SECTION A – 40 MARKS

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

Question 1

Choose the correct answers to the questions from the given options. **[15]**

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

(i) Unsaturated hydrocarbons undergo:

(a) Addition reaction

(b) Substitution reaction

(c) Oxidation reaction

(d) Redox reaction

(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.

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

(a) Duralumin

(b) Brass

(c) Bronze

(d) Solder

(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

(v) Reaction of an alcohol with a carboxylic acid in the presence of concentrated H_2SO_4 is termed as:

(a) Halogenation

(b) Esterification

(c) Hydrogenation

(d) Dehydrohalogenation

(vi) Conversion of Ethanol to Ethene by the action of concentrated sulphuric acid involves:

(a) Dehydration

(b) Dehydrogenation

(c) Dehydrohalogenation

(d) Hydrolysis

(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

(viii) Electron Affinity is maximum in:

(a) Mg

(b) Ar

(c) Li

(d) Br

(ix) The compound that is **not** a constituent of the electrolytic mixture used in the Hall-Heroult's process is:

(a) Al_2O_3

(b) $NaAlO_2$

(c) Na_3AlF_6

(d) CaF_2

(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

(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

(xii) Ammonia gas is collected by downward displacement of air since ammonia is:

(a) very slightly soluble in water.

(b) heavier than air.

(c) lighter than air.

(d) insoluble in water.

(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]

(xiv) In the molecule of water, oxygen atom has:

(a) One shared pair of electrons.

(b) Three shared pairs of electrons.

(c) Two lone pairs of electrons.

(d) One lone pair of electrons.

(xv) A mineral from which the metal can be extracted economically and conveniently is known as:

(a) Matrix

(b) Ore

(c) Flux

(d) Alloy

Comments of Examiners

(i) Many candidates answered this question correctly as 'Addition reaction' except for a few candidates who were confused with either 'Substitution reaction' or 'Oxidation reaction'.

(ii) Most candidates answered correctly except a few who answered incorrectly with option (a) as 'It has unstable electronic configuration'.

(iii) Majority of the candidates chose the correct option 'bronze' while some opted for 'brass' as they were confused between 'brass' and 'bronze,' while a few of them even selected 'duralumin' instead.

(iv) Most candidates correctly identified 'Aluminum hydroxide', except a few who selected incorrect options such as 'calcium hydroxide' or 'magnesium hydroxide.'

(v) Many candidates chose the option 'dehydrohalogenation' instead of the correct answer, 'esterification'. While some others incorrectly chose 'hydrogenation' or 'halogenation.'

(vi) Many candidates incorrectly chose 'dehydrogenation' instead of 'dehydration'. Also, most of them were confused by terms like 'dehydrogenation' and 'dehydrohalogenation'.

(vii) Most candidates correctly answered 'sulphuric acid.' However, many candidates struggled with the concepts of 'oxidation' and 'oxidizing agents,' leading them to incorrectly choose 'sulphur dioxide.'

(viii) Majority of the candidates chose option 'Ar' or option 'Li' instead of the correct option 'Br'.

Suggestions for teachers

- Teach the difference between unsaturated and saturated hydrocarbons and highlight their reactivity and types of reactions they undergo.
- Facilitate revision and practice of these reactions using structural diagrams.
- Emphasize that ionization potential increases across a period due to greater nuclear charge, leading to stronger attraction for outer electrons.
- Highlight that Neon, at the extreme end of the second period, exhibits the highest ionization potential.
- Conduct regular practice tests covering all periodic trends, including exceptions, and explain these trends thoroughly, focusing on noble gases.
- Explain the variations in properties across periods and groups with numerous examples, relating these changes to atomic structure and nuclear charge.
- Stress the reasons behind maximum ionization potential in inert gases and teach students to connect periodic properties with atomic structure.
- Clearly explain the differences in alloy compositions and their uses, emphasizing the primary metal in a particular alloy.
- Provide revision of the compositions of alloys and their primary metals.
- Explain the concepts of acidic, basic, amphoteric, and neutral oxides with equations, and highlight the differences between amphoteric and other metallic oxides/hydroxides.
- Explain organic compound reactions and their conditions, ensuring adequate revision of each method and practice of writing the equations with examples.
- Stress the difference between dehydrohalogenation (removal of halogen and water) and dehydration (removal of only water).

(ix) Many candidates correctly answered '$NaAlO_2$', though a few wrote 'Al_2O_3'.' Some candidates who answered incorrectly were not thoroughly familiar with the formula and hence chose 'Na_3AlF_6' instead. Also, some candidates overlooked the word **'not'** in the question, leading to incorrect answers.

(x) Most of the candidates were unsure about whether ammonia is a reducing or oxidizing agent and many confused its actual reducing property to oxidizing property. Consequently, several candidates incorrectly identified ammonia as having a basic property or as an oxidizing agent, while some correctly recognized its reducing property.

(xi) Majority of the candidates answered this question correctly except a few who chose 'SO_2' or 'HCl' which was incorrect. Some incorrectly associated the rotten egg smell with HCl gas.

(xii) Some candidates were confused and wrote 'heavier than air' or 'insoluble in water.' Most candidates correctly answered, 'lighter than air,' but a few confused the collection process of ammonia and HCl, writing 'heavier than air' or mentioning its solubility in water.

(xiii) Many candidates were confused by this question and as they were unclear with the concept and thus many selected option 'C (2 & 3)' or 'all options (1, 2 & 3)' to avoid confusion. Several candidates answered without working out any calculation.

