Question 1

Choose the correct answers to the questions from the given options.

(Do not copy the questions, write the correct answers only.)

(i) Which gas decolourises potassium permanganate ($KMnO_4$) solution?

(a) Sulphur dioxide

(b) Ammonia

(c) Hydrogen chloride

(d) Carbon dioxide

Correct answer: **(a) Sulphur dioxide**

Explanation:
Sulphur dioxide (SO_2) is a reducing agent. When it reacts with potassium permanganate ($KMnO_4$), which is an oxidizing agent, it reduces the purple-colored $KMnO_4$ to a colorless manganese compound, thus **decolourising** the solution.

The reaction between **sulphur dioxide (SO_2)** and **potassium permanganate ($KMnO_4$)** is a classic redox reaction where SO_2 acts as a **reducing agent**, and $KMnO_4$ acts as an **oxidizing agent**.

In Acidic Medium:

Balanced chemical equation:

$$2KMnO_4 + 5SO_2 + 2H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 2H_2SO_4$$

Explanation:

- **$KMnO_4$ (purple)** gets reduced to **Mn^{2+} (colorless)**.
- **SO_2** gets oxidized to **SO_4^{2-} (sulphate ion)**.
- This reaction causes the purple color of $KMnO_4$ to disappear, hence it is said to be *decolourised*.

(ii) Which formula represents a *saturated* hydrocarbon?

(a) C_4H_8

(b) C_5H_{12}

(c) C_4H_6

(d) C_5H_{10}

(iii) The metal whose oxide can be reduced by common reducing agents:

(a) Copper

(b) Sodium

(c) Aluminium

(d) Potassium

(iv) An organic compound has a vapour density of 22. The molecular formula of the organic compound is:

[*Atomic weight: C = 12, H = 1*]

(a) CH_4

(b) C_2H_4

(c) C_2H_6

(d) C_3H_8

(v) In the reaction given below *sulphuric acid* acts as a/an:

$$S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$$

(a) Non-volatile acid

(b) Dibasic acid

(c) Oxidising agent

(d) Reducing agent

Correct answer: **(c) Oxidising agent**

Explanation:

In the reaction:

$$S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$$

- **Sulphur (S)** is being **oxidized** from 0 oxidation state to +4 in **SO_2**.
- **Sulphuric acid (H_2SO_4)** provides oxygen and accepts electrons, causing the oxidation of elemental sulphur.

Hence, **H_2SO_4 acts as an oxidising agent.**

(vi) **Assertion (A):** The tendency of losing electrons increases down the Group.

Reason (R): The most reactive metal is placed at the top of Group 1.

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

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

(c) (A) is true but (R) is false.

(d) (A) is false but (R) is true.

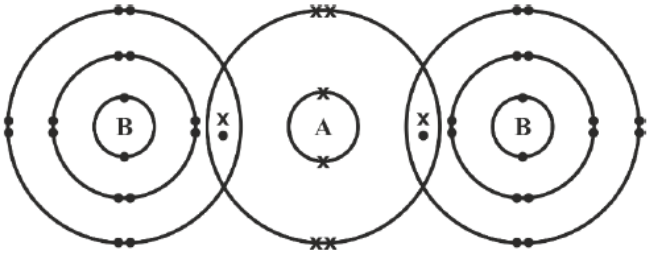
Correct answer: (c) (A) is true but (R) is false.

Explanation:

- **Assertion (A):** True
  In **Group 1 (alkali metals)**, the atomic size increases down the group, so the outermost electron is farther from the nucleus and more easily lost. Hence, the **tendency to lose electrons increases** down the group.
- **Reason (R):** False
  The **most reactive metal in Group 1 is at the bottom** (e.g., **Francium** or **Cesium**), not at the top. Reactivity **increases** down the group, not the other way around.

So, **(A) is true but (R) is false.**

(viii) The diagram given below shows the bonding in the covalent molecule AB_2.



Which option represents the correct electronic configuration of atoms **A** and **B** **before** combining together to form the above molecule?

	A	**B**
(a)	2, 4	2, 8, 6
(b)	2, 4	2, 8, 7
(c)	2, 8	2, 8, 8
(d)	2, 6	2, 8, 7

(ix) Which of the following options has all the compounds which are members of the *same* homologous series?

(a) CH_4, C_2H_6, C_3H_8

(b) CH_4, C_2H_6, C_3H_6

(c) C_3H_4, C_3H_6, C_3H_8

(d) C_2H_4, C_3H_6, C_4H_{10}

(x) **Assertion (A):** In the *Contact Process* SO_3 gas is not directly dissolved in water to obtain sulphuric acid.

Reason (R): Dense fog or misty droplets of sulphuric acid are formed which is difficult to condense.

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

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

(c) (A) is true but (R) is false.

(d) (A) is false but (R) is true.

Correct answer: (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).

Explanation:

- **Assertion (A):** True
  In the **Contact Process**, **SO_3 is not directly dissolved in water** because it forms a dense mist of sulphuric acid, which is difficult to condense and handle.
- **Reason (R):** True
  When SO_3 reacts with water directly, it forms **dense fog or misty droplets** of sulphuric acid (H_2SO_4), making the process inefficient and hard to manage.

Thus, **(R) correctly explains (A).**

(xi) Given below are four ions:

Cl^-, Li^+, Al^{3+}, K^+

Identify the pair of ions which have the same electronic configuration.

[*Atomic number: Cl = 17, Li = 3, Al = 13, K = 19*]

(a) Cl^- & Li^+

(b) Al^{3+} & K^+

(c) Cl^- & K^+

(d) Li^+ & K^+

(xii) Which pair of reactants can be **best** used to produce lead (II) sulphate?

(a) Sulphuric acid + Lead

(b) Sulphuric acid + Lead hydroxide

(c) Sodium sulphate + Lead nitrate

(d) Potassium sulphate + Lead oxide

Correct answer: (b) Sulphuric acid + Lead hydroxide

Explanation:

Lead(II) sulphate (**$PbSO_4$**) can be best prepared by a **neutralization reaction** between:

- **Lead hydroxide ($Pb(OH)_2$)** – a base
- **Sulphuric acid (H_2SO_4)** – an acid

$$Pb(OH)_2 + H_2SO_4 \rightarrow PbSO_4 + 2H_2O$$

This reaction produces **insoluble lead(II) sulphate** as a precipitate.

Other options are not suitable because:

- (a) Lead reacts slowly with sulphuric acid and may form a passivating layer of $PbSO_4$.
- (c) No reaction occurs between two salts (double displacement requires solubility).
- (d) Potassium sulphate and lead oxide don't efficiently form $PbSO_4$ directly.

Thus, **option (b)** is the best choice.

(xiii) Aqueous copper (II) sulphate is electrolysed using copper electrodes. Which statement about the electrolysis is **not** correct?

(a) An oxidation reaction occurs at the positive electrode.

(b) The current is carried through the electrolyte by ions.

(c) The positive electrode loses mass.

(d) The number of copper (II) ions in the electrolyte decreases.

Correct answer: (d) The number of copper (II) ions in the electrolyte decreases.

