is tasteless, colourless and odourless
4. It has high heat capacity.
5. It expands on cooling and contracts on heating
6. It is the only substance that exists in all 3 States of solids, liquids and gas.

Q. No. 2 (ix)

a) Dehydration of Alcohols:-

Dehydration means "loss of water", Alcohols dehydrate their vapours and produce ~~ethene~~ alkene when they pass through heated Alumina

$$\underset{\text{(ethanol)}}{CH_3-\underset{OH}{\underset{|}{CH_2}}} \xrightarrow[240^\circ C \text{ to } 370^\circ C]{Al_2O_3} \underset{\text{(ethene)}}{CH_2=CH_2} + H_2O.$$

(b) Dehydrohalogenation of Alkyl Halides:- It means "loss of hydrogen halide". It occurs in presence of alcoholic pottasium hydroxide

$$\underset{\text{(ethyl chloride)}}{CH_3-\underset{Cl}{\underset{|}{CH_2}}} + KOH \xrightarrow{Alcohol} \underset{\text{(ethene).}}{CH_2=CH_2} + KCl + H_2O$$

.....

Q. No. 2 (x)

KMnO4 and alkanes:-

The $KMnO_4$ gives reaction only with unsaturated ~~substances~~ hydrocarbons. Since alkane is not an unsaturated hydrocarbon it does not give Baeyers Test with $KMnO_4$, meaning no colour is discharged as alkanes are saturated.

Reaction of KMnO4 with alkene :-

On other hand alkene give reaction with $KMnO_4$.

$$\underset{\text{(ethene)}}{3\,CH_2=CH_2} + 2\,KMnO_4 + 4H_2O \rightarrow 3\,\underset{OH\ \ OH}{\underset{|\ \ \ |}{CH_2-CH_2}} + 2MnO_2 + 2H_2O$$

(ethylene glycol)

1/. addition of $2\,OH^-$ group occurs and pink colour is discharged.

Q. No. 2 (xi)

Nucleic acids like **DNA** and **RNA** are important in our lifes because.

IMPORTANCE :-

- DNA is the genetic material which stores all genetic information like genes.
- DNA plays an important role in genetic variation and inheritance.
- DNA is the information control centre of cell and what a cell is doing is actually done by DNA.
- RNA is involved in protein synthesis which is essential as proteins are required for our muscles, characteristics and for the formation of enzymes.

.....

Q. No. 2 (xii)

* **Depletion of Ozone Layer :-**

When Chlorflourocarbon (CFC) interact with (UV) radiation they form free radicals **($Cl^{\cdot}$)**. These interact and disintegrate ozone layer by forming Chlorine monoxide **($Cl^{\cdot}O$)** and then it reacts with atomic oxygen to regenerate free radical ($Cl^{\cdot}$)

$$CCl_3F \xrightarrow{UV} CCl_2F + Cl^{\cdot}$$

$$\left\{ \begin{array}{l} Cl^{\cdot} + O_3 \longrightarrow Cl^{\cdot}O + O_2 \\ Cl^{\cdot}O + O \longrightarrow Cl^{\cdot} + O_2. \end{array} \right\}$$

Net Reaction :- $O + O_3 \longrightarrow 2O_2$.

This causes ozone depletion and ultimately ozone holes.

* Thus one $Cl^{\cdot}$ radical is responsible for the **disintegration** of 1000s of O_3 molecules. It acts as a catalyst in break-down of Ozone layer. Thus CFC's have been banned.

Q. No. 2 (xiii)

REMOVING TEMPORARY HARDNESS :-

- **Clark's Method :- Adding slaked lime**

At large scale production, Temporary hardness is removed by adding slaked lime $\{Ca(OH)_2\}$ to hard water. This reaction converts the soluble hydrogen carbonates into insduble carbonates.

Reaction :-

* $Ca(HCO_3)_2 + Ca(OH)_2 \longrightarrow 2CaCO_3 + 2H_2O$

* $Mg(HCO_3)_2 + Ca(OH)_2 \longrightarrow MgCO_3 + CaCO_3 + 2H_2O$

$MgCO_3$ and $CaCO_3$ are now insoluble carbonates which are removed, leaving the water (soft).

.....

