

ICSE 2024 EXAMINATION

CHEMISTRY

SAMPLE PAPER - 1

Time allowed: Two hours

Max. Marks : 80

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 15 minutes.

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

Section A is compulsory. Attempt any four questions from Section B.

The intended marks for questions or parts of questions are given in brackets [].

SECTION A

(Attempt all questions from this Section.)

Question 1 : Choose one correct answer to the questions from the given options :

[15]

- (i) Element with the lowest electron affinity in Periodic Table is :
(a) Caesium (b) Fluorine (c) Lithium (d) Chlorine
- (ii) The largest atomic volume amongst the following is :
(a) I (b) I^- (c) I^+ (d) none of these
- (iii) Which of the following is not an alkali metal?
(a) Sodium (b) Magnesium (c) Lithium (d) Potassium
- (iv) Which of the following properties generally decrease while moving from left to right in a period?
(a) Electronegativity (b) Metallic character (c) Electron affinity (d) Ionisation potential
- (v) On moving from top to bottom in a group the number of electron shells
(a) Increase by one at a time (b) Decrease by one at a time
(c) Do not increase or decrease (d) Sometimes increase and sometimes decrease.
- (vi) A non-metal with lustre is :
(a) sulphur (b) iodine (c) graphite (d) both (b) and (c).
- (vii) A non-metallic hydroxide, which forms dense white fumes with HCl gas is a compound of:
(a) Nitrogen and hydrogen (b) Nitrogen and oxygen
(c) Nitrogen and carbon (d) Nitrogen and sulphur
- (viii) The common name for conc. nitric acid is :
(a) Aqua regia (b) Aqua fortis (c) Aqua pure (d) Any of these
- (ix) The reaction between ethyl alcohol and acetic acid in the presence of conc. H_2SO_4 is called:
(a) Neutralisation (b) Double displacement
(c) Esterification (d) Saponification.
- (x) A gaseous hydrocarbon X is passed through ammoniacal cuprous chloride solution. It is observed that no visible reaction takes place. The hydrocarbon may be :
(a) C_2H_6 (b) C_2H_4 (c) C_2H_2 (d) Any of (a) or (b)

- (xi) The elements of group 18 called :
 (a) Halogens (b) Alkali metals (c) Noble gases (d) Alkaline earth metals.
- (xii) Amongst the following, which is not a polar covalent compound?
 (a) NH_3 (b) H_2S (c) HI (d) CCl_4
- (xiii) The hydrated salt which loses its water of crystallization on exposure to air is called :
 (a) Hydrated salt (b) Anhydrous salt (c) Hygroscopic salt (d) Efflorescent salt
- (xiv) During the electrolysis of copper sulphate solution, the mass of anode gradually :
 (a) Increases (b) Decreases (c) remains same (d) None of these
- (xv) An element whose molecules are monoatomic is :
 (a) oxygen (b) sulphur (c) phosphorus (d) sodium

Question 2

- (i) Hydrogen chloride gas is prepared in the laboratory using concentrated sulphuric acid and sodium chloride. Answer the questions that follow based on this reaction : [5]

- Give the balanced chemical equation for the reaction with suitable condition (s) if any.
- Why is concentrated sulphuric acid used instead of concentrated nitric acid?
- How is the gas collected?
- Name the drying agent not used for drying the gas.
- Name the drying agent used for drying the gas.

- (ii) Match the following Column A with Column B : [5]

Column A		Column B	
(a)	Hydrogen sulphide	1.	Turns acidified potassium dichromate solution green.
(b)	Nitric oxide	2.	Turns limewater milky.
(c)	Carbon dioxide	3.	Turn reddish brown when it reacts with oxygen.
(d)	Sulphur dioxide	4.	Turns moist lead acetate paper silvery black
(e)	Ammonia	5.	Gives dense white fumes, when a rod dipped in HCl is introduced in gas.