Explanation:

In the electrolysis of **aqueous copper(II) sulphate ($CuSO_4$)** using **copper electrodes**:

- At the **cathode (negative electrode)**:
  Cu^{2+} ions are **reduced** to copper metal and deposited.
  $\mathrm{Cu}^{2+} + 2e^- \rightarrow \mathrm{Cu\ (s)}$
- At the **anode (positive electrode)**:
  Copper metal is **oxidized** to Cu^{2+} ions and goes into the solution.
  $\mathrm{Cu\ (s)} \rightarrow \mathrm{Cu}^{2+} + 2e^-$

So, **for every Cu^{2+} ion removed at the cathode, one is added at the anode**, and the **concentration of Cu^{2+} ions in the electrolyte remains constant.**

Thus, statement (d) is not correct.

(xiv) X, Y & Z are three metallic atoms in successive order belonging to the same group such that atomic radii of 'X' is the smallest. Which of the three atoms is the **best** reducing agent?

(a) X

(b) Y

(c) Z

(d) All three have the same reducing power.

Correct answer: (c) Z

Explanation:

- X, Y, and Z are **metallic atoms in the same group**, and **X has the smallest atomic radius**, meaning **X is at the top** and **Z is at the bottom** of the group.
- As you move **down a group**, the **atomic size increases**, and **ionization energy decreases**, making it **easier to lose electrons**.
- Since **reducing agents donate electrons**, the **lower the element in the group**, the **stronger the reducing power**.

Therefore, Z (at the bottom) is the best reducing agent.

(xv) 40 cm^3 of methane (CH_4) is reacted with 60 cm^3 of oxygen.

The equation for the reaction is given below:

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

All volumes are measured at room temperature.

What is the **total** volume of the gases remaining at the end of the reaction?

(a) 60 cm^3

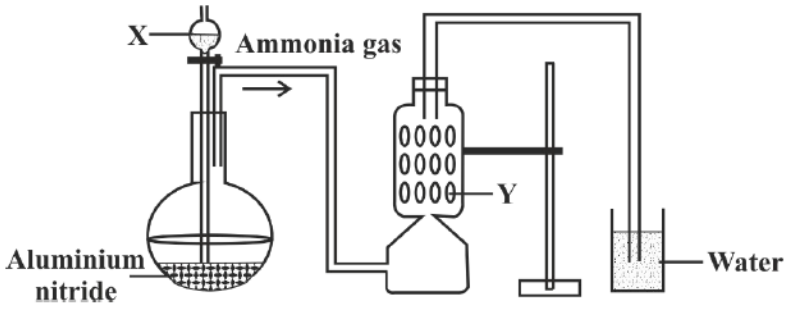
(b) 40 cm^3

(c) 45 cm^3

(d) 50 cm^3

Question 2

(i) A student was instructed by the teacher to prepare and collect ammonia gas in the laboratory by using aluminium nitride. The student had set up the apparatus as shown in the diagram below. Study the given diagram and answer the following questions: [5]



(a) Name the substance **X** added through the thistle funnel by the student.

(b) Write a balanced equation for the reaction occurring between Aluminium nitride and substance **X**.

(c) Identify the substance **Y**.

(d) State the function of **Y**.

(e) Why could the student **not collect** ammonia gas at the end of the experiment?

(ii) State the **terms** for the following: [5]

(a) *Undistilled* alcohol containing a large amount of methanol.

(b) A *salt* formed by the *partial* replacement of the *hydroxyl group* of a di-acidic or a tri-acidic base by an acid radical.

(c) Organic compounds having the *same* molecular formula but *different* structural formula.

(d) The tendency of an atom to attract the shared pair of electrons towards itself when combined in a compound.

(e) The type of covalent bond in which electrons are shared *unequally* between the combining atoms.

Here are the correct terms for each part of the question:

(a) Methylated spirit

(b) Acid salt

(c) Isomers

(d) Electronegativity

(e) Polar covalent bond

(iii) Complete the following sentences by choosing the *correct word(s)* from the brackets: [5]

(a) _____ solution forms a coloured precipitate with ammonium hydroxide which is soluble in excess of ammonium hydroxide.
[*Ferrous chloride / Copper nitrate*]

(b) Zinc blende is converted to zinc oxide by _____. [*Calcination / Roasting*]

(c) _____ conducts electricity by the movement of ions.
[*Molten iron / Molten sodium chloride*]

(d) The reaction that takes place at the anode during the electrolysis of aqueous Sodium argentocyanide with silver electrodes is _____.
[$Ag \rightarrow Ag^+ + e^-$ / $Ag^+ + e^- \rightarrow Ag$]

(e) The salt formed when ZnO reacts with hot concentrated NaOH is _____. [*sodium zincate / zinc hydroxide*]

(a) *Copper nitrate* solution forms a coloured precipitate with ammonium hydroxide which is soluble in excess of ammonium hydroxide.

(b) Zinc blende is converted to zinc oxide by *Roasting*.

(c) *Molten sodium chloride* conducts electricity by the movement of ions.

(d) The reaction that takes place at the anode during the electrolysis of aqueous sodium argentocyanide with silver electrodes is:

$Ag \rightarrow Ag^+ + e^-$

(e) The salt formed when ZnO reacts with hot concentrated NaOH is *sodium zincate*.

(a) Copper nitrate

- **Reaction**:
  Copper nitrate (Cu^{2+}) reacts with ammonium hydroxide to form **blue precipitate** of copper(II) hydroxide:

$$Cu^{2+} + 2NH_4OH \rightarrow Cu(OH)_2(blueppt) + 2NH_4^+$$

  This precipitate is **soluble in excess NH_4OH**, forming a **deep blue complex**:

$$Cu(OH)_2 + 4NH_4OH \rightarrow [Cu(NH_3)_4]^{2+} + 4H_2O$$

- **Why not Ferrous chloride?**
  Ferrous hydroxide is **insoluble** in excess NH_4OH.

(b) Roasting

- **Roasting** involves heating the **sulphide ore (Zinc blende – ZnS)** in the presence of oxygen to convert it into **oxide**:

$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$$

  This is typical for **sulphide ores**.
- **Calcination** is used for **carbonate ores**, not sulphides.

(c) Molten sodium chloride

- **Molten sodium chloride (NaCl)** conducts electricity due to the **movement of free Na^+ and Cl^- ion**
  It undergoes electrolysis:

$$NaCl_{(l)} \rightarrow Na^+ + Cl^-$$

- **Molten iron** is a **metal**, conducts electricity via **free electrons**, not ions.

(d) $Ag \rightarrow Ag^+ + e^-$

- This is **oxidation** occurring at the **anode** (loss of electrons):

$$Ag(anode) \rightarrow Ag^+ + e^-$$

- The silver ions go into solution, and **electrons flow to the cathode**.

(e) Sodium zincate

- When **ZnO reacts with hot concentrated NaOH**, it forms **sodium zincate (Na_2ZnO_2)** and water:

$$ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$$

- This is an example of **amphoteric oxide** behavior of zinc oxide.