(xiv) Many candidates were not able to answer with the correct option as 'two lone pairs' of electrons and instead chose 'one lone pair' which was incorrect. Also, a few candidates got confused with ammonia and water, and some incorrectly assumed Hydrogen to have one lone pair and so chose three lone pair of electrons incorrectly.

(xv) Most of the candidates answered this question correctly as 'ore,' though a few confused the term with 'alloy' or 'matrix' and answered incorrectly.

Suggestions for teachers

- Encourage students to read all options carefully to eliminate incorrect ones while answering.
- Clarify oxidation-reduction concepts and the roles of oxidizing and reducing agents using equations.
- Explain that there is electron (loss/gain) in reactions and distinguish oxidation and reduction with examples.
- Provide practice of identifying the properties of concentrated sulphuric acid as oxidizing agents with equations.
- Provide students with in-depth information on periodic properties and their variations across periods and down the groups.
- Use multiple examples and emphasize exceptional cases and clarify that inert gases have zero electron affinity and have no tendency to attract electrons.
- Emphasize the steps involved in metal extraction from ores.
- Explain the extraction of aluminium in detail to ensure students can answer correctly.
- Provide practice of writing the formula and components of the electrolytic mixture used in aluminium extraction, including their ratios and purposes.
- Instruct students to read questions carefully and pay attention to bold or italicized words.
- Clearly explain the fundamental differences between the basic nature and reducing property of ammonia.
- Emphasize teaching through practical experiments to help students retain facts more easily.
- Encourage experimental learning to help students recognize and recall lab observations.
- Provide adequate revision of observation-based questions, especially those involving colors and precipitates.
- Emphasize the identification of gases by smell and color and provide regular objective tests to avoid mistakes.
- Demonstrate the laboratory preparation of ammonia to help students understand that it is lighter than air and collected by downward displacement of air.

Suggestions for teachers

- Create a comparative chart of HCl and NH_3 to clarify their collection methods and properties and provide more revision on these topics.
- Explain when to use upward or downward displacement of air or water during gas collection along with reasoning by using ample examples.
- Discourage guesswork and encourage solving problems to arrive at the correct answer.
- Provide relevant examples and repetitive practice to differentiate between lone pairs and shared pairs of electrons.
- Emphasize lone pairs and coordinate covalent bonds, using diagrams of hydronium and ammonium ions. Draw structures of compound to explain the types of electron pairs.
- Emphasize learning the names of important ores and clarify terms related to metallurgy and ensure students understand the processes.
- Ensure students learn correct definitions with key words.

MARKING SCHEME

Question 1

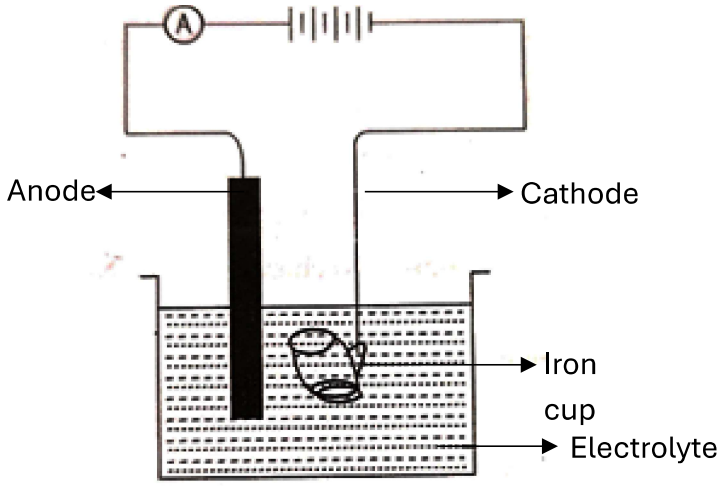
(i)	(a) /A/ Addition reaction
(ii)	(d) / D/ The outer most shell is completely filled.
(iii)	(c) / C / Bronze /b / B / Brass
(iv)	(c) / C / Aluminium hydroxide / $Al(OH)_3$ /Aluminium/Al
(v)	(b) / B / Esterification/Ester
(vi)	(a) / A/ Dehydration
(vii)	(b) / B / Sulphuric acid / H_2SO_4
(viii)	(d) / D / Br / bromine //Br_2/br_2 /br
(ix)	(b) / B / $NaAlO_2$ / sodium aluminate/ sodium meta aluminate
(x)	(c) / C / Reducing property / Reducing agent / Reducing

(xi)	(b) / B / H_2S gas / Hydrogen sulphide
(xii)	(c) / C / lighter than air/ lighter
(xiii)	(b) / B / 1 & 3/ or 32 gm of oxygen gas and 6.022 x 10^{23} molecules of ammonia
(xiv)	(c) / C / Two lone pairs of electrons /2
(xv)	(b) / B / Ore

Question 2

(i) The following sketch represents the electroplating of an Iron cup with Nickel metal. **[5]**

Study the diagram and answer the following questions:



(a) During electroplating the iron cup is placed at the cathode. Why?

(b) Name the ion that **must** be present in the electrolyte.

(c) State one condition that is necessary to ensure that the deposit is smooth, firm and even.

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

(e) What change would you observe at the anode?

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

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

(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]*

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

(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.

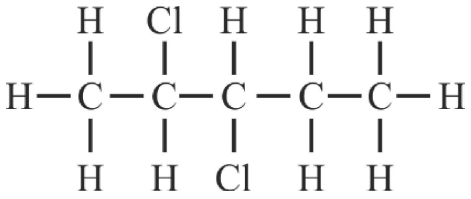
(c) The amount of substance which contains the same number of units as the number of atoms in carbon-12.