- (iii) Complete the following by choosing the correct answers from the bracket :

- The energy required to remove an electron from a neutral isolated gaseous atom and convert it into a positively charged gaseous ion is called _____. (electron affinity, ionisation potential, electronegativity)
- The compound that does not have a lone pair of electrons is _____. (water, ammonia, carbon tetrachloride)
- When a metallic oxide is dissolved in water, the solution formed has a high concentration of _____ ions. (H^+ , H_3O^+ , OH^-)
- Potassium sulphite on reacting with hydrochloric acid releases _____ gas. (Cl_2 , SO_2 , H_2S)
- The compound formed when ethene reacts with Hydrogen is _____. (CH_4 , C_2H_6 , C_3H_8).

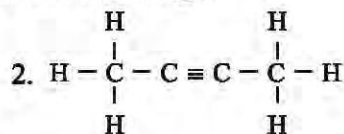
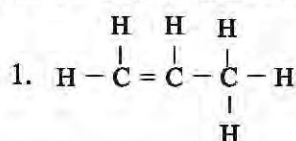
- (iv) Identify the following : [5]

- The formula that represents the simplest ratio of the various elements present in one molecule of the compound.
- The substance that releases hydronium ion as the only positive ion when dissolved in water.
- The tendency of an atom to attract electrons towards itself when combined in a covalent compound.
- The process by which certain ores, specially carbonates, are converted to oxides in the absence of air.
- The covalent bond in which the electrons are shared equally between the combining atoms.

- (v) (a) Give the structural formulae of each of the following [5]

- 2-methyl propane
- Ethanoic acid
- Butan-2-ol

(b) Write the IUPAC names of each of the following :



Section B

(Attempt any four questions.)

Question 3

- (i) Identify the anion present in the following compounds : [2]
- (a) Compound X on heating with copper turnings and concentrated sulphuric acid liberates a reddish brown gas.
- (b) When a solution of compound Y is treated with silver nitrate solution a white precipitate is obtained which is soluble in excess of ammonium hydroxide solution.
- (ii) Complete the following equations : [2]
- (a) $\text{S} + \text{conc. HNO}_3 \rightarrow$
- (b) $\text{Cu} + \text{dil. HNO}_3 \rightarrow$
- (iii) Arrange the following according to the instructions given in brackets : [3]
- (a) K, Pb, Ca, Zn. (In the increasing order of the reactivity)
- (b) Mg^{2+} , Cu^{2+} , Na^+ , H^+ (In the order of preferential discharge at the cathode)
- (c) Ethane, methane, ethene, ethyne. (In the increasing order of the molecular weight)
- [H = 1, C = 12]
- (iv) Fill in the blanks from the choices given in brackets: [3]
- (a) The polar covalent compound in gaseous state that does not conduct electricity is _____.
(carbon tetrachloride, ammonia, methane)
- (b) A salt prepared by displacement reaction is _____. (ferric chloride, ferrous chloride, silver chloride)
- (c) An alkali which completely dissociates into ions is _____.
(ammonium hydroxide, calcium hydroxide, lithium hydroxide)

Question 4

- (i) The following questions are relevant to the extraction of Aluminium : [2]
- (a) State the reason for addition of caustic alkali to bauxite ore during purification of bauxite.
- (b) Give a balanced chemical equation for the above reaction.
- (ii) (a) How is the molecular mass related to its vapour density? [2]
- (b) Calculate the vapour density of butane gas. [C = 12, H = 1].
- (iii) (a) Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. [3]
- (b) State why concentrated sulphuric acid is not used for drying ammonia gas.
- (c) Why is ammonia gas not collected over water?
- (iv) Explain the following : [3]
- (a) Ionisation potential of the element increases across a period.
- (b) Alkali metals are good reducing agents.
- (c) Hydrogen chloride gas cannot be dried over quick lime.

Question 5

- (i) Give chemical names for : [2]
 (a) Aqua fortis (b) Sal ammoniac
- (ii) Name a probable cation present based on the following observations : [2]
 (a) Fine milky white precipitate insoluble in sodium hydroxide.
 (b) Gelatinous white precipitate soluble in excess sodium hydroxide.
- (iii) Write balanced chemical equations for the laboratory preparation of : [3]
 (a) Methane from sodium ethanoate. (b) Ethene from ethanol. (c) Ethyne from calcium carbide.
- (iv) State one relevant observation for each of the following reactions : [3]
 (a) Action of Sodium hydroxide solution on ferrous sulphate solution.
 (b) Burning of ammonia in air.
 (c) Action of concentrated Sulphuric acid on hydrated copper sulphate.