(iv) Match the **Column A** with **Column B**: [5]

	Column A		**Column B**
(a)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	1.	Vanadium Pentoxide
(b)	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	2.	Nickel
(c)	$2SO_2 + O_2 \rightleftharpoons 2SO_3$	3.	Iron
(d)	$C_2H_4 + H_2 \rightarrow C_2H_6$	4.	Concentrated Sulphuric acid
(e)	$CuSO_4.5H_2O \rightarrow CuSO_4 + 5H_2O$	5.	Platinum

Here is the correct matching of **Column A** with **Column B**:

Column A	Column B
(a) $N_2 + 3H_2 \rightleftharpoons 2NH_3$	**3. Iron**
(b) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	**5. Platinum**
(c) $2SO_2 + O_2 \rightleftharpoons 2SO_3$	**1. Vanadium Pentoxide**
(d) $C_2H_4 + H_2 \rightarrow C_2H_6$	**2. Nickel**
(e) $CuSO_4.5H_2O \rightarrow CuSO_4 + 5H_2O$	**4. Concentrated Sulphuric acid**

Explanation:

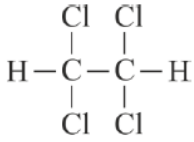
- **(a) Iron** is the catalyst used in the **Haber process** for ammonia synthesis.
- **(b) Platinum** is used in the **oxidation of ammonia to nitric oxide** in the Ostwald process.
- **(c) Vanadium Pentoxide (V_2O_5)** is the catalyst in the **Contact Process** for making sulphuric acid.
- **(d) Nickel** is the catalyst for **hydrogenation** of alkenes to alkanes.
- **(e) Concentrated sulphuric acid** acts as a **drying agent** to remove water of crystallization from hydrated salts like copper(II) sulphate.

(v) (a) Draw the structural diagram for the following organic compounds: [5]

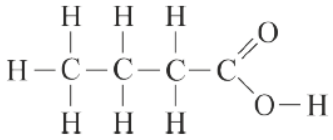
1. 2-methyl propene
2. butanal

(b) Give IUPAC name for the following organic compounds:

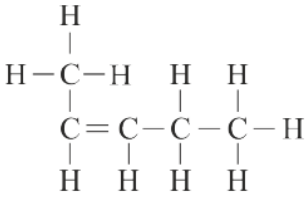
1.



2.



3.



Question 3

(i) The atomic number of two atoms **'X'** and **'Y'** are 14 and 8 respectively. [2]

State:

(a) the period to which **'X'** belongs.

(b) the formula of the compound formed between **'X'** and **'Y'**.

*(Do not identify **X** and **Y**)*

(ii) Justify the following statements: [2]

(a) Anode is known as the oxidizing electrode.

(b) Graphite electrodes are preferred in the electrolysis of molten lead bromide.

(iii) The reaction between concentrated sulphuric acid and magnesium can be represented by the equation given below: [3]

$$Mg + 2H_2SO_4 \rightarrow MgSO_4 + 2H_2O + SO_2$$

If 60 g of magnesium is used in the reaction, calculate the following:

(a) The mass of sulphuric acid needed for the reaction.

(b) The volume of sulphur dioxide gas liberated at S.T.P.

[*Atomic weight: Mg=24, H=1, S=32, O=16*]

(iv) Give one **significant** observation when: [3]

(a) a solution of barium chloride is added to zinc sulphate solution.

(b) lead nitrate is heated in a test tube.

(c) chlorine gas is passed over moist starch iodide paper.

Here are the **significant observations** for each reaction:

(a) When a solution of **barium chloride is added to zinc sulphate solution:**

👉 **No visible reaction** is observed because **both barium sulphate and zinc chloride are soluble**, and there is no precipitate formed.

(b) When **lead nitrate is heated in a test tube:**

👉 A **yellow solid (lead(II) oxide)** is formed and **brown fumes of nitrogen dioxide (NO_2)** are evolved.

(c) When **chlorine gas is passed over moist starch iodide paper:**

👉 The paper turns **blue-black** due to the **liberation of iodine**, which reacts with starch.

(a) Barium chloride added to zinc sulphate solution

Observation:

👉 **No visible reaction**; both products are soluble.

Equation:

$$\mathrm{BaCl_2}(aq) + \mathrm{ZnSO_4}(aq) \rightarrow \mathrm{BaSO_4}(aq) + \mathrm{ZnCl_2}(aq)$$

However, **$BaSO_4$ is actually insoluble**, so a **white precipitate of barium sulphate would** be expected **if barium reacts with sulphate.** But since zinc is more reactive, it stays in solution, and **no precipitate forms**, assuming concentrations are low.

➡️ The better correction:

$$\mathrm{Ba^{2+}}(aq) + \mathrm{SO_4^{2-}}(aq) \rightarrow \mathrm{BaSO_4}(s)$$

So the **significant observation** should actually be:

👉 **White precipitate of barium sulphate is formed.**

(b) Heating lead nitrate

Observation:

👉 A **yellow solid** is formed and **brown fumes** evolve.

Equation:

$$2\mathrm{Pb(NO_3)_2}(s) \xrightarrow{\text{heat}} 2\mathrm{PbO}(s) + 4\mathrm{NO_2}(g) + \mathrm{O_2}(g)$$

- **PbO** = yellow solid
- **NO_2** = brown gas

(c) Chlorine gas passed over moist starch iodide paper

Observation:

👉 The paper turns **blue-black.**

Explanation & Equation:

Chlorine displaces iodine from potassium iodide:

$$\mathrm{Cl_2}(g) + 2\mathrm{KI}(aq) \rightarrow 2\mathrm{KCl}(aq) + \mathrm{I_2}(aq)$$

The released iodine reacts with starch:

$$\mathrm{I_2} + \text{starch} \rightarrow \text{blue-black complex}$$

Question 4

(i) A gas cylinder can hold 150 g of hydrogen under certain conditions of temperature and pressure. If an identical cylinder with the same capacity can hold 450 g of gas **'G'** under the same conditions of temperature and pressure, find: [2]

(a) the vapour density of the gas **'G'**.

(b) the molecular weight of gas **'G'**.

(ii) Complete and balance the following equations: [2]

(a) $CH_3COONa + NaOH \xrightarrow[\Delta]{CaO}$

(b) $CH_3COOH + Mg \rightarrow$

(a) $CH_3COONa + NaOH \rightarrow$ (in presence of CaO and heat)

This is a **decarboxylation reaction** (removal of CO_2) of a sodium salt of a carboxylic acid with NaOH and **CaO as a catalyst**.

Balanced Equation:

$$CH_3COONa + NaOH \xrightarrow{CaO,\Delta} CH_4 + Na_2CO_3$$

Products: Methane (CH_4) gas and sodium carbonate (Na_2CO_3)

(b) $CH_3COOH + Mg \rightarrow$

This is an **acid–metal reaction**, where acetic acid reacts with magnesium to produce a salt and hydrogen gas.

Balanced Equation:

$$2CH_3COOH + Mg \rightarrow (CH_3COO)_2Mg + H_2 \uparrow$$

Products: Magnesium acetate and hydrogen gas

(iii) Name the **gas** produced during each of the following reactions: [3]

(a) When copper is treated with hot, concentrated nitric acid.

(b) When ammonia is burnt in an atmosphere of oxygen.

(c) When ferrous sulphide reacts with dilute hydrochloric acid.

(a) When copper is treated with hot, concentrated nitric acid:

👉 **Nitrogen dioxide (NO_2)** is produced — a **brown, toxic gas.**

Reaction:

$$Cu + 4HNO_3(conc) \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

(b) When ammonia is burnt in an atmosphere of oxygen:

👉 **Nitrogen (N_2)** gas is produced.

Reaction:

$$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$$

> If a **platinum catalyst** is used, nitric oxide (NO) can form instead.

(c) When ferrous sulphide reacts with dilute hydrochloric acid:

👉 **Hydrogen sulphide (H_2S)** gas is produced — has a **rotten egg smell.**

Reaction:

$$FeS + 2HCl \rightarrow FeCl_2 + H_2S \uparrow$$

(iv) Study the table given below. Use only the letters given in the table to answer the questions. **Do not identify** the elements. [3]

IA	IIA						
		IIIA	IVA	VA	VIA	VIIA	0
			E		J		Q
	L			G			
	M	D				P	
	N						

(a) State the valency of element 'G'.