Q. No. 2 (xiv)

- **Urea :-**

Urea is a **synthetic fertilizer**. Its formula is NH_2CONH_2 It is an excellent fertilizer as it contains maximum amount of Nitrogen (46.6%)

Preparation :-

1) Reaction of Ammonia and Carbondioxide :-

$$2NH_3 + CO_2 \longrightarrow NH_2COOHNH_4$$

(ammonium carbamate).

2) Distillation of ammonium carbamate :-

$$NH_2COOHNH_4 \longrightarrow NH_2-\overset{\overset{O}{\|}}{C}-NH_2 + H_2O$$

(Urea solution)

3) Evaporation of liquid urea and granulation :-

Urea is evaporated and then cooled down to urea prills

Q. No. 2 (xv)

→ FRACTIONS OF PETROLEUM :-

1) Diesel
2) Kerosene
3) Naptha
4) Bitumen
5) Feul Oil
6) Lubricating Oil
7) Petrol / Gasoline
8) Liquified Petroleum Gas

Q. No. 3 (Page 1/4)

(a)

***Law of Mass Action:-** (Introduced in 1864)

Law of Mass Action states that the rate at which a substance reacts is directly proportional to its active mass. Alternate defination is

"The rate at which a reaction proceeds is directly proportional to the product of the active mass of the reactants in a chemical reaction"

***ACTIVE MASS:-**

The term active mass refers to concentration of reactants and products in $mol \cdot dm^{-3}$ and it is represented in square brackets. "[ ]."

- **Example:-**

Consider the following Reaction:-

***Equation:-**

$$PCl_3 + Cl_2 \rightleftharpoons PCl_5$$

DERIVATION:-

→ Forward Reaction:- $PCl_3 + Cl_2 \longrightarrow PCl_5$

→ Reverse Reaction:- $PCl_5 \longrightarrow PCl_3 + Cl_2$.

Rate of Forward Reaction $\propto [PCl_3][Cl_2]$

Rate of forward Reaction $= K_f [PCl_3][Cl_2]$

Rate of Reverse Reaction $\propto [PCl_5]$

Rate of Reverse Reaction $= K_r [PCl_5]$

Q. No. 3 (Page 2/4)

At equilibrium,

Rate of Forward Reaction = Rate of Reverse Reaction

$$K_f [PCl_3][Cl_2] = K_r [PCl_5]$$

Rearranging for K_c

$$\frac{K_f}{K_r} = \frac{[PCl_5]}{[PCl_3][Cl_2]}$$

Where, $\frac{K_f}{K_r} = K_c$

Hence,

$$K_c = \frac{[PCl_5]}{[PCl_3][Cl_2]}$$

Defination:-

K_c :- It is defined as ratio of product of active mass of products to the product of active mass of reactants each raised to power equal to the coeffient in a balanced chemical equation.