Question 6

- (i) (a) The formula of butanoic acid is C_3H_7COOH , what is its empirical formula? [2]
 (b) The vapour density of a compound is 32. What is its molecular weight?
- (ii) What volume of oxygen is required to burn completely 90 dm^3 of butane under similar conditions of temperature and pressure? [2]

$$2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$$
- (iii) Copy and complete the following table relating to an important industrial processes. Output refers to the product of the process **not** the intermediate steps. [3]

Name of process	Inputs	Catalyst	Equation for catalysed reaction	Output
	Ammonia + air			Nitric acid
Contact Process	Sulphur dioxide + oxygen			

- (iv) Write balanced chemical equations, for the preparation of the given salts [3]
 (a) to (c) by using the methods A to C respectively.
 A. Neutralisation B. Precipitation C. Titration
 (a) Copper sulphate (b) Zinc carbonate (c) Ammonium sulphate

Question 7

- (i) The percentage composition of a gas is : [2]
 Nitrogen 82.35%, Hydrogen 17.64%.
 Find the empirical formula of the gas. [N = 14, H = 1]
- (ii) (a) Give the IUPAC name of acetic acid. [2]
 (b) Name the organic compound obtained as the end product of fermentation of sugar solution.
- (iii) (a) Give the name of a metal which is extracted by electrolysis. [3]
 (b) At which electrode metal ions are discharged during electrolysis?
 (c) Give one important application of electrolysis.

- (iv) Calculate : [3]
- (a) The volume occupied by 80 g of carbon dioxide at STP.
 - (c) Calculate the number of molecules in 4.4 gm of CO_2 . [Atomic mass of C = 12, O = 16]

Question 8

- (i) (a) What is a lone pair of electrons? [2]
(b) Draw an electron dot diagram of a hydronium ion and label the lone pair of electrons.
- (ii) Distinguish between the following pairs of compounds using the reagent given in the bracket. [2]
 - (a) Manganese dioxide and copper (II) oxide. (using concentrated HCl)
 - (b) Dilute hydrochloric acid and dilute sulphuric acid. (using lead nitrate solution)
- (iii) Choose non-electrolyte, weak electrolyte and strong electrolyte from the given descriptions : [3]
 - (a) Molten ionic compound
 - (b) Carbon tetrachloride
 - (c) A solution containing solvent molecules, solute molecules and ions formed by the dissociation of solute molecules.
- (iv) Match the atomic number 2, 4, and 8 with each of the following : [3]
 - (a) A gaseous element with valency 2.
 - (b) An element belonging to Group 2.
 - (c) A rare gas.



SOLUTION

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The time given at the head of this Paper is the time allowed for writing the answers.

Section A is compulsory. Attempt **any four** questions from **Section B**.

The intended marks for questions or parts of questions are given in brackets [].

SECTION A

(Attempt **all** questions from this Section.)

Question 1 : Choose one correct answer to the questions from the given options :

[15]

- (i) Element with the lowest electron affinity in Periodic Table is :
(a) Caesium (b) Fluorine (c) Lithium (d) Chlorine
- (ii) The largest atomic volume amongst the following is :
(a) I (b) I^- (c) I^+ (d) none of these
- (iii) Which of the following is not an alkali metal?
(a) Sodium (b) Magnesium (c) Lithium (d) Potassium
- (iv) Which of the following properties generally decrease while moving from left to right in a period?
(a) Electronegativity (b) Metallic character (c) Electron affinity (d) Ionisation potential
- (v) On moving from top to bottom in a group the number of electron shells
(a) Increase by one at a time (b) Decrease by one at a time
(c) Do not increase or decrease (d) Sometimes increase and sometimes decrease.
- (vi) A non-metal with lustre is :
(a) sulphur (b) iodine (c) graphite (d) both (b) and (c).
- (vii) A non-metallic hydroxide, which forms dense white fumes with HCl gas is a compound of:
(a) Nitrogen and hydrogen (b) Nitrogen and oxygen
(c) Nitrogen and carbon (d) Nitrogen and sulphur
- (viii) The common name for conc. nitric acid is :
(a) Aqua regia (b) Aqua fortis (c) Aqua pure (d) Any of these
- (ix) The reaction between ethyl alcohol and acetic acid in the presence of conc. H_2SO_4 is called:
(a) Neutralisation (b) Double displacement
(c) Esterification (d) Saponification.
- (x) A gaseous hydrocarbon X is passed through ammoniacal cuprous chloride solution. It is observed that no visible reaction takes place. The hydrocarbon may be :
(a) C_2H_6 (b) C_2H_4 (c) C_2H_2 (d) Any of (a) or (b)