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

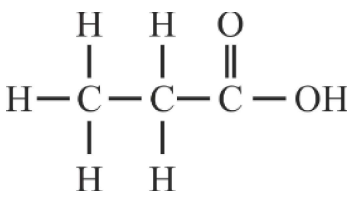
(e) The formula which represents the simplest ratio between the atoms of elements present in a compound.

(v) (a) Give the IUPAC names of the organic compounds represented by the structural formulae given below: **[5]**

1.



2.



(b) Draw the *structural diagram* for the following organic compounds:

1. 3-methyl pentane
2. propyne
3. methanal

Comments of Examiners

(i)(a) Most candidates failed to justify why the iron cup was placed at the cathode during electroplating and most of them incorrectly stated that the object to be electroplated should be at the cathode without providing the actual reason. Some were confused with correct usage of terms like using 'discharged' instead of 'deposited' and 'oxidizing electrode' instead of 'reducing electrode.' Additionally, many candidates failed to provide accurate explanations, with some mentioning the cathode's role as a reducing agent or the attraction of cations/ ions to the cathode.

(b) Most candidates correctly answered 'Ni^{2+}.' However, some struggled with providing the correct valency for nickel, while others incorrectly wrote 'iron (Fe)' as the ion present.

(c) Most candidates wrote the conditions correctly, but a few incorrectly mentioned using large or high current. Some candidates incorrectly wrote 'slow current for a long time.'

(d) Many candidates got the equation wrong. While some answered correctly, many were confused by the valency of Ni, and a few even wrote the equation in reverse, as 'Ni $\rightarrow$ Ni^{2+}.'

(e) Most candidates correctly observed that the anode diminishes, though a few incorrectly wrote 'no change' or 'no reaction' due to a lack of awareness of the process.

(ii) Many candidates answered correctly. However, some were confused in identifying water as a covalent compound and calcium oxide as an ionic compound. A few candidates mixed up halogen (iodine) and alkali metal (lithium), and some incorrectly identified sulphuric acid as a weak acid.

(iii) Some candidates were able to answer correctly. Many incorrectly answered '$FeCl_2$' instead of '$FeCl_3$' for the salt prepared by direct combination, and 'Al_2O_3' instead of 'Fe_2O_3'. Most were confused between ferrous and ferric chloride, and between reducing agents 'Al_2O_3' and 'Fe_2O_3'. Many candidates mixed-up roasting and calcination. While most candidates correctly identified the

Suggestions for teachers

- Explain the concept of electroplating clearly, detailing where the article to be plated should be placed and how ions are deposited.
- Elucidate the roles of the anode and cathode with equations, illustrating the movement of ions and teach the concepts of reducing and oxidizing electrodes clearly.
- Clearly explain the element valencies and ions present in electrolytes and emphasize the concept of ion migration to specific electrodes.
- Lay emphasis on the use of DC for smooth and uniform electroplating and the use of low current for a long period.
- Explain all conditions necessary for a smooth and firm metal deposit during electroplating, including the consequences of using low and high current and ensure students use the correct key words in their explanations.
- Discuss the differences between simple electrolysis, electroplating, and electrorefining, and provide practice in writing the reactions at the cathode and anode for clarity also emphasize the products formed at each electrode, ensuring students understand that these are neutral atoms or ions.
- Explain the products and changes at the anode and cathode, detailing observations with both inert and active electrodes.
- Teach the basic concept of covalent and ionic compounds and explain water as covalent and calcium oxide as ionic.
- Explain halogens and alkali metals with their names and symbols and give examples of ionic and covalent compounds along with examples of weak and strong acids.
- Ensure enough practice with the six methods of salt preparation, including examples and correct equations, and emphasize identifying different salts.
- Conduct quizzes and provide practice on processes like roasting, calcination in metallurgy, and using different electrodes in electrolysis.

electrode as copper, a few were wrong about the metallic nitrate, confusing it with copper nitrate.

(iv)(a) Many candidates correctly identified the group as 'alkyl,' but some confused the term and wrote 'alkyne.' Some could not recollect the correct term and instead gave an example of the group.

(b) Most candidates wrote 'cathode and anode,' while some simply wrote 'electrodes.'

(c) Majority of candidates failed to write the term 'mole.' Most wrote 'relative molecular mass' instead of 'mole' and lost marks. Also, they were confused by the given statement.

(d) Majority of candidates answered correctly, as they understood the question and wrote 'electronegativity,' while some confused it with 'electron affinity.'

(e) Many candidates incorrectly answered, 'molecular formula' instead of 'empirical formula.' Candidates were confused about the definitions of empirical and molecular formula.

(v)(a) Most candidates wrote '2 chloro, 3 chloropentane' instead of '2,3 dichloropentane,' and some wrote 'pentene' instead of 'pentane.' Most candidates confused propanoic acid with propanol and propanal while some answered it correctly.

(b) Many candidates drew the structure of 3-methylpentane correctly, but a few made mistakes. While many candidates answered correctly, a few misplaced the methyl group or forgot to include the correct number of hydrogens in their respective positions. Some candidates drew the structure of propyne correctly. However, several candidates failed to show carbon's tetravalency in the structure. Many candidates failed to depict the double bond for oxygen in methanal and answered incorrectly.