Units:-

$$K_c = \frac{[PCl_5]}{[PCl_3][Cl_2]}$$

$$K_c = \frac{[mol \cdot dm^{-3}]}{[mol \cdot dm^{-3}][mol \cdot dm^{-3}]}$$

$$K_c = \frac{1}{mol \cdot dm^{-3}}$$

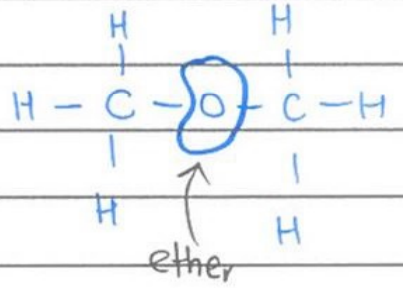
$$K_c = mol^{-1} \cdot dm^3$$

$$K_c = dm^3 \cdot mol^{-1}$$

Q. No. 3 (Page 3/4)

-b-

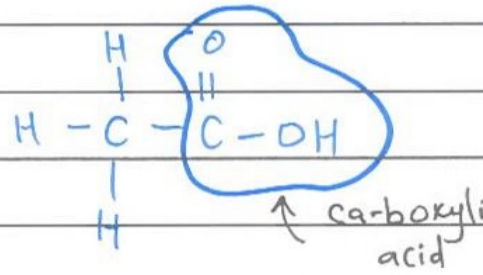
(i) CH_3OCH_3



FUNCTIONAL GROUPS

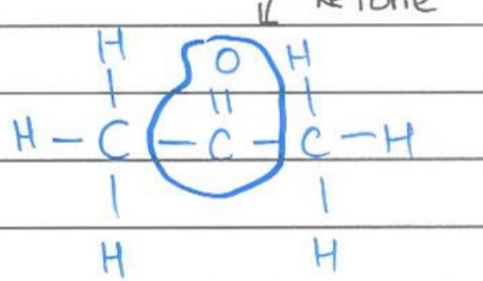
The functional group is (Ether). There exists an oxygen atom between 2 alkyl radical groups

(ii) CH_3COOH



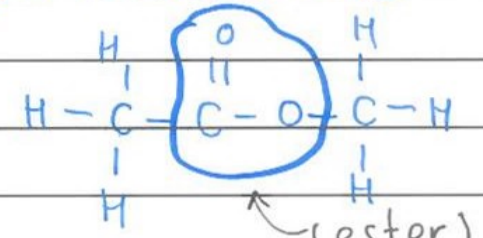
The functional group is (carboxylic acid). As an H atom on one side is attached with the carboxyl group.

(iii) CH_3COCH_3



The functional group is (Ketone). As two alkyl radicals are attached with carbonyl group.

(iv) CH_3COOCH_3



The functional group is (Ester). It contains two alkyl radicals bonded with carboxyl group.

Q. No. 3 (Page 4/4)

Q. No. 4 (Page 1/4)

(a)

REACTION OF ALKYNE WITH $KMnO_4$:-

1) Strong alkaline solution of $KMnO_4$:-

In first step the alkaline solution of $KMnO_4$ is converted in to strong alkaline solution of $KMnO_4$. It reacts with pottasium hydroxide solution and gives a basic solution and oxygen.

Reaction:-

$$4KMnO_4 + 4KOH \rightarrow 4K_2MnO_4 + 4[O] + 2[H_2O]$$

2) Production of Tetrahydroxy ethane :-

In second step ethyne is converted in to tetra hydroxy ethane by adding of 4 Hydroxyl groups. (OH^-)

$$CH \equiv CH + 2[O] + 2H_2O \rightarrow \underset{\displaystyle OH \quad OH}{\overset{\displaystyle OH \quad OH}{CH - CH}}$$

(Tetrahydroxy ethane).

3) Production of Glyoxal :-

Tetrahydroxy ethane is unstable. It undergoes **dehydration**.

$$\underset{\displaystyle OH \quad OH}{\overset{\displaystyle OH \quad OH}{CH - CH}} \xrightarrow{-2H_2O} \underset{}{\overset{\displaystyle O \quad O}{H - C - C - H}}$$

(glyoxal)

4) Formation of Oxalic Acid :-

The glyoxal produced then undergoes **oxidation** and oxalic acid is produced

$$\overset{\displaystyle O \quad O}{H - C - C - H} + 2[O] \rightarrow \overset{\displaystyle O \quad O}{HO - C - C - OH}$$

Q. No. 4 (Page 2/4)

(b)

Carbohydrates :-

Uses	Sources
1) Starch is used to make dextrin used for wallpaper glue	It is obtained from plants, sugar, fruits vegetables, cereals, wheat, barley and dairy products.
2) Cellulose is used in furniture building etc	
3) Sucrose is common table sugar	

Proteins

Uses	Sources
- They are used ~~to~~ as antibodies - To make gelatin - Formation of enzymes	Dairy Products and Meat, Fish, Egg, Poultry etc Also from seeds of plants

Lipids

Uses	Sources
- To produce fat soluble vitamin - To provide insulation to inner	• Cod Liver • Salmon and Whales • Dairy Products

Q. No. 4 (Page 3/4)

organs

Beans, Corn, seeds etc

- For production of ghee by catalytic hydrogenation.
- For cooking, frying etc

Q. No. 4 (Page 4/4)

Q. No. 5 (Page 1/4)

(a)

Types of Hard Water:- There are 2 types of hard water

1) Temporary Hardness
2) Permanent Hardness.

Temporary Hardness:-

* It is so called as it can be removed by "boiling"
* It is the water that contains dissolved calcium and magnesium hydrogen carbonates.