- (xi) The elements of group 18 called :
 (a) Halogens (b) Alkali metals (c) Noble gases (d) Alkaline earth metals.
- (xii) Amongst the following, which is not a polar covalent compound?
 (a) NH_3 (b) H_2S (c) HI (d) CCl_4
- (xiii) The hydrated salt which loses its water of crystallization on exposure to air is called :
 (a) Hydrated salt (b) Anhydrous salt (c) Hygroscopic salt (d) Efflorescent salt
- (xiv) During the electrolysis of copper sulphate solution, the mass of anode gradually :
 (a) Increases (b) Decreases (c) remains same (d) None of these
- (xv) An element whose molecules are monoatomic is :
 (a) oxygen (b) sulphur (c) phosphorus (d) sodium

ANSWERS

- (i) (a) (ii) (b) (iii) (b) (iv) (b) (v) (a) (vi) (d) (vii) (a) (viii) (b)
 (ix) (c) (x) (d) (xi) (c) (xii) (d) (xiii) (d) (xiv) (b) (xv) (d)

Question 2

- (i) Hydrogen chloride gas is prepared in the laboratory using concentrated sulphuric acid and sodium chloride. Answer the questions that follow based on this reaction : [5]

- (a) Give the balanced chemical equation for the reaction with suitable condition (s) if any.
 (b) Why is concentrated sulphuric acid used instead of concentrated nitric acid?
 (c) How is the gas collected?
 (d) Name the drying agent not used for drying the gas.
 (e) Name the drying agent used for drying the gas.

- Ans.** (a) $\text{NaCl(s)} + \text{H}_2\text{SO}_4\text{(aq)} \xrightarrow{< 200^\circ\text{C}} \text{NaHSO}_4\text{(aq)} + \text{HCl(g)}$
 (b) Conc. sulphuric acid is used since it is non-volatile and has a high boiling point. So it displaces the volatile hydrogen chloride from the salt sodium chloride.
 (c) Dry hydrogen chloride gas is collected by the upward displacement of air.
 (d) Calcium oxide or phosphorus pentoxide.
 (e) Conc. H_2SO_4 .

- (ii) Match the following Column A with Column B :

[5]

Column A		Column B	
(a)	Hydrogen sulphide	1.	Turns acidified potassium dichromate solution green.
(b)	Nitric oxide	2.	Turns limewater milky.
(c)	Carbon dioxide	3.	Turn reddish brown when it reacts with oxygen.
(d)	Sulphur dioxide	4.	Turns moist lead acetate paper silvery black
(e)	Ammonia	5.	Gives dense white fumes, when a rod dipped in HCl is introduced in gas.

- Ans.** (a) 4. (b) 3. (c) 2. (d) 1. (e) 5.

- (iii) Complete the following by choosing the correct answers from the bracket :

- (a) The energy required to remove an electron from a neutral isolated gaseous atom and convert it into a positively charged gaseous ion is called _____. (electron affinity, ionisation potential, electronegativity)
 (b) The compound that does not have a lone pair of electrons is _____. (water, ammonia, carbon tetrachloride)
 (c) When a metallic oxide is dissolved in water, the solution formed has a high concentration of _____ ions. (H^+ , H_3O^+ , OH^-)

(d) Potassium sulphite on reacting with hydrochloric acid releases _____ gas. (Cl_2 , SO_2 , H_2S)

(e) The compound formed when ethene reacts with Hydrogen is _____. (CH_4 , C_2H_6 , C_3H_8).