Suggestions for teachers

- Emphasize observations at each electrode and clarify oxidizing and reducing agents.
- Familiarize students with terms and their derivatives, such as alkyl, alkane, alkene, and alkyne and clearly explain these concepts with various examples and discuss the bonding of hydrogen with carbon.
- Ensure students understand the terms involved in electrolysis and stress on their functions.
- Insist on learning the definitions and familiarize students with all terms in the syllabus, especially RMM, RAM, mole, Avogadro's law, Gay-Lussac's law, gram atom, vapor density, etc.
- Teach property trends with clear definitions and ensure a thorough understanding of the concepts.
- Emphasize the concept that the simplest ratio of atoms in a compound is its empirical formula.
- Acquaint students with naming compounds according to the IUPAC system.
- Stress the importance of IUPAC nomenclature and structural formulas of organic compounds.
- Familiarize students with the basic rules, such as selecting the longest chain and numbering carbons, and teach concepts like 'di' and 'tri' before respective structures.
- Conduct periodic tests to assess student understanding of this concept.
- Emphasize regular practice in drawing structures with various compounds.
- Ensure correctly placing functional groups and provide students with ample structural examples for better conceptual clarity.
- Train students to draw structural formulas, ensuring all carbon atoms satisfy their valencies and avoid condensed formulas.
- Ensure adequate practice through quizzes and structure-writing exercises.
- Demonstrate carbon as tetravalent and oxygen as bivalent and emphasize on the functional groups and their proper positioning according to IUPAC nomenclature.

Suggestions for teachers

- Stress the correct placement of functional groups and provide students with numerous structural examples.
- Emphasize the importance of counting carbon bonds and ensuring the correct number of hydrogens for each carbon to satisfy tetravalency is essential.

MARKING SCHEME

Question 2

(i)

(a) The metal gets deposited / The metal ion gets discharged at the cathode/nickel ions or cations move to the cathode/Ni^{+2} gets discharged/ reduction takes place at the cathode / cathode acts as reducing electrode.

(b) Nickel / Ni^{+2} / Nickel ion/ Ni

(c) Small / low current for a long period of time/ DC should be used/AC should **not be** used/high current for short period of time **should not** be used/article should be thoroughly cleaned/ article should be dipped completely in the electrolyte

(d) $Ni^{+2} + 2e^- \rightarrow Ni$ / $Ni^{2+} \rightarrow Ni - 2e^-$

(e) The anode decreases in mass / size/ becomes thinner/ diminishes/reduces/dissolves/used up\

(ii)

Column A		Column B
(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

Column A	***a***	***b***	***c***	***d***	***e***
Column B	***3***	***1***	***2***	***5***	***4***

Or 1-b / 2-c /3-a /4-e /5-d

(iii)

(a) $FeCl_3$ / ferric chloride / Iron(III) chloride

(b) Fe_2O_3 / ferric oxide/ Iron(III) oxide/ Fe/Iron

(c) Copper nitrate / $Cu(NO_3)_2$ / Copper(II) nitrate/ Copper/ Cu/ cupric nitrate

(d) Copper / Cu

(e) Calcination

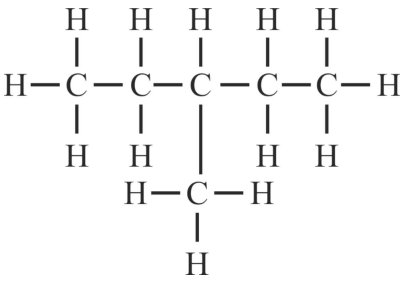
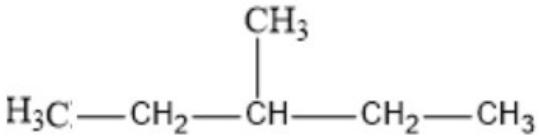
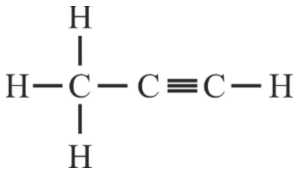
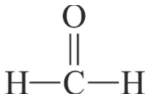
(iv)

(a) Alkyl group /alkyl

(b) Electrodes / cathode and anode together

(c) Mole/ one mole

(d) Electronegativity

	(e)	Empirical formula /empirical
(v)	(a)	1. 2, 3 dichloro-pentane / 2,3 dichloropentane
		2. Propanoic acid/ propan-1-oic acid/ 1-propanoic acid
	(b)	1. 
		
		Or
		Or $H_3C\text{-}CH_2\text{-}CH(CH_3)\text{-}CH_2\text{-}CH_3$
		Or $CH_3\text{-}CH_2\text{-}CH(CH_3)\text{-}CH_2\text{-}CH_3$
		2. 
		Or $CH_3-C\equiv CH$
		3.  Or $H_2C=O$

SECTION B (40 Marks)

*(Attempt **any four** questions from this **Section**.)*

Question 3

(i) Rewrite the following statements by adding the correct word as shown in the example: **[2]**

Example:
Given Statement: Ammonia changes moist red litmus to blue.
Correct Statement: <u>Aqueous</u> ammonia changes moist red litmus to blue.

(a) Sulphuric acid acts as a dehydrating agent.

(b) Ammonia reacts with chlorine to give ammonium chloride and nitrogen.

(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.

(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?

(iv) The following table is related to an Industrial process of an acid. **[3]**

Name of the process	**Reactant**	**Catalyst**	**Final product**
(a)	$SO_2 + O_2$	(b)	(c)

Identify (a), (b) and (c).

Comments of Examiners

(i) (a) Many candidates wrote the correct answer by adding 'concentrated sulphuric acid,' but few candidates only wrote the word 'concentrated' and lost marks for not providing the full sentence.