(b) Which element can exhibit catenation?

(c) Write the formula of the compound formed between 'M' and 'P'.

(a) State the valency of element 'G':

- Element **G** is in **Group VA.**
- Elements in Group VA have **5 valence electrons.**
- To complete the octet, they need **3 more electrons**, so **valency = 3.**

✅ **Answer: 3**

(b) Which element can exhibit catenation?

- **Catenation** is the ability of an element to form chains with itself.
- It is shown mainly by **Group IVA** elements.
- From the table, element **E** is in **Group IVA.**

✅ **Answer: E**

(c) Write the formula of the compound formed between 'M' and 'P':

- **M** is in **Group IIA** → valency = **2**
- **P** is in **Group VIIA** → valency = **1**

To balance the charges, 1 M will bond with 2 P atoms.

✅ **Answer: MP_2**

Question 5

(i) Given below are two sets of elements from two different periods. [2]

Name the element with the **highest** ionisation potential in each of the following sets.

(a) Al, Cl, Mg

(b) Ne, O, F

(a) Set: Al, Cl, Mg

Ionisation potential increases **across a period** (left to right).

- **Al**: Group 13
- **Mg**: Group 2
- **Cl**: Group 17

✅ **Answer: Cl** (Chlorine has the highest ionisation potential)

(b) Set: Ne, O, F

All are in **Period 2**.

Ionisation potential increases across a period, but **noble gases** like neon have **exceptionally high ionisation energies** due to stable electronic configurations.

✅ **Answer: Ne** (Neon has the highest ionisation potential)

(ii) Ammonia gas is passed over heated copper (II) oxide in a combustion tube: [2]

(a) Name the gas evolved.

(b) What will be the colour of the residue that is left in the combustion tube at the end of the reaction?

(a) Name the gas evolved:

In this reaction, **ammonia reduces copper(II) oxide (CuO)** to metallic copper, and **nitrogen gas (N_2)** is evolved.

✅ **Answer: Nitrogen (N_2)**

Balanced equation:

$$3CuO + 2NH_3 \rightarrow 3Cu + 3H_2O + N_2$$

(b) Colour of the residue left in the combustion tube:

- The black **CuO** is reduced to **copper metal**, which has a **reddish-brown** colour.

✅ **Answer: Reddish-brown**

(iii) Give balanced equations for the following: [3]

(a) Action of dilute hydrochloric acid on ammonium carbonate.

(b) Oxidation of sulphur with hot concentrated nitric acid.

(c) Reaction of concentrated sulphuric acid with carbon.

(a) Action of dilute hydrochloric acid on ammonium carbonate:

$$(NH_4)_2CO_3 + 2HCl \rightarrow 2NH_4Cl + H_2O + CO_2 \uparrow$$

✅ Products: **Ammonium chloride**, **water**, and **carbon dioxide gas**

(b) Oxidation of sulphur with hot concentrated nitric acid:

$$S + 6HNO_3(conc) \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$$

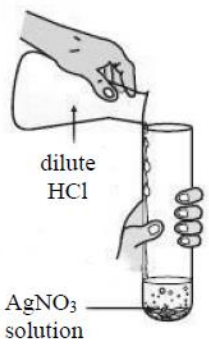
✅ Sulphur is oxidized to **sulphuric acid**, and **nitrogen dioxide** is released.

(c) Reaction of concentrated sulphuric acid with carbon:

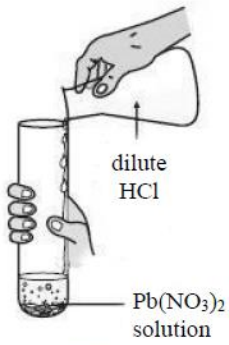
$$C + 2H_2SO_4(conc) \rightarrow CO_2 + 2SO_2 + 2H_2O$$

✅ Sulphuric acid acts as an oxidizing agent; carbon is oxidized to **carbon dioxide**, and **sulphur dioxide** gas is evolved.

(iv) Rohit took two different salt solutions in test tubes **C** and **D** as shown in the figure below. He added dilute HCl to each of the two test tubes. The products formed in the test tubes **C** and **D** are *silver chloride* and *lead chloride* respectively. [3]



Test tube **C**



Test tube **D**

State:

(a) one common observation made by Rohit in both the reactions.

(b) the observations made by him on addition of excess of ammonium hydroxide to the products formed in:

1. test tube **C**
2. test tube **D**

(a) One common observation made by Rohit in both reactions:

👉 A **white precipitate** is formed in **both test tubes** upon addition of **dilute HCl**.

- In test tube **C**: **Silver chloride (AgCl)** precipitate
- In test tube **D**: **Lead(II) chloride ($PbCl_2$)** precipitate

✅ **Answer:** Formation of a **white precipitate** in both test tubes.

(b) Observations on addition of excess ammonium hydroxide (NH_4OH):

1. Test tube C (AgCl formed):

- **Silver chloride** is **soluble in excess ammonium hydroxide**, forming a **colourless complex**.

✅ **Observation:** The white precipitate **dissolves**, forming a **clear solution**.

Reaction:

$$AgCl + 2NH_4OH \rightarrow [Ag(NH_3)_2]^+ + Cl^- + 2H_2O$$

---

2. Test tube D ($PbCl_2$ formed):

- **Lead(II) chloride** is **insoluble** in excess ammonium hydroxide.

✅ **Observation:** The white precipitate **does not dissolve**.

Final Answers Summary:

(a) Common observation:

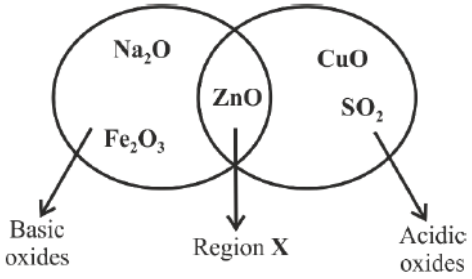
➡️ White precipitate is formed in both test tubes.

(b)

1. **Test tube C:** Precipitate dissolves in excess NH_4OH.
2. **Test tube D:** Precipitate remains unchanged in excess NH_4OH.

Question 6

(i) Given below is a diagram showing the placement of five different oxides. With respect to the given diagram answer the following questions: [3]



(a) Name the **type** of oxide represented in region **X** in the diagram.

(b) Identify the oxide which has been **incorrectly** placed in the above diagram.

(c) Name the oxide from the above diagram which will form an **alkali** when dissolved in water.

(a) Name the type of oxide represented in region X in the diagram:

- **Region X** lies between basic and acidic oxides → these are **amphoteric oxides.**
- Amphoteric oxides can react with both acids and bases.

✅ **Answer: Amphoteric oxides**

(b) Identify the oxide which has been incorrectly placed in the diagram:

- **CuO (Copper(II) oxide)** is a **basic oxide**, but it is placed in the **acidic oxide** section.

✅ **Answer: CuO**

(c) Name the oxide from the diagram that will form an alkali when dissolved in water:

- Only **sodium oxide (Na_2O)** is **soluble** and forms **sodium hydroxide**, a strong alkali.

