

C_2H_5OH

$CH_3CH_2OH + [O] \xrightarrow{KMnO_4/H_2SO_4} CH_3CHO$

$CH_3CHO + [O] \rightarrow CH_3COOH$

C	H	O
38.71 g	9.68 g	51.61 g
12	1	16
3.22	9.68	3.22
3.22	3.22	3.22
1	3	1

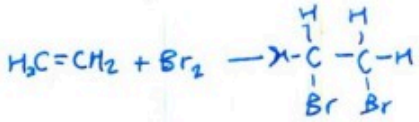
CH_3O

$12 + 3 + 16$

31

$\frac{62}{31}$ $n = 2$

$C_2H_6O_2$

$H_2C=CH_2 + Br_2 \rightarrow$ 

$NO_2 \rightarrow NO + [O]$

$H + [O] \rightarrow RCO$

$RCO + O_2 \rightarrow RCO(O_2)$

$RCO(O_2) + NO_2 \rightarrow RCO(O_2)NO_2$

$SO_2 \rightarrow$

✓ $SO_2 + H_2O \rightarrow H_2SO_3$ (Acid)

$CuO \rightarrow$

✓ $CuO + 2HCl \rightarrow CuCl_2 + H_2O$

Al_2O_3

✓ $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$

✓ $Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2NaAl(OH)_4$

$2NaAl(OH)_4$

Sodium Aluminate

Use for rough work

$$CH_2=CH_2 + H_2O_{(g)} \xrightarrow[6\,atm,\,300^\circ C]{H_3PO_4} CH_3CH_2OH$$

Metal + Steam ⟶ Metal Hydroxide

Naphtha : Chemical feedstock
LPG : Gas for cooking
Gasoline:
Kerosine oil:

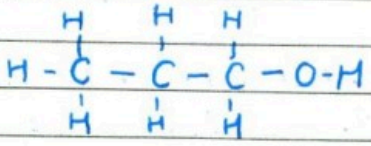
Q. No. 2 Part (i) Following is structural and displayed formula of Propan-1-ol.

Structural:

⇒ $CH_3CH_2CH_2OH$

Displayed:

⇒



Q. No. 2 Part (ii)

Given:

Mass of NaOH = m = 20g

Volume of Solution = V = 1dm³

Molar Mass of NaOH = 23 + 16 + 1

M_r = 40g/mol

To Find:

Concentration in mol/dm³ = ?

Solution

⇒ Moles of NaOH :

$\because n = m / M_r$

$n = 20g / 40g/mol$

$n = 0.5$ mol ★

⇒ Concentration in mol/dm³ :

$\because$ Molarity = $\frac{\text{moles of solute (mol)}}{\text{volume of solution}}$

$= \frac{0.5 \text{ mol}}{1 \text{ dm}^3}$

$= 0.5 \text{ mol/dm}^3$ ★ Ans

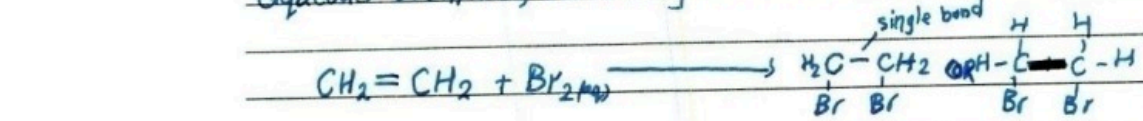
Hence concentration in mol/dm³ of a solution containing 20g of NaOH in 1dm³ solution is **0.5 mol/dm³.**

Q. No. 2 Part (iii) **Observation:**

When an unsaturated hydrocarbon such as an alkene or alkyne reacts with aqueous bromine, the brown colour of bromine water is discharged and the solution becomes colourless. Hence, brown colour of bromine water is seen being discharged.

Example:

Whene ethene (unsaturated hydrocarbon) reacts with aqueous bromine, following reaction occurs:



It reacts with ethene to form colourless 1,2-dibromoethane confirming the presence of unsaturated hydrocarbon.

Q. No. 2 Part (iv) **Polymer:**

A polymer is a large, long chain molecule formed by small molecules called monomers. Hence they are chains of monomers.

Example:

① Polyester is a type of polymer such as PET.
② Polyethylene is a polymer made from ethene (monomer).
③ Nylon is a polymer made from monomers adipic acid and hexamethyleneamine.

Q. No. 2 Part (v) **Reaction of Reactive Metal with Dilute Acid:**

Reactive metals readily react with dilute acid to produce a salt and hydrogen gas.

General Equation:

Metal + Acid ⟶ Salt + Hydrogen gas.

Example:

Reactive metals such as Na, K, and ~~Mg~~ Ca react with dilute acids. Their reactions are strong and rapid:

⇒ $2Na + 2HCl \longrightarrow 2NaCl + H_2$

⇒ $2Na + H_2SO_4 \longrightarrow Na_2SO_4 + H_2$

Above examples show that reactive metals react with acids to produce salt and hydrogen gas.