(b) Many candidates mistakenly wrote 'aqueous' instead of 'excess' and failed to answer correctly due to confusion between two reactions: 'excess of chlorine with ammonia and excess of ammonia with chlorine.'

(ii)(a) Many candidates failed to identify the correct anions, with some providing the wrong formula and others providing the correct valencies but the wrong formula.

(b) Most candidates failed to write the correct anion as nitrate. Some wrote the ion symbolically but with incorrect valencies, while others used wrong symbols, resulting in loss of marks.

(iii)(a) Some candidates incorrectly identified R and Q, as both solutions had a pH less than 7 and were acidic. Most candidates correctly identified the solutions as R/2 and Q/5, which also produce hydrogen. However, a few candidates were confused in correlating the given question with the options, leading to errors in identification.

(b) Most of the candidates were correct in answering this question as 'P and 13' but few candidates were confused in understanding the question with the given options and wrote the answer as 'R/2.'

(c) Many candidates answered incorrectly. Most were confused about the particles in the solution based on metals and non-metals, choosing R and P instead of Q.

(iv) Some candidates confused the Contact Process with the Ostwald Process or Bayer's Process, though most identified it correctly. Many candidates correctly noted the catalyst and wrote the correct final product as 'SO_3 or H_2SO_4.'

Suggestions for teachers

- Teach all properties of sulphuric acid with examples and discuss by initiating group discussions in class.
- Guide students to read questions properly and answer accordingly.
- Train students to write chemical equations with necessary conditions.
- Teach reactions with clear conditions and observations, emphasizing the words 'excess with ammonia' and 'chlorine' as separate reactions with equations and products formed.
- Familiarize students with the practical test of the evolved gas CO_2, starting with the lime water test followed by the acidified dichromate solution test and explain the rationale behind each test.
- Teach how to identify anions and cations present in compounds through confirmatory tests and engage students in hands-on practical activities
- Demonstrate the brown ring test using freshly prepared ferrous sulphate solution to detect the presence of nitrate or nitric acid.
- Teach anions and cations formation thoroughly through practical work, emphasizing reactions with correct observations and equations.
- Provide various metals for practice on equations and gas formation based on this concept.
- Teach the gases formed from reactions, especially with ammonia and other acidic gases, and explain their nature, state, and properties using a table.
- Acquaint students with pH scale that represents the concentration of (H3O+) ion in solution.
- Explain about the particles present in the compounds as whether it is molecules/ions or both molecules and ions with respect to their bondings.
- Emphasize every step of the industrial process (Contact Process) for preparing sulphuric acid in detail.
- Provide practice of all processes involved according to the syllabus, creating a table to differentiate processes by name, reactants, products, catalyst, and special conditions.
- Conduct constant drilling to prevent confusion.

MARKING SCHEME Question 3	
(i)	(a) **Concentrated** Sulphuric acid acts as a dehydrating agent. (b) **Excess** ammonia reacts with chlorine to give ammonium chloride and Nitrogen.
(ii)	(a) Carbonate / Bicarbonate / hydrogen carbonate/CO_3^{-2} / HCO_3^- (b) Nitrate / NO_3^-
(iii)	(a) R / 2 or Q /5 (b) P / 13 (c) Q / 5
(iv)	(a) Contact process / oxidation/ catalytic oxidation (b) Vanadium Pentoxide / V_2O_5 / Platinum / Pt (c) Sulphuric acid / H_2SO_4 /SO_3/ sulphur trioxide

Question 4

(i) Define the following terms: **[2]**

(a) Molar volume

(b) Normal salt

(ii) Draw the *electron dot* structure of: **[2]**

(a) Methane molecule

(b) Nitrogen molecule

[Atomic number: N = 7, C = 6, H = 1]

(iii) Complete and balance the following equations: **[3]**

(a) $Al_2O_3 + NaOH \rightarrow$

(b) $C_2H_5COONa + NaOH \xrightarrow[CaO]{\Delta}$

(c) $C_2H_4Br_2$ + alcoholic KOH $\xrightarrow{\Delta}$

(iv) Choose the organic compound from the list given below to answer the following questions: **[3]**

Ethene	Ethanoic acid	Ethanol	Methanal

(a) The compound which does **not** have a double bond in its structure.

(b) The compound which in its pure form turns into an ice like solid on cooling.

(c) The compound which is used for artificial ripening of fruits.

Comments of Examiners

(i) (a) Many candidates were unclear with the concept of molar volume and were unable to define it accurately. Several candidates did not include STP/NTP in their answers, and some wrote definitions that did not specify gas. Others confused molar volume with relative molecular mass.

(b) Many candidates failed to clearly distinguish between normal salt and salt and thus missed the complete replacement of the hydronium ion by a base during neutralization reactions. Also, most candidates incorrectly stated that 'acid reacts with base to form salt and water,' missing key phrases like 'complete replacement of replaceable hydrogen ion.' Additionally, many failed to specify 'an acid molecule by a basic radical/ammonium ion/metallic.' Many candidates lost marks for not using the correct keywords outlined in the marking scheme.

(ii)(a) While most candidates drew methane's correct electron dot structure, many others depicted covalent bonds between dots or dot and cross. Some candidates failed to differentiate annotations between atoms, using either dots or crosses for both elements.

(b) Many candidates correctly answered this question except a few who made mistakes while answering. Some candidates depicted the electron dot structure with a triple bond between nitrogen atoms, but some forgot to include the other two electrons on the nitrogen atom not involved in the covalent bond at the center. Additionally, many included orbital structures.