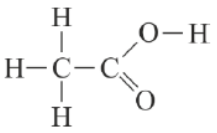
$$Na_2O + H_2O \rightarrow 2NaOH$$

✅ **Answer: Na_2O**

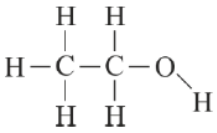
(ii) Given below are organic compounds labelled **A** to **F**. [3]

Answer the questions that follow:

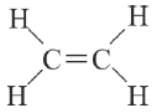
A.



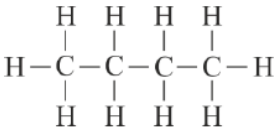
B.



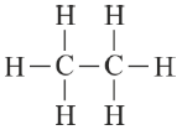
C.



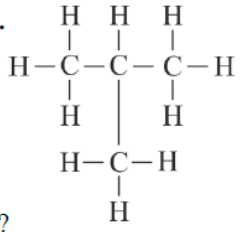
D.



E.



F.



(a) Which compound forms a **single** product with **bromine**?

(b) Which **two** compounds have the **same** molecular formula?

(c) Which **two** compounds will react together in the presence of concentrated H_2SO_4 to form a product with a **fruity smell**?

(iii) An organic compound '**X**' contains carbon, oxygen and hydrogen only. The percentage of carbon and hydrogen are 47.4% and 10.5% respectively. The relative molecular mass of **'X'** is 76. Find the **empirical** formula and the **molecular** formula of **'X'**. [4]

[*Atomic weight: C = 12, O = 16, H = 1*]

Question 7

(i) Seema added a few pieces of copper turnings to a test tube containing concentrated acid **P** and she noticed that a reddish-brown gas evolved. [2]

(a) Name the acid **P** used by Seema.

(b) Write a balanced chemical equation for the reaction that took place.

(a) Name the acid P used by Seema:

- The reddish-brown gas observed is **nitrogen dioxide (NO_2)**.
- This gas is produced when **copper reacts with concentrated nitric acid**.

✅ **Answer: Concentrated nitric acid (HNO_3)**

(b) Write a balanced chemical equation for the reaction:

$$Cu + 4HNO_3(conc) \rightarrow Cu(NO_3)_2 + 2NO_2 \uparrow + 2H_2O$$

- NO_2 is the reddish-brown gas evolved.

✅ **Balanced Equation:**

$$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

(ii) Answer the following questions with reference to the concentration of **bauxite ore**. [2]

(a) Name the process used to concentrate the ore.

(b) Give a balanced chemical equation for the conversion of aluminium hydroxide to pure alumina.

(iii) Draw the **dot and cross** structure of the following: [3]

(a) An ionic compound formed when Mg reacts with the dilute HCl.

(b) A covalent compound formed when H_2 reacts with Cl_2.

(c) The positive ion produced when ammonia gas is dissolved in water.

[*Atomic number: Mg = 12, Cl = 17, H = 1, N = 7*]

(iv) Acidulated water is electrolysed using platinum electrodes. [3]

Answer the following questions:

(a) Why is dilute sulphuric acid added to water?

(b) Write the reaction taking place at the cathode.

(c) What is the observation at the anode?

Question 8

(i) (a) State Avogadro's Law. [2]

(b) Define Co-ordinate bond.

(a) State Avogadro's Law:

✅ **Answer:**

Avogadro's Law states that equal volumes of all gases, under the same conditions of temperature and pressure, contain an equal number of molecules.

(b) Define Coordinate bond:

✅ **Answer:**

A coordinate bond (also called a dative covalent bond) is a type of covalent bond in which both the shared electrons are donated by only one of the atoms involved in the bond.

(ii) Differentiate between the following pairs of compounds using the **reagent** given in the bracket: [2]

(a) Ammonium chloride and Sodium chloride *(using an alkali)*

(b) Zinc Nitrate solution and Calcium Nitrate solution
(using excess sodium hydroxide solution)

(a) *Ammonium chloride* vs *Sodium chloride*

(Using an alkali – e.g., sodium hydroxide NaOH)

✅ **Ammonium chloride:**

- On heating with NaOH, it gives off a **pungent-smelling gas (ammonia).**
- Gas turns **red litmus blue.**

✅ **Sodium chloride:**

- No gas is evolved on heating with NaOH.

(b) *Zinc nitrate solution* vs *Calcium nitrate solution*

(Using excess sodium hydroxide solution)

✅ **Zinc nitrate:**

- Forms a **white precipitate** of $Zn(OH)_2$ with NaOH.
- **Precipitate dissolves** in **excess NaOH**, forming a **clear solution.**

✅ **Calcium nitrate:**

- Forms a **white precipitate** of $Ca(OH)_2$.
- **Precipitate does NOT dissolve** in excess NaOH.

(iii) You are provided with some compounds in the box. [3]

PbO	CH_4	PbO_2		CO_2
	HCl	NCl_3	SO_2	

Choose the most appropriate compound which fits the descriptions (a) to (c) given below:

(a) A colourless gas which turns acidified $K_2Cr_2O_7$ from *orange to green*.

(b) A *yellow explosive* oily liquid formed when excess chlorine gas reacts with ammonia gas.

(c) A *yellow metallic* oxide formed on thermal decomposition of $PbCO_3$.

(a) A colourless gas which turns acidified $K_2Cr_2O_7$ from orange to green:

- This describes a **reducing gas**, and the gas must be **sulfur dioxide (SO_2)**.
- SO_2 is a **colourless gas** and a **reducing agent**.

✅ **Answer: SO_2**

(b) A yellow explosive oily liquid formed when excess chlorine reacts with ammonia gas:

- The compound formed is **nitrogen trichloride (NCl_3)**.
- It is a **yellow, oily, explosive liquid**.

✅ **Answer: NCl_3**

(c) A yellow metallic oxide formed on thermal decomposition of $PbCO_3$:

- When **lead carbonate ($PbCO_3$)** is heated, it decomposes to form **lead(II) oxide (PbO)** and CO_2.
- PbO is a **yellow metallic oxide**.

✅ **Answer: PbO**

Final Answers:

- (a) → **SO_2**
- (b) → **NCl_3**
- (c) → **PbO**

(a)

SO_2 turns acidified $K_2Cr_2O_7$ from orange to green

This is a **redox reaction** where SO_2 acts as a **reducing agent**, reducing $Cr_2O_7^{2-}$ to Cr^{3+}.

$$Cr_2O_7^{2-} + 3SO_2 + 2H^+ \rightarrow 2Cr^{3+} + 3SO_4^{2-} + H_2O$$

(b)

Reaction of excess chlorine with ammonia to form NCl_3:

In presence of **excess chlorine**, **nitrogen trichloride** is formed:

$$NH_3 + 3Cl_2 \rightarrow NCl_3 + 3HCl$$

- **NCl_3** = yellow, oily, explosive liquid
- **HCl** = gas evolved

(c)

Thermal decomposition of lead(II) carbonate ($PbCO_3$):

$$PbCO_3 \xrightarrow{\Delta} PbO + CO_2$$

- **PbO** = yellow metallic oxide
- **CO_2** = colourless gas

(iv) **P**, **Q**, **R** and **S** are the different methods of preparation of salts. [3]

P – Simple displacement

Q – Neutralisation by titration

R – Precipitation

S – Direct combination

Choose the **most appropriate** method to prepare the following salts:

(a) $PbCl_2$

(b) $FeCl_3$

(c) Na_2SO_4

(a) $PbCl_2$

Lead(II) chloride is an **insoluble salt**, typically prepared by **precipitation**.