Ans. (a) Ionisation potential (b) Carbon tetrachloride (c) OH^- (d) SO_2 (e) C_2H_6

(iv) Identify the following :

[5]

(a) The formula that represents the simplest ratio of the various elements present in one molecule of the compound.

(b) The substance that releases hydronium ion as the only positive ion when dissolved in water.

(c) The tendency of an atom to attract electrons towards itself when combined in a covalent compound.

(d) The process by which certain ores, specially carbonates, are converted to oxides in the absence of air.

(e) The covalent bond in which the electrons are shared equally between the combining atoms.

Ans. (a) Empirical formula (b) Acid (c) Electronegativity

(d) Calcination (e) Non-polar covalent compound

(v) (a) Give the structural formulae of each of the following

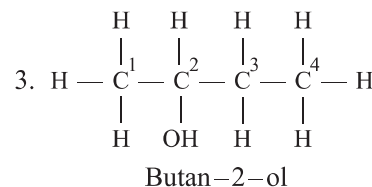
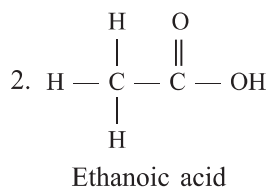
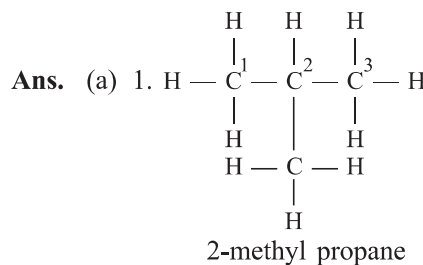
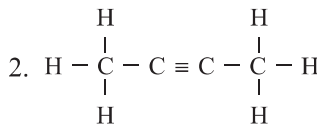
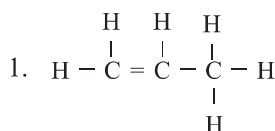
[5]

1. 2-methyl propane

2. Ethanoic acid

3. Butan-2-ol

(b) Write the IUPAC names of each of the following :



2-methyl propane

Ethanoic acid

Butan-2-ol

(b) 1. Propene

2. 2-Butyne

Section B

(Attempt **any four** questions.)

Question 3

(i) Identify the anion present in the following compounds :

[2]

(a) Compound **X** on heating with copper turnings and concentrated sulphuric acid liberates a reddish brown gas.

(b) When a solution of compound **Y** is treated with silver nitrate solution a white precipitate is obtained which is soluble in excess of ammonium hydroxide solution.

Ans. (a) Nitrate (NO_3^-) ion (b) Chloride (Cl^-) ion

(ii) Complete the following equations :

[2]

(a) $\text{S} + \text{conc. HNO}_3 \rightarrow$

(b) $\text{Cu} + \text{dil. HNO}_3 \rightarrow$

Ans. (a) $\text{S} + 6\text{HNO}_3 (\text{conc.}) \xrightarrow{\Delta} \text{H}_2\text{SO}_4 + 2\text{H}_2\text{O} + 6\text{NO}_2(\text{g})$

(b) $3\text{Cu} + 8\text{HNO}_3 (\text{dil.}) \longrightarrow 3\text{Cu}(\text{NO}_3)_2 + 4\text{H}_2\text{O} + 2\text{NO}(\text{g})$

(iii) Arrange the following according to the instructions given in brackets :

[3]

(a) K, Pb, Ca, Zn. (In the increasing order of the reactivity)

(b) Mg^{2+} , Cu^{2+} , Na^+ , H^+ (In the order of preferential discharge at the cathode)

(c) Ethane, methane, ethene, ethyne. (In the increasing order of the molecular weight)

[H = 1, C = 12]