(iii)(a) Many candidates incorrectly wrote the products as 'aluminum hydroxide' and 'sodium oxide.' While most candidates balanced the equations correctly, many were confused with the formula for sodium aluminate and made errors in balancing the equation.

(b) Most candidates answered correctly as they knew the lab preparation method for ethane. While most balanced the equations correctly, a few made errors or overbalanced them.

Suggestions for teachers

- Emphasize that the molar volume of a gas is the volume occupied by one gram-molecular mass or one mole of gas at S.T.P.
- Stress that molar volume applies only to gases to avoid confusion with substances or compounds.
- Train students with correct definitions, particularly in mole concept and stoichiometry, to ensure a clear understanding of each concept.
- Guide students by demonstrating in practical classes to prepare normal salt through complete replacement of the hydronium ion by a metal ion or a base.
- Acquaint students to the various properties of salts using relevant examples.
- Train students with correct definitions containing all keywords and encourage them to write complete sentences for each definition to convey a complete meaning.
- Provide ample practice of drawing electron-dot structures, bonding, and orbital diagrams to discern their differences effectively.
- Emphasize drawing different elements with distinct notations as dots and crosses, ensuring bonds are not drawn between them.
- Provide ample practice through short quizzes, board work, and classroom activities to master drawing electron structures, including single, double, and triple bonds.
- Guide students to differentiate annotations on different elements and provide more practice in drawing these types of electron dot structures.
- Ensure students understand amphoteric oxides and their properties.
- Advise students to write clear chemical reactions, noting gases formed and necessary conditions.
- Provide ample practice for completing and balancing equations of alkanes, alkenes, and alkynes with an emphasis on balancing chemical equations with necessary conditions, especially in organic chemistry.

(c) Most candidates could not answer the question correctly. Many wrote C_2H_6 instead of C_2H_2, failed to balance the equation, or wrote hydrogen instead of water.

(iv)(a) While most candidates answered correctly, some overlooked the question details and chose incorrect options like methanal or ethanoic acid instead of ethanol. Additionally, some misidentified the compound as ethene due to the presence of a double bond without thoroughly reading the prompt.

(b) Many candidates correctly chose 'ethanoic acid' from the list, while some were confused and selected other options provided in the question.

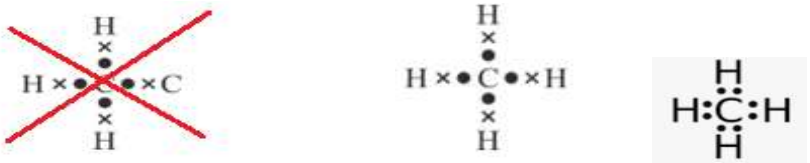
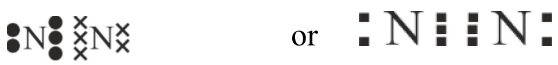
(c) Most candidates correctly identified 'ethene' from the options, while a few mistakenly chose 'ethanol.'

Suggestions for teachers

- Stress the difference between products formed with aqueous KOH (substitution reaction) and alcoholic KOH (elimination reaction).
- Explain organic compound preparation with balanced equations and conditions and provide more practice and tests for better understanding.
- Clarify various functional groups using relevant examples and emphasize terms in organic chemistry.
- Ensure students learn to write balanced equations and grasp the properties of all organic compounds.
- Familiarize students with organic compound properties to match descriptions with correct options.
- Explain properties of key organic compounds like ethanoic acid, also known as glacial acetic acid upon cooling, and discuss its uses.
- Guide students to read questions carefully and analyze answers appropriately.
- Discuss the impact of chemicals in daily life, explaining terms with relevant examples.
- Elucidate the diverse uses of organic compounds to get a clear understanding.

MARKING SCHEME

Question 4

(i)	(a) Molar Volume – Volume occupied by 1 gm molecular weight of a gas/ or one mole of a gas at **S.T.P.** (b) Normal Salt: The salts formed by **complete/ total** replacement of the hydrogen of an **acid** molecule by a **basic/ base** radical / metallic / ammonium ion./ Salt formed by **complete** neutralization of an acid by a base.
(ii)	(a)  (b)  or

(iii)	(a) $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$ (b) $C_2H_5COONa + NaOH \xrightarrow[CaO]{\Delta} C_2H_6 + Na_2CO_3$ (c) $C_2H_4Br_2$ + alcoholic $2KOH \xrightarrow{\Delta} C_2H_2 + 2KBr + 2H_2O$
(iv)	(a) Ethanol/ C_2H_5OH/ ethyl alcohol (b) Ethanoic acid/ acetic acid/ glacial acetic acid/ CH_3COOH (c) Ethene/ C_2H_4/ ethylene

Question 5

(i) Name the **main metal** used in making of the alloys given below: **[2]**

(a) Duralumin

(b) Stainless steel

(ii) Differentiate between the following pairs based on the criteria given: **[2]**

(a) Sulphuric acid and Nitric acid *(using barium chloride solution)*

(b) Unsaturated and Saturated hydrocarbons *(type of bond present)*

(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?

(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.

Comments of Examiners

(i)(a) Most candidates correctly identified Aluminum as the main metal in Duralumin, with some also stating the correct percentage composition. However, a few candidates listed additional components, failing to emphasize Aluminum as the primary metal.

(b) Most candidates correctly identified iron as the main metal in stainless steel, while some also provided the correct composition of the alloy. However, several candidates made mistakes by listing additional components without highlighting iron as the primary metal in stainless steel.