✅ **Method: R – Precipitation**

Example Reaction:

$$Pb(NO_3)_2 + 2NaCl \rightarrow PbCl_2 \downarrow + 2NaNO_3$$

(b) $FeCl_3$

Ferric chloride is formed by **direct combination** of iron with chlorine gas.

✅ **Method: S – Direct combination**

Example Reaction:

$$2Fe + 3Cl_2 \rightarrow 2FeCl_3$$

(c) Na_2SO_4

Sodium sulfate is a **soluble salt**, typically formed by **neutralisation** (acid + base).

✅ **Method: Q – Neutralisation by titration**

Example Reaction:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

✅ **Final Answers:**

- (a) **R**
- (b) **S**
- (c) **Q**

2024

(iii) Match the salts underlined in Column A with the most suitable method of preparation given in Column B. [3]

	Column A		Column B
(a)	$\underline{ZnCl_2}$ from Zn	1.	Precipitation
(b)	$\underline{KNO_3}$ from KOH	2.	Direct combination
(c)	$\underline{CaCO_3}$ from $CaCl_2$	3.	Displacement reaction
		4.	Neutralization

Column A	Column B
(a) $ZnCl_2$ from Zn	3. Displacement reaction
(b) KNO_3 from KOH	4. Neutralization
(c) $CaCO_3$ from $CaCl_2$	1. Precipitation

(a) $ZnCl_2$ from Zn

- Zinc reacts directly with chlorine or acids to form $ZnCl_2$.
- This is a **displacement reaction** when zinc reacts with an acid, or **direct combination** when zinc reacts with chlorine.
- Since the question mentions "from Zn" without specifying chlorine, the typical method is displacement (e.g., $Zn + 2HCl \rightarrow ZnCl_2 + H_2$).

Match: 3. Displacement reaction

(b) KNO_3 from KOH

- KNO_3 is a salt formed by the neutralization of potassium hydroxide (a base) with nitric acid (an acid).
- This is a **neutralization** reaction.

Match: 4. Neutralization

(c) $CaCO_3$ from $CaCl_2$

- $CaCO_3$ (calcium carbonate) is an **insoluble salt** and can be prepared by **precipitation** when calcium chloride reacts with sodium carbonate.

(b) Empirical formula of Ethyne.

The **molecular formula** of **ethyne** is:

$$C_2H_2$$

To find the **empirical formula**, we reduce the molecular formula to the simplest whole number ratio of atoms.

$$C_2H_2 \rightarrow CH$$

✅ **Empirical formula of Ethyne: CH**

(iv) The following table shows the electronic configuration of the atoms A, B, C and D. [3]

Element	A	B	C	D
Electronic configuration	2, 8, 8, 2	2, 6	2, 8, 7	2, 4

(a) Write the formula of the compound formed between:

1. A and B

2. D and C

(b) Which of the above elements will exhibit catenation?

(iii) Ammonia burns in oxygen as shown below. [3]

$$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$$

If 240 cc of ammonia is burnt in 300 cc of oxygen, find out the composition of the resultant gaseous mixture at room temperature.

Question 7

(i) Rita was given an unknown salt for identification. She prepared a solution of the salt and divided it into two parts. [2]

- To the first part of the salt solution, she added a few drops of ammonium hydroxide and obtained a reddish-brown precipitate.
- To the second part of the salt solution, she added a few drops of silver nitrate solution and obtained a white precipitate.

Name:

(a) the cation present and

(b) the anion present in the salt given for identification.

Based on the observations:

- **Reddish-brown precipitate** with **ammonium hydroxide** → indicates the presence of **Fe^{3+} (ferric ion).**
- **White precipitate** with **silver nitrate** → indicates the presence of **Cl^- (chloride ion).**

Answers:

(a) The **cation** present: **Ferric ion (Fe^{3+})**

(b) The **anion** present: **Chloride ion (Cl^-)**

(a) Reaction with Ammonium Hydroxide (NH_4OH):

Salt contains Fe^{3+} (ferric ion)

$$Fe^{3+} + 3NH_4OH \rightarrow Fe(OH)_3 \downarrow + 3NH_4^+$$

- **Observation:** A **reddish-brown precipitate** of **ferric hydroxide ($Fe(OH)_3$)** is formed.

(b) Reaction with Silver Nitrate ($AgNO_3$):

Salt contains Cl^- (chloride ion)

$$Cl^- + AgNO_3 \rightarrow AgCl \downarrow + NO_3^-$$

- **Observation:** A **white precipitate** of **silver chloride (AgCl)** is formed.

(ii) Fill in the blanks by choosing the correct answer from the bracket: [2]

(a) Carbon tetrachloride is a _____ *[polar / non-polar]* covalent molecule.

(b) During electrolysis of acidulated water, the gas liberated at the anode is _____ *[oxygen / hydrogen]*.

(a) Carbon tetrachloride is a **non-polar** covalent molecule.

→ Even though C–Cl bonds are polar, the symmetrical tetrahedral shape cancels the dipole moments.

(b) During electrolysis of acidulated water, the gas liberated at the anode is **oxygen**.

→ At the anode, oxidation occurs, and O_2 is released from water.

(iv) Identify the following: [3]

(a) An element in period 1 which can be placed in both group 1 and group 17 of the Periodic Table.

(b) The element having electronic configuration 2, 8, 6.

(c) The most electronegative element of period 3.

(a) An element in period 1 which can be placed in both group 1 and group 17 of the Periodic Table.

➡ **Hydrogen (H)**

- Hydrogen can lose 1 electron (like group 1 alkali metals)
- It can also gain 1 electron (like group 17 halogens)
- Hence, it is sometimes considered for placement in both groups.

(b) The element having electronic configuration 2, 8, 6.

➡ **Sulphur (S)**

- Atomic number 16
- Electronic configuration: 2 (K shell), 8 (L shell), 6 (M shell).

(c) The most electronegative element of period 3.

➡ **Chlorine (Cl)**

- Chlorine is the most electronegative element in period 3.

(iii) Arrange the following as per the instructions given in the brackets: [3]

(a) Carbon, Fluorine, Beryllium *(decreasing order of atomic size)*

(b) Sulphuric acid, Phosphoric acid, Acetic acid *(increasing order of number of replaceable H atoms per molecule)*

(c) Potassium, Lithium, Sodium *(increasing order of ionization potential)*

(a) Carbon, Fluorine, Beryllium *(decreasing order of atomic size)*

➡ **Beryllium > Carbon > Fluorine**

- Atomic size decreases across a period from left to right.

(b) Sulphuric acid, Phosphoric acid, Acetic acid

(increasing order of number of replaceable H atoms per molecule)

➡ **Acetic acid (1) < Phosphoric acid (3) < Sulphuric acid (2)**

Correction needed: This seems contradictory as per actual values:

- **Acetic acid:** 1 replaceable H
- **Phosphoric acid:** 3 replaceable H
- **Sulphuric acid:** 2 replaceable H

So correct increasing order:

➡ **Acetic acid < Sulphuric acid < Phosphoric acid**

(c) Potassium, Lithium, Sodium *(increasing order of ionization potential)*

➡ **Potassium < Sodium < Lithium**

- Ionization potential increases as atomic size decreases (across group 1, top to bottom).

(ii) Give reasons for the following: [2]

(a) Inert gases do not form ions.

(b) Covalent compounds have a low melting and boiling point.

(a) Inert gases do not form ions.

➡ **Because they have a completely filled outermost electron shell (octet configuration), making them stable and chemically non-reactive.**

Hence, they do not need to gain or lose electrons to form ions.