- Ans.** (a) $\text{Pb} < \text{Zn} < \text{Ca} < \text{K}$ (b) $\text{Cu}^{2+} > \text{H}^+ > \text{Mg}^{2+} > \text{Na}^+$ (c) Methane < Ethyne < Ethene < Ethane
(iv) Fill in the blanks from the choices given in brackets: [3]
(a) The polar covalent compound in gaseous state that does not conduct electricity is _____.
(carbon tetrachloride, ammonia, methane)
(b) A salt prepared by displacement reaction is _____. (ferric chloride, ferrous chloride, silver chloride)
(c) An alkali which completely dissociates into ions is _____.
(ammonium hydroxide, calcium hydroxide, lithium hydroxide)

Ans. (a) Ammonia (b) Ferrous chloride (c) Lithium hydroxide

Question 4

- (i) The following questions are relevant to the extraction of Aluminium : [2]
(a) State the reason for addition of caustic alkali to bauxite ore during purification of bauxite.
(b) Give a balanced chemical equation for the above reaction.
Ans. (a) The caustic alkali dissolves aluminium oxide to form sodium aluminate, but does not dissolve impurities.
(b) $\text{Al}_2\text{O}_3 + 2\text{NaOH} \rightarrow 2\text{NaAlO}_2 + \text{H}_2\text{O}$
(ii) (a) How is the molecular mass related to its vapour density? [2]
(b) Calculate the vapour density of butane gas. [C = 12, H = 1].
Ans. (a) Molecular mass = $2 \times \text{Vapour density}$
(b) Molecular mass of butane (C_4H_{10}) = $(4 \times 12) + (10 \times 1) = 58$.
 $\therefore \text{Vapour density of butane} = \frac{\text{Molecular mass}}{2} = \frac{58}{2} = 29$.
(iii) (a) Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. [3]
(b) State why concentrated sulphuric acid is not used for drying ammonia gas.
(c) Why is ammonia gas not collected over water?
Ans. (a) $2\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \xrightarrow{\text{warm}} \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{NH}_3(\text{g})$
(b) Because ammonia gas reacts chemically with conc. sulphuric acid to form ammonium sulphate.
 $2\text{NH}_3 + \text{H}_2\text{SO}_4(\text{conc.}) \rightarrow (\text{NH}_4)_2\text{SO}_4$
(c) Because ammonia gas is extremely soluble in water. However solubility of ammonia gas in hot water vapour is low.
(iv) Explain the following : [3]
(a) Ionisation potential of the element increases across a period.
(b) Alkali metals are good reducing agents.
(c) Hydrogen chloride gas cannot be dried over quick lime.
Ans. (a) As the number of protons increase in the elements across the period, but the shell number of electrons remains same, therefore, the nucleus exerts a strong pull on the electrons. This in turn increases ionisation potential.
(b) Alkali metals have only one electron in their valence shell which they can easily donate and hence they themselves get easily oxidised and are powerful reducing agents.
(c) Hydrogen chloride gas is an acidic gas. It reacts with quick lime (CaO) to form calcium chloride and water. So, quick lime cannot be used for drying hydrogen chloride gas.

Question 5

- (i) Give chemical names for : [2]
(a) Aqua fortis (b) Sal ammoniac
Ans. (a) Aqua fortis is a conc. nitric acid.
(b) Sal ammoniac is ammonium chloride.

(ii) Name a probable cation present based on the following observations : [2]

- (a) Fine milky white precipitate insoluble in sodium hydroxide.
 (b) Gelatinous white precipitate soluble in excess sodium hydroxide.

Ans. (a) Mg^{2+} (b) Zn^{2+}

(iii) Write balanced chemical equations for the laboratory preparation of : [3]

- (a) Methane from sodium ethanoate. (b) Ethene from ethanol. (c) Ethyne from calcium carbide.

Ans. (a) $\text{CH}_3\text{COONa} + \text{NaOH} \xrightarrow{\text{CaO}} \text{CH}_4 + \text{Na}_2\text{CO}_3$

(b) $\text{C}_2\text{H}_5\text{OH} + \text{H}_2\text{SO}_4 \xrightarrow{>160^\circ\text{C}} \text{C}_2\text{H}_4 + \text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$

(c) $\text{CaC}_2 + 2\text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2 + \text{C}_2\text{H}_2$

(iv) State one relevant observation for each of the following reactions : [3]

- (a) Action of Sodium hydroxide solution on ferrous sulphate solution.
 (b) Burning of ammonia in air.
 (c) Action of concentrated Sulphuric acid on hydrated copper sulphate.