(ii)(a) Many candidates were unable to differentiate between Sulphuric acid and Nitric acid using the reagent '$BaCl_2$.' Also, several candidates failed to note the absence of a precipitate with nitric acid, while correctly identifying the white precipitate of '$BaSO_4$' with sulphuric acid. Most of the candidates answered incorrectly with some noting a brown precipitate with nitric acid instead.

(b) Most candidates accurately distinguished between saturated and unsaturated hydrocarbons based on bond types. However, a few candidates confused the concepts, resulting in incorrect answers. Some even provided examples for both types.

(iii)(a) While most candidates correctly calculated the mass of 5 moles of Calcium carbonate as 500 grams, some provided the answer without calculation, writing '500 grams' directly or '5 x 100' and lost marks.

(b) Most candidates successfully obtained the correct answer, although some found the calculation difficult. The majority of the candidates correctly determined the moles of HCl in calcium carbonate as 10 moles, while a few made errors in calculation or omitted this part entirely.

(c) Many candidates calculated the volume of carbon dioxide at STP correctly as (5x22.4) Liters. However, many others just wrote the answer as 22.4 Liters without proper calculation.

Suggestions for teachers

- Conduct regular quizzes and objective tests to reinforce memory of alloy components and properties.
- Teach alloys and their components, ensuring students understand the composition and main metal involved in each alloy.
- Clearly explain metals and other components used in stainless steel, emphasizing that carbon is the only non-metal used.
- Demonstrate the '$BaCl_2$' test in the lab for sulphate ions, resulting in the formation of white precipitate ($BaSO_4$).
- Clarify distinctions between acids, emphasizing dilution and concentration differences along with equations and observations.
- Provide ample practice for correct differentiation in assessments.
- Ensure students grasp the distinctions between saturated and unsaturated organic compounds by emphasizing bond types and electron availability.
- Guide students to do step-by-step numerical problem-solving and provide ample practice.
- Explain the equivalence between moles, molar mass, and molar volume.
- Encourage thorough solutions with correct units and provide additional examples for practice on equation-based problems for calculating relative molecular mass.
- Guide students on balancing equations and selecting the correct components to calculate mole numbers in compound-based questions.
- Explain how to use the standard volume of 22.4 liters (or 22,400 cc) in calculations based on the given questions.
- Stress on the products formed on complete combustion of organic compounds as carbon dioxide and water.
- Provide hands-on experience of the decomposition of carbonates through experiments.
- Emphasize carbon dioxide turns lime water milky but does not affect acidified Potassium Dichromate solution.
- Explain the reaction with observations and equations to clarify the process.

(iv)(a) Many candidates answered correctly, identifying carbon dioxide as the gas. However, a few made mistakes and identified it as carbonate (CO_3^{2-}) and answered incorrectly.

(b) Many candidates correctly identified the answer as carbon dioxide, while a few made mistake and wrote carbon monoxide.

(c) A number of candidates failed to answer correctly. While most wrote 'Chlorine' correctly, many lost marks for writing its formula as Cl instead of Cl_2, and some candidates by mistake wrote 'chloride ion' as the answer.

MARKING SCHEME **Question 5**		
(i)	(a)	Aluminium / Al
	(b)	Iron / Fe
(ii)	(a)	Sulphuric acid forms a ppt / insoluble substance or Barium sulphate when treated with $BaCl_2$ but HNO_3 does not form any ppt./ or forms soluble substance / no such observations/ no visible change.
	(b)	Unsaturated hydrocarbons have a double or triple bond whereas a saturated hydrocarbon has only single bonds = bond or ≡ bond / - bond Or correct structure/ examples/ carbon skeleton
(iii)	(a)	5 x 100 / 500 g
	(b)	10 moles/ 10
	(c)	5 x 22.4 = 112.0 L/ 5 x 22.4 / 112 5x 22400/ 112000
(iv)	(a)	CO_2 / Carbon dioxide
	(b)	CO_2 / Carbon dioxide
	(c)	Cl_2 / Chlorine / Cl / greenish yellow gas

Question 6

(i) **X -** $HCl \leftrightharpoons H^{1+} + Cl^{-}$ *(in solution state)* **[2]**

Y - $PbBr_2 \leftrightharpoons Pb^{2+} + 2Br^{1-}$ *(in molten state)*

From the above reactions **X** or **Y**, identify the reaction which exhibits:

(a) electrolytic dissociation

(b) ionization

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

(a) Inert gases do not form ions.

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

(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)*

(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.

Comments of Examiners

(i) (a) Most of the candidates identified **Y** as electrolytic dissociation. While many answered correctly, a few confused it with other processes and chose different equations.

(b) Majority of the candidates failed to recognize that **X** undergoes ionization, leading to incorrect answers. While some candidates correctly chose ionization with the equation, a few confused it with electrolytic dissociation due to unclear concepts.

(ii) (a) Many candidates correctly answered by stating that inert gases do not form ions due to their stable electronic configuration. Also, most of them gave the correct reasoning, but a few simply wrote 'because they are inert' or 'they cannot participate in chemical reactions' and hence could not score.

(b)Most candidates failed to explain why covalent compounds have low melting and boiling points. They did not use the correct keywords such as 'weak Van der Waals forces between the molecules.' Instead, they wrote that covalent compounds have weak electrostatic forces, or simply mentioned less force/attraction. Also, many did not specify 'between the molecules,' resulting in loss of marks.

(iii)(a) Many candidates incorrectly arranged elements in decreasing order of atomic size, often confusing the greater/lesser symbols. Some candidates wrote the opposite sequence, with fluorine, carbon, and beryllium in a reverse order.