Q. No. 2 Part (vi) In Usual state, ionic compounds are **Solids.**

Reasons:

① Ionic compounds have strong electrostatic force between ions that are not easy to overcome.

② Ionic compounds have high melting and boiling points due to which they are solids in normal conditions.

③ Ionic compounds have crystal lattice structures in which each ion has strong attraction with all surrounding ions which needs high energy to overcome and change state.

Because of these reasons, Ionic Compounds are solids at normal conditions.

Q. No. 2 Part (vii) Yes, CaO, calcium oxide is considered a basic oxide. Generally all metal oxides are considered basic in nature. But CaO also displays characteristic qualities of bases as justified with equations below.

Chemical Equations:

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

Here CaO reacts with water to form Calcium Hydroxide with is a very strong base.

⇒ $CaO + H_2SO_4 \longrightarrow CaSO_4 + H_2O$

Here CaO reacts with an acid and neutralizes it to form salt and water displaying basic nature.

This is why calcium oxide is considered a basic oxide.

Q. No. 2 Part (viii)

Given:

- Empirical Formula = CH_2O
- Molar Mass = Mr of molecular formula = 180

- Molar Mass of Empirical formula
  $CH_2O = 12 + 2 + 16$
  $= 30$

To Find:

- Molecular Formula of Compound = ?

Solution:

$\because$ Molecular Formula = (Empirical Formula)$_n$

$\because n = \frac{\text{Mr of Molecular Formula}}{\text{Mr of Empirical Formula}}$

$n = 180/30 \Rightarrow n = 6$ ★

Molecular Formula = $(CH_2O)_6$

" " = $C_6H_{12}O_6$ ★ ANS

Q. No. 2 Part (ix) Following are reaction showing how PAN is formed :

⇒ $NO_{2(g)} \xrightarrow{\text{UV rays}} NO_{(g)} + [O]_{(g)}$ (nascent oxygen)

① $\text{Hydrocarbons}_{(g)} + [O]_{(g)} \xrightarrow{\text{Sunlight}} RCO_{(g)}$ (organic radical)

② $RCO_{(g)} + O_{2(g)} \xrightarrow{\text{Sunlight}} RC(O)O_{2(g)}$ (peroxy acyl radical)

③ $RC(O)O_{2(g)} + NO_{2(g)} \xrightarrow{\text{Sunlight}} RC(O)O_2NO_{2(g)}$ (peroxyacetyl Nitrate)

In this way, unburnt hydrocarbons (VOCs) react with nitrogen oxides to make PAN.

Q. No. 2 Part (x) **Vitamin A:**

Sources:

1. Carrots
2. Spinach
3. Nuts

Function:

1. vitamin A improves Vision.

Q. No. 2 Part (xi) Following is complete balanced equation for addition of steam to ethene to form ethanol:

⇒ $CH_2 = CH_2 + H_2O_{(g)} \xrightarrow[60atm,\ 300^\circ C]{H_3PO_4} CH_3CH_2OH$

ethene — ethanol

OR

⇒ $C_2H_4 + H_2O_{(g)} \xrightarrow[300^\circ C]{H_3PO_4,\ 60atm} C_2H_5OH$

ethene — ethanol

Q. No. 3 (Page 1) **Petroleum Fractions:**

Following are the names of four petroleum fractions that are obtained from crude oil:

1. Liqueified Petrol Gas (LPG)
2. Gasoline / Petrol
3. Naphtha
4. Kerosine Oil / Parrafine
5. Bitumen (Extra)

Uses of Given Petroleum Fractions:

1. LPG:

It is used for cooking. Our homes recieve LPG. It is burnt on cooking stoves to cook food. It is also used to light heaters in our homes.

2. Gasoline/Petrol:

It is used as fuel for cars and motorbikes.

3. Naphtha:

It is used as chemical feedstock for chemicals, plastics and drugs.

4. Kerosine Oil/Parrafine:

It is used fuel of jets and airplanes.

(P.T.O)

Q. No. 3 (Page 2) 5. Bitumen: It is used for making roads and rooftops.

Q. No. 4 (Page 1) **Classification of Oxides:**

① SO_2:

⇒ It is an acidic oxide.

⇒ Most non-metal oxides exhibit acidic properties and so does SO_2, Sulphur dioxide.

Balanced Equation:

⇒ $SO_2 + H_2O \longrightarrow H_2SO_3$

Sulphur dioxide — Sulphurous Acid

This shows that when sulphur dioxide is dissolved in water, it becomes an acid. This confirms that SO_2 is an acidic oxide.

② CuO:

⇒ Copper Oxide is a basic oxide.

⇒ Most metal oxides display basic properties and so does Copper oxide.

Balanced Equation:

⇒ $CuO + 2HCl \longrightarrow CuCl_2 + H_2O$

This shows that CuO, when it is reacted with an acid, it performs a neutralization reaction forming salt and water. This is a characteristic of a base. Hence this proves that Copper Oxide, CuO, is a basic oxide.