Ans. (a) A dirty green precipitate is formed which is insoluble in excess of sodium hydroxide solution.
 (b) Ammonia gas burns with a pale blue flame forming nitrogen and water vapour.
 (c) Blue coloured copper sulphate crystals crumble with a hissing sound and change to white powdery mass.

Question 6

- (i) (a) The formula of butanoic acid is $\text{C}_3\text{H}_7\text{COOH}$, what is its empirical formula? [2]
 (b) The vapour density of a compound is 32. What is its molecular weight?

Ans. (a) Empirical formula of $\text{C}_3\text{H}_7\text{COOH}$ is $\text{C}_2\text{H}_4\text{O}$.

(b) Molecular weight = $2 \times \text{Vapour density} = 2 \times 32 = 64$.

- (ii) What volume of oxygen is required to burn completely 90 dm^3 of butane under similar conditions of temperature and pressure?

$2\text{C}_4\text{H}_{10} + 13\text{O}_2 \longrightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$ [2]

Ans. $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \longrightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
 2 Vols. 13 Vols. 8 Vols. Nil (By Gay Lussac's law)

1 Vol $\frac{13}{2}$ Vols.

90 dm^3 $\frac{13}{2} \times 90 \text{ dm}^3 = \mathbf{585 \text{ dm}^3}$.

- (iii) Copy and complete the following table relating to an important industrial processes. Output refers to the product of the process **not** the intermediate steps. [3]

Name of process	Inputs	Catalyst	Equation for catalysed reaction	Output
	Ammonia + air			Nitric acid
Contact Process	Sulphur dioxide + oxygen			

Ans.

Name of process	Input	Catalyst	Equation for catalysed reaction	Output
Ostwald's Process	Ammonia + air	Platinum	$\text{NH}_3 + 2\text{O}_2 \xrightleftharpoons[500^\circ\text{C}]{\text{Pt}} \text{H}_2\text{O} + \text{HNO}_3$	Nitric acid
Contact Process	Sulphur dioxide + oxygen	Platinised asbestos or Vanadium pentaoxide	$2\text{SO}_2 + \text{O}_2 \xrightleftharpoons[\text{or V}_2\text{O}_5 - 450^\circ\text{C}]{\text{Platinised asbestos}} 2\text{SO}_3$	Sulphur trioxide

(iv) Write balanced chemical equations, for the preparation of the given salts

(a) to (c) by using the methods A to C respectively.

A. Neutralisation

B. Precipitation

C. Titration

(a) Copper sulphate

(b) Zinc carbonate

(c) Ammonium sulphate

Ans. (a) $\text{Cu}(\text{OH})_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{CuSO}_4 + 2\text{H}_2\text{O}$

(b) $\text{ZnSO}_4 + (\text{NH}_4)_2\text{CO}_3 \longrightarrow (\text{NH}_4)_2\text{SO}_4 + \text{ZnCO}_3\downarrow$

(c) $2\text{NH}_3 + \text{H}_2\text{SO}_4 \longrightarrow (\text{NH}_4)_2\text{SO}_4$

Question 7

(i) The percentage composition of a gas is :

Nitrogen 82.35%, Hydrogen 17.64%.

Find the empirical formula of the gas. [N = 14, H = 1]

[2]

Ans.	Element	Percentage weight	Atomic weight	Relative number of moles	Simple ratio of atoms
	Nitrogen	82.35	14	$82.35 \div 14 = 5.88$	$5.88 \div 5.88 = 1$
	Hydrogen	17.64	1	$17.64 \div 1 = 17.64$	$17.64 \div 5.88 = 3$

$\therefore$ Empirical formula of compound = NH_3 .

(ii) (a) Give the IUPAC name of acetic acid.

[2]

(b) Name the organic compound obtained as the end product of fermentation of sugar solution.