(b) Covalent compounds have a low melting and boiling point.

➡ **Because they consist of discrete molecules held together by weak intermolecular forces (van der Waals forces), which require little energy to break.**

This results in low melting and boiling points.

(iv) Identify the *gas evolved* in each of the following reactions: [3]

(a) Methane undergoes complete combustion.

(b) Copper carbonate is heated.

(c) MnO_2 reacts with concentrated HCl.

(a) Methane undergoes complete combustion.

Gas evolved: ◆ *Carbon dioxide (CO_2)*

Balanced equation:

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

(b) Copper carbonate is heated.

Gas evolved: ◆ *Carbon dioxide (CO_2)*

Balanced equation:

$CuCO_3 \rightarrow CuO + CO_2\uparrow$

(c) MnO_2 reacts with concentrated HCl.

Gas evolved: ◆ *Chlorine gas (Cl_2)*

Balanced equation:

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2\uparrow$

(iii) Calcium carbonate reacts with dilute hydrochloric acid as given below: [3]

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

(a) What is the mass of 5 moles of calcium carbonate? *(Relative molecular mass of calcium carbonate is 100)*

(b) How many moles of HCl will react with 5 moles of calcium carbonate?

(c) What is the volume of carbon dioxide liberated at S.T.P. at the same time?

Question 4

(i) Define the following terms: [2]

(a) Molar volume

(b) Normal salt

(a) Molar volume:

Molar volume is the volume occupied by one mole of a gas at standard temperature and pressure (STP: 0°C and 1 atm pressure).

✅ **It is equal to 22.4 litres.**

(b) Normal salt:

A **normal salt** is a salt formed when **all the replaceable hydrogen atoms** of an acid are completely replaced by metal or ammonium ions.

✅ *Example:* NaCl is a normal salt formed from HCl and NaOH.

(iii) Mohan has three solutions **P**, **Q** and **R** having a pH of 13, 5 and 2 respectively. [3]
Which of the above solutions **P**, **Q** or **R**:

(a) will react with Magnesium to liberate hydrogen gas?

(b) will liberate ammonia gas when it reacts with ammonium chloride?

(c) will contain molecules as well as ions?

Given:

- P has pH = 13
- Q has pH = 5
- R has pH = 2

(a) Will react with Magnesium to liberate hydrogen gas?

- Magnesium reacts with **acids and alkalis** to liberate hydrogen gas.
- pH 13 indicates a **strongly alkaline** solution → **P** (alkali).
- pH 5 is slightly acidic but not strong enough, pH 2 is strongly acidic → both acids will react, but alkalis also react.
- **Answer: P (alkaline solution)**

(b) Will liberate ammonia gas when it reacts with ammonium chloride?

- Ammonia gas is liberated when **alkali reacts with ammonium salts** (like ammonium chloride).
- Alkali solution has pH = 13 → **P.**
- **Answer: P**

(c) Will contain molecules as well as ions?

- Solutions with pH close to 7 (neutral) usually contain mostly ions.
- Weak acids or weak bases contain **molecules as well as ions.**
- pH 5 is slightly acidic, indicating a **weak acid → Q.**
- **Answer: Q**

Summary:

- (a) P
- (b) P
- (c) Q

(ii) Identify **only** the **anion** present in the following compound: [2]

(a) The compound on heating produces a colourless, odourless gas which turns lime water milky and has no effect on acidified potassium dichromate solution.

(b) The solution of the compound which on treating with concentrated sulphuric acid and freshly prepared ferrous sulphate solution produces a brown ring.

(a)

- The compound on heating produces a **colourless, odourless gas** which **turns lime water milky** (this gas is CO_2).
- It has **no effect on acidified potassium dichromate** → so it is **not a reducing agent** like SO_2.
- This indicates the compound is a **carbonate** and the anion present is **carbonate ion, CO_3^{2-}**.

(b)

- The solution on treating with concentrated sulphuric acid and freshly prepared ferrous sulphate produces a **brown ring** → this is a test for nitrate ions.
- The anion present is **nitrate ion, NO_3^-**.

Summary:

- (a) Anion: **CO_3^{2-}** (carbonate ion)
- (b) Anion: **NO_3^-** (nitrate ion)

(iv) State the **terms** for the following:

(a) The group obtained by removing one hydrogen atom from the parent alkane.

(b) Two metal plates or wires through which the current enters and leaves the electrolytic cell.

(c) The amount of substance which contains the same number of units as the number of atoms in carbon-12.

(d) The tendency of an atom to pull a shared pair of electrons towards itself in a compound.

(e) The formula which represents the simplest ratio between the atoms of elements present in a compound.

(a) The group obtained by removing one hydrogen atom from the parent alkane.
Answer: Alkyl group

(b) Two metal plates or wires through which the current enters and leaves the electrolytic cell.
Answer: Electrodes

- Specifically:
  - The plate where current enters = **Anode**
  - The plate where current leaves = **Cathode**

(c) The amount of substance which contains the same number of units as the number of atoms in carbon-12.
Answer: Mole

(d) The tendency of an atom to pull a shared pair of electrons towards itself in a compound.
Answer: Electronegativity

(e) The formula which represents the simplest ratio between the atoms of elements present in a compound.
Answer: Empirical formula

(iii) Complete the following sentences by choosing the correct answer from the brackets: [5]

(a) The salt that can be prepared by Direct Combination is _____. *[$FeCl_3$ / $FeCl_2$]*

(b) The metallic oxide which can be reduced by using common reducing agents is _____. *[Fe_2O_3 / Al_2O_3]*

(c) The metal nitrate which on thermal decomposition forms a black residue is _____. *[zinc nitrate / copper nitrate]*

(d) During the electrolysis of copper sulphate solution, if _____ is used as electrodes, the colour of the electrolyte does not fade. *[copper / platinum]*

(e) The process of heating the concentrated ore in a limited supply or absence of air is _____ *[roasting / calcination]*

(a) The salt that can be prepared by Direct Combination is **$FeCl_3$.**
($FeCl_3$ is prepared by the direct reaction of iron and chlorine gas)

(b) The metallic oxide which can be reduced by using common reducing agents is **Fe_2O_3.**
(Fe_2O_3 can be reduced by carbon or other reducing agents, Al_2O_3 is very stable and not easily reduced)

(c) The metal nitrate which on thermal decomposition forms a black residue is **copper nitrate.**
(Copper nitrate decomposes to copper oxide, a black residue; zinc nitrate forms white zinc oxide)

(d) During the electrolysis of copper sulphate solution, if **platinum** is used as electrodes, the colour of the electrolyte does not fade.
(Platinum electrodes do not dissolve, so the blue colour remains. Copper electrodes dissolve and maintain the color)

(e) The process of heating the concentrated ore in a limited supply or absence of air is **calcination.**
(Roasting involves heating in excess air, calcination in limited air)

(ii) Match the *Column A* with *Column B*:

	Column A		Column B
(a)	Water	1.	Lithium
(b)	Alkali metal	2.	Iodine
(c)	Halogen	3.	Covalent compound
(d)	Calcium oxide	4.	Acetic acid
(e)	Weak acid	5.	Ionic compound
		6.	Sulphuric acid

(a) Water — 3. Covalent compound
(b) Alkali metal — 1. Lithium
(c) Halogen — 2. Iodine
(d) Calcium oxide — 5. Ionic compound
(e) Weak acid — 4. Acetic acid

(xiii) Which of the following would occupy 22.4 litres at S.T.P.?