③ Al_2O_3:

⇒ Aluminium oxide is an amphoteric oxide.

⇒ Amphoteric oxides are those oxides that exhibit both basic and acidic properties. Hence Al_2O_3 also exhibits both acidic and basic properties.

Q. No. 4 (Page 2) **Balanced Equation :**

⇒ $Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$

Aluminium oxide — Hydrochloric acid — Aluminium chloride

This reaction displays the basic nature of Aluminium oxide as it reacts with an acid to produce salt and water which is a neutralization reaction. In this reaction, aluminium oxide acts as a base.

⇒ $Al_2O_3 + 2NaOH + 3H_2O \longrightarrow 2NaAl(OH)_4$

Aluminium oxide — Sodium hydroxide — Sodium Aluminate

This reaction shows acidic nature of Al_2O_3 which reacts as an acid with a base forming a salt.

⇒ These two reactions show that Al_2O_3 can display both acidic and basic properties hence is classified as an amphoteric oxide.

Q. No. 5 (Page 1)

Given:

⇒ C = 38.71% , H = 9.68% , O = 51.61 %

⇒ Molar Mass of Molecular Formula = 62g/mol

To Find:

Empirical formula = ?

Molecular Formula = ?

Solution:

Suppose in 100g of given compound:

C = 38.71 g , H = 9.68g , O = 51.61g

Find moles:

- Moles of C = $\frac{38.71\,g}{12\,g/mol}$ = 3.22 mol ∵ $n = \frac{m}{Mr}$
- Moles of H = $\frac{9.68\,g}{1\,g/mol}$ = 9.68 mol
- Moles of O = $\frac{51.61\,g}{16\,g/mol}$ = 3.22 mol

NOW

C	:	H	:	O	: Divide by smallest value
3.22	:	9.68	:	3.22	
3.22/3.22	:	9.68/3.22	:	3.22/3.22	
1	:	3	:	1	

Empirical Formula: CH_3O.

Now, for Molecular Formula:

∵ $n = \frac{\text{Molar mass of molecular Formula}}{\text{Molar mass of empirical Formula}}$

∴ Molecular Formula = (Empirical formula)$_n$

(P.T.O)

Q. No. 5 (Page 2)

* Molar mass of empirical formula: $CH_3O = 12+3+16$
$= 31\ g/mol$

$\Rightarrow n = \frac{62\ g/mol}{31\ g/mol}$

$\Rightarrow n = 2$ ★

Now,

Molecular Formula = (Empirical Formula)$_n$

" " = $(CH_3O)_n$

" " = $(CH_3O)_2$

" " = $C_2H_6O_2$

Molecular Formula: $C_2H_6O_2$

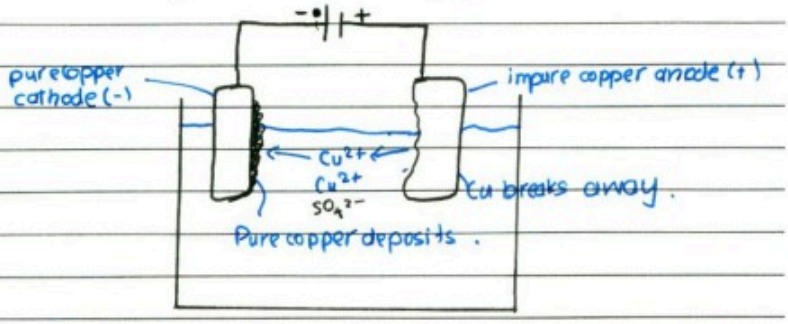
ANSWERS:

Empirical Formula: CH_3O

Molecular Formula: $C_2H_6O_2$

Q. No. 6 (Page 1) **Electrolysis of Dilute Copper Sulphate Using Copper Electrodes:**

- Following is what happens when we conduct electrolysis of Copper Sulphate using Copper electrodes.
- ⇒ Basically this process is for the purification of impure copper.
- ⇒ Impure Copper electrode is made the anode and pure copper bar is made the cathode.
- ⇒ Oxidation occurs at anode and reduction occurs at cathode.
- ⇒ In this specific electrolysis, Copper oxidizes and breaks away from the anode and is deposited on the copper cathode where it is reduced.
- ⇒ In this way, the anode loses mass (copper) and the cathode gains mass (copper).



- ⇒ Hence through this process, impurities are removed from copper.
- ⇒ Copper obtained through this process is 99.5% pure.

(P.T.O)

Q. No. 6 (Page 2) **Reactions at Both Electrodes:**

At Anode: $Cu_{(s)} \longrightarrow Cu^{2+} + 2e^-$

At Cathode: $Cu^{2+} + 2e^- \longrightarrow Cu_{(s)}$

=> Oxidation occurs at anode, Cu atoms lose electrons.
=> These electrons move through external circuit to cathode.
=> Reduction occurs at cathode where Cu^{2+} ions gain electrons to become atoms and deposit on the cathode.