Methods to Remove Temporary Hardness

1) By Boiling
2) By adding slaked lime (Clark's Method).

Permanent Hardness

It is the hard water whose hardness cannot be removed by boiling.

Permanent Hard Water contains dissolved "Calcium and magnesium sulphates and chlorides"

Methods to Remove Permanent Hardness:-

It can be removed by 2 ways

1) Adding washing soda
2) Ion Exchange Resin Reaction

Q. No. 5 (Page 2/4)

1) Adding Washing Soda :-

In this process washing soda ($Na_2CO_3 \cdot 10H_2O$) is reacted with the ~~Ca+2~~ Ca^{+2} and Mg^{+2} ions of water and it converts them into insoluble Ca^{+2} and Mg^{+2} carbonates which is then removed leaving water soft.

Reaction :-

$$M^{+2} + CO_3^{-2} \longrightarrow MCO_3$$

where $M^{+2} = Ca^{+2}$ or Mg^{+2}

2) Using Ion Exchange Resin :-

Ion exchanging are also widely used to remove permanent hardness of water.

Example :- "Sodium Zeolite" is a natural ion exchange resin. It is mainly Sodium Aluminium Silicate and is generally represented as Na_2Z. During reaction with hard water zeolite exchanges its metal ions and forms bond with either Ca or Mg by liberating Na ions

Reaction :-

$$M^{+2} + Na_2Z \longrightarrow 2Na^{+} + MZ$$

where $M^{+2} = Ca^{+2}$ or Mg^{+2}.

The solid resin is then removed and so is the Ca^{+2} and Mg^{+2} ions causing hardness.

$$M^{+2}Z + 2NaCl \longrightarrow Na_2Z + M^{+2}Cl_2$$

where $M^{+2} = Ca^{+2}$ or Mg^{+2}

Q. No. 5 (Page 3/4)

(b)

* SOLVAY PROCESS:-

It is a large scale process done for the production of Soda Ash or Sodium Carbonate (Na_2CO_3).

* Raw Materials:-

Reactions:-

1) NH_3 (Ammonia)
2) Conc. NaCl (Brine)
3) $CaCO_3$ (limestone) as a source of CO_2 and slaked lime.

* **Reactions:-** Following Reactions occurs in formation of Soda Ash (Na_2CO_3).

1) Preparation of Ammonical Brine:-

Firstly Ammonia gas is dissolved in concentrated solution of NaCl (Brine). This leads to formation of Ammonical Brine

2) Carbonation:-

Ammonical Brine is fed into carbonating tower from where it reacts with carbondioxide.

$$NH_3 + CO_2 + H_2O \rightarrow NH_4HCO_3$$

$$NH_4HCO_3 + NaCl \rightarrow NaHCO_3 + NH_4Cl.$$

At lower compartments of carbonating tower the solution is heated at 15°C and $NaHCO_3$ precipitates out.

3) Filtration:-

The sodium hydrogen carbonate ($NaHCO_3$) is removed

Q. No. 5 (Page 4/4)

as Baking Soda

4) Calcinations:-

$NaHCO_3$ (sodium bicarbonate) is heated to produce soda ash (Na_2CO_3) and CO_2.

$$2NaHCO_3 \xrightarrow[\text{heat}]{} Na_2CO_3 + H_2O + CO_2$$

The CO_2 produced is utilized and fed in carbonating tower.

5) Limestone as source of CO_2 and slaked lime

Limestone ($CaCO_3$) is heated and produces CO_2 and CaO (lime)

$$CaCO_3 \xrightarrow{heat} CO_2 + CaO$$

CaO reacts with water at the lower compartments of carbonating tower and forms slaked lime $Ca(OH)_2$

$$CaO + H_2O \longrightarrow Ca(OH)_2$$

6) Recovery of Ammonia :-

Ammonia is recovered in Ammonia Recovery Tower by reaction of ammonium chloride (NH_4Cl) and slaked lime ($CaOH_2$). The following reaction occurs and it also produces $CaCl_2$.

$$2NH_4Cl + Ca(OH)_2 \rightarrow 2NH_3 + CaCl_2 + H_2O$$

The ammonia produced is reused

FLOW CHART:-