1. 32g of oxygen gas
2. 2 moles of hydrogen gas
3. 6.022×10^{23} molecules of ammonia

(a) 1 & 2

(b) 1 & 3

(c) 2 & 3

(d) 1, 2 & 3

[Atomic weights: O = 16, H = 1, N = 14]

- **1. 32g of oxygen gas**
  Oxygen (O_2) molecular weight = 16 × 2 = 32 g/mol
  32g is exactly 1 mole of oxygen gas.
  At STP, 1 mole of gas occupies 22.4 litres.
  So, **32g of oxygen gas occupies 22.4 litres.**
- **2. 2 moles of hydrogen gas**
  1 mole of any gas occupies 22.4 litres at STP, so 2 moles occupy 2 × 22.4 = 44.8 litres.
  So, **2 moles of hydrogen gas occupy 44.8 litres**, NOT 22.4 litres.
- **3. 6.022×10^{23} molecules of ammonia**
  6.022×10^{23} molecules = 1 mole of ammonia gas.
  At STP, 1 mole of gas occupies 22.4 litres.
  So, **this occupies 22.4 litres.**

Conclusion: Only options 1 and 3 occupy 22.4 litres at STP.

Answer: (b) 1 & 3

(xi) Rotten egg smell is due to the liberation of:

(a) HCl gas

(b) H_2S gas

(c) Cl_2 gas

(d) SO_2 gas

Rotten egg smell is due to the liberation of:

(b) H_2S gas (Hydrogen sulfide gas)

It has the characteristic foul smell like rotten eggs.

(x) On passing ammonia gas over heated copper oxide for some time, a reddish-brown residue is left behind. What property of ammonia is demonstrated here?

(a) Basic property

(b) Oxidising property

(c) Reducing property

(d) Acidic property

Correct answer: (c) Reducing property

Explanation:

- **Heated copper(II) oxide (CuO)** is black in color.
- When **ammonia (NH_3)** is passed over it, it **reduces** the black CuO to **reddish-brown copper metal (Cu)**.
- This shows that ammonia acts as a **reducing agent** by donating electrons to Cu^{2+} ions.

Reaction:

$$3CuO + 2NH_3 \rightarrow 3Cu + 3H_2O + N_2$$

Thus, the **reducing property** of ammonia is demonstrated. ✅

(viii) Electron Affinity is maximum in:

(a) Mg

(b) Ar

(c) Li

(d) Br

✅ **Correct answer: (d) Br**

Explanation:

- **Electron affinity** is the amount of energy released when an atom gains an electron.
- **Halogens (Group 17 elements)** have the highest electron affinity because they are just one electron short of a stable noble gas configuration.
- **Bromine (Br)** is a halogen and has a **high electron affinity**.
- Other options:
  - **Mg**: Group 2 metal; low electron affinity.
  - **Ar**: Noble gas; full shell, electron affinity is ~0 or even positive.
  - **Li**: Group 1 metal; low electron affinity.

(vii) The oxidizing agent in the equation $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$ is:

(a) Sulphur

(b) Sulphuric acid

(c) Sulphur dioxide

(d) Water

✅ **Correct answer: (b) Sulphuric acid**

Explanation:

- In this reaction:
  - **Elemental sulphur (S)** is being **oxidized** to **sulphur dioxide (SO_2)**.
  - **Sulphuric acid (H_2SO_4)** acts as the **oxidizing agent**.
- The sulphur in **H_2SO_4** (oxidation state +6) oxidizes elemental sulphur (oxidation state 0) to SO_2 (oxidation state +4).
- An oxidizing agent is the substance that **gains electrons (gets reduced)** and causes **oxidation** of another substance.

(iv) The metal hydroxide which reacts with both acids and alkalis to form salt and water is:

(a) Calcium hydroxide

(b) Magnesium hydroxide

(c) Aluminium hydroxide

(d) Ferric hydroxide

✅ **Correct answer: (c) Aluminium hydroxide**

Explanation:

- A substance that reacts with both acids and alkalis is called **amphoteric**.
- **Aluminium hydroxide ($Al(OH)_3$)** is an **amphoteric hydroxide**, meaning it reacts with:
  - **Acids** to form **aluminium salts** and water.
  - **Alkalis** to form **aluminates** and water.

Examples:

- With acid:

$$Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$$

- With base:

$$Al(OH)_3 + NaOH \rightarrow Na[Al(OH)_4]$$

So, the hydroxide that shows both acidic and basic behavior is **Aluminium hydroxide**.

(iii) Copper, Zinc and Tin are the metals alloyed to form:

(a) Duralumin

(b) Brass

(c) Bronze

(d) Solder

Explanation of Alloys:

1. **Duralumin** – Aluminium + Copper + Manganese + Magnesium
2. **Brass** – Copper + Zinc
3. **Bronze** – Copper + Tin
4. **Solder** – **Lead** + **Tin**, and sometimes contains small amounts of **Copper or Zinc**

But in **some soft solder compositions**, **Copper** + **Zinc** + **Tin** are added together for **better electrical conductivity** and mechanical strength.

Given the specific combination **Copper** + **Zinc** + **Tin**, the best match from the options is:

✔ **(d) Solder**

> None of the other options contain all three: **Copper, Zinc, and Tin**.

(viii) Electron Affinity is maximum in:

(a) Mg

(b) Ar

(c) Li

(d) Br

(d) Br (Bromine)

Explanation: Electron affinity generally increases across a period and decreases down a group. Halogens like bromine have high electron affinity because they are one electron short of a full outer shell and tend to gain electrons easily.

(vii) The oxidizing agent in the equation $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$ is:

(a) Sulphur

(b) Sulphuric acid

(c) Sulphur dioxide

(d) Water

The oxidizing agent in the equation
$S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$
is:

(b) Sulphuric acid

Explanation:
In this reaction, sulfur (S) is being oxidized to sulfur dioxide (SO_2), and sulfuric acid (H_2SO_4) acts as the oxidizing agent because it gains electrons (is reduced) while causing the oxidation of sulfur.

(ii) In the 2nd period Neon has maximum Ionization Potential because:

(a) It has unstable electronic configuration.

(b) It easily accepts electrons.

(c) It easily loses electrons.

(d) The outer most shell is completely filled.

✅ **Correct answer: (d) The outermost shell is completely filled**

Explanation:

- **Ionization potential** (or ionization energy) is the energy required to remove an electron from a gaseous atom.
- **Neon (Ne)** has the electronic configuration: **$1s^2$ $2s^2$ $2p^6$** — a **completely filled outer shell**, making it

(i) Unsaturated hydrocarbons undergo:

(a) Addition reaction

(b) Substitution reaction

(c) Oxidation reaction

(d) Redox reaction

The correct answer is:

(a) Addition reaction

Explanation:

Unsaturated hydrocarbons (such as **alkenes** and **alkynes**) contain one or more double or triple bonds between carbon atoms. These multiple bonds make them more reactive and they typically undergo **addition reactions**, where atoms or groups are added to the carbon atoms involved in the multiple bond, converting them into single bonds.

Examples of addition reactions:

- Ethene + H_2 → Ethane (Hydrogenation)
- Ethene + Br_2 → 1,2-Dibromoethane (Halogen addition)

Substitution reactions are more common in **saturated hydrocarbons** like alkanes.
Oxidation and **redox reactions** can occur but are not the characteristic reactions of unsaturated hydrocarbons.