Ans. (a) IUPAC name of acetic acid is ethanoic acid.

(b) The product of fermentation of sugar solution is ethanol.

(iii) (a) Give the name of a metal which is extracted by electrolysis.

[3]

(b) At which electrode metal ions are discharged during electrolysis?

(c) Give one important application of electrolysis.

Ans. (a) Aluminium

(b) Cathode

(c) Electro-refining of impure metals.

(iv) Calculate :

[3]

(a) The volume occupied by 80 g of carbon dioxide at STP.

(c) Calculate the number of molecules in 4.4 gm of CO_2 . [Atomic mass of C = 12, O = 16]

Ans. (a) Gram-molecular weight of carbon dioxide = $(12 + 2 \times 16)$ g = 44 g

Now, 44 g of carbon dioxide occupies at STP = 22.4 dm^3

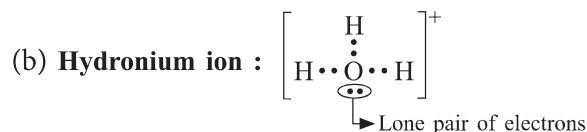
$\therefore$ 80 g of carbon dioxide occupies at STP = $\frac{22.4 \text{ dm}^3 \times 80 \text{ g}}{44 \text{ g}} = 40.73 \text{ dm}^3$

(b) 44 g of carbon dioxide contains number of carbon dioxide molecules = 6×10^{23}

$\therefore$ 4.4 g of carbon dioxide contains number of carbon dioxide molecules

$= \frac{6 \times 10^{23} \times 4.4 \text{ g}}{44 \text{ g}} = 6 \times 10^{22}$ molecules.

- (i) (a) What is a lone pair of electrons? [2]
(b) Draw an electron dot diagram of a hydronium ion and label the lone pair of electrons.
- Ans.** (a) The unshared pair of electrons around an atom in the middle of a molecule of a polar covalent compound is known as **lone pair of electrons**.



- (ii) Distinguish between the following pairs of compounds using the reagent given in the bracket. [2]
- (a) Manganese dioxide and copper (II) oxide. (using concentrated HCl)
- (b) Dilute hydrochloric acid and dilute sulphuric acid. (using lead nitrate solution)
- Ans.** (a) $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
In this case greenish yellow chlorine gas is evolved.
- $\text{CuO} + 2\text{HCl} \longrightarrow \text{CuCl}_2 + \text{H}_2\text{O}$
In this case chlorine gas is not evolved but reaction mixture turns greenish-blue.
- (b) $\text{Pb}(\text{NO}_3)_2 (\text{sol.}) + 2\text{HCl}(\text{dil.}) \longrightarrow 2\text{HNO}_3 + \text{PbCl}_2\downarrow$
In this case, a thick white precipitate of PbCl_2 and HNO_3 acid are formed, on heating the white precipitate dissolves.
- $\text{Pb}(\text{NO}_3)_2 (\text{sol.}) + \text{H}_2\text{SO}_4 \longrightarrow 2\text{HNO}_3 + \text{PbSO}_4\downarrow$
In this case, a white precipitate of PbSO_4 and HNO_3 are formed. This precipitate is insoluble in all acids and does not dissolve on heating also.
- (iii) Choose non-electrolyte, weak electrolyte and strong electrolyte from the given descriptions : [3]
- (a) Molten ionic compound
- (b) Carbon tetrachloride
- (c) A solution containing solvent molecules, solute molecules and ions formed by the dissociation of solute molecules.
- Ans.** (a) Molten ionic compound — Strong electrolyte
- (b) Carbon tetrachloride — Non-electrolyte
- (c) A solution containing solvent molecules, solute molecules and ions formed by the dissociation of solute molecules — weak electrolyte.
- (iv) Match the atomic number 2, 4, and 8 with each of the following : [3]
- (a) A gaseous element with valency 2.
- (b) An element belonging to Group 2.
- (c) A rare gas.
- Ans.** (a) Atomic number 8 (gaseous element with valency 2)
- (b) Atomic number 4 (element belonging to group 2)
- (c) Atomic number 2 (A rare gas)