(b) Many candidates failed to correctly arrange the acids in order of increasing replaceable H atoms per molecule.

(c) Most of the candidates were correct in answering the correct sequence of this question. But, many of them wrote it in reverse order without correct symbols '</>'. A few candidates were confused with the property trend of ionization potential down the group and wrote wrong sequence.

Suggestions for teachers

- Emphasize that metals typically have 1, 2, or 3 valence electrons, while non-metals have 4, 5, 6, or 7.
- Stress that the bond between metal and non-metal is ionic/electrovalent, leading to electrolytic dissociation.
- Clarify the distinction between electrolytic dissociation and ionization, focusing on the formation and separation of ions and the compounds involved in these reactions.
- Explain that when two non-metals combine, they form molecular or covalent bonds, which ionize when put in solution.
- Clarify when and where electrolytic dissociation and ionization occur, particularly in solution or molten states, and explain the associated equations.
- Emphasize that inert gases do not form ions or react due to their stable electronic configuration with 2/ 8 valence electrons.
- Clearly explain the stability of noble gases compared to other elements based on their electronic configurations and chemical activity.
- Emphasize the differences between the properties of electrovalent and covalent compounds, along with the reasons associated with them.
- Explain the concept and the meaning of electrostatic force and van der Waals forces with their nature and where they exist.
- Emphasize the periodic trend of properties of elements as they move across a period from left to right, relating to their electronic configuration.
- Provide regular practice on questions related to these elements to reinforce learning.
- Focus on the basicity of an acid, specifically the number of hydronium ions produced by one molecule in aqueous solution.
- Teach students to identify monobasic, dibasic, and tribasic acids based on the number of replaceable hydrogen atoms.
- Emphasize the importance of reading questions and instructions carefully and writing correct symbols.

(iv)(a) Many candidates correctly identified the element as hydrogen, except a few who wrote it incorrectly as lithium.

(b) Many candidates answered correctly. However, a few were confused by the atomic number and electronic configuration, resulting in incorrect identifications.

(c) Many candidates were confused and thus incorrectly identified the element as fluorine or bromine. Additionally, a few candidates were confused with chlorine due to its electronegativity, while others made mistakes in writing the correct symbols.

Suggestions for teachers

- Provide sequential practice questions with different criteria to reinforce understanding.
- Illustrate the concept with examples and explain how to arrange acids in increasing or decreasing order based on their basicity.
- Familiarize students with all properties, except exceptions and teach students the periodic table trends, focusing on periodic properties of elements across periods and down groups.
- Encourage students to memorize elements up to atomic number 20 and provide ample practice with these elements, focusing on their properties and exceptions.
- Facilitate group discussions and quizzes to reinforce learning of atomic numbers and valencies for identification and provide practice in writing correct answers with accurate symbols.
- Emphasize the importance of understanding the electronic configuration of elements and their placement in the periodic table according to group and period based on atomic number.
- Provide ample practice on trends across periods and down groups, focusing on properties such as exceptions, highest, and lowest elements.

MARKING SCHEME

Question 6

(i)	(a) $Y / PbBr_2 \leftrightharpoons Pb^{+2} + 2Br^-$ (b) $X / HCl \leftrightharpoons H^+ + Cl^-$
(ii)	(a) Because their outermost shell is complete / they have stable electronic configuration/ they do not lose or donate electrons / octet or duplet state. (b) Because they have a weak force of attraction/ Van der Waal's force of attraction between **the molecules/particles.**
(iii)	(a) Beryllium, Carbon, Fluorine /Be, C, F/ Be>, C> F Be C F or F C Be ↑ Note: If it is written downwards as shown then arrow upwards is a must for the 2nd set if it begins with F. (b) Acetic acid, Sulphuric acid, Phosphoric acid If it is written downwards as shown, then arrow upwards is a must for the 2nd set if it begins with phosphoric acid acetic acid sulhuric acid phosphoric acid or phosphoric acid sulphuric acid acetic acid ↑ (c) Potassium, Sodium, Lithium/ K< Na< Li/ K, Na, Li If it is written downwards as shown, then arrow upwards is a must for the 2nd set if it begins with lithium Potassium Sodium Lithium or Lithium Sodium Potassium ↑ Note: all three names should be there for comparison.
(iv)	(a) H / Hydrogen (b) S / Sulphur (c) Cl / Chlorine

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.

(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]*.

(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.

(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?

Comments of Examiners

(i) (a) Many candidates correctly identified the ion present. However, many misunderstood the question regarding the cation and answered incorrectly. Some wrongly identified one cation and some even listed two cations. Many omitted charge on the element, simply stating 'Iron' or 'Fe,' while a few candidates wrote 'Fe^{2+}' (ferrous) incorrectly.

(b) The anion was identified correctly by a few candidates. However, many candidates misunderstood the question and listed both cation and anion in both parts of the solution. Some failed to identify the anion in the second part and only wrote the cation.

(ii) (a) Most candidates correctly identified the non-polar covalent molecule, but a few confused it with polar and answered incorrectly.

(b) Many candidates identified oxygen and answered correctly. However, a few were confused about the products at the anode and cathode and incorrectly answered hydrogen.

(iii) Many candidates used Guy Lussac's Law to find the amount of oxygen used and unused but failed to calculate the amount of nitrogen formed. Some calculated the amount of water correctly. A few solved the entire problem and scored full marks, while others missed the excess oxygen calculation or only noted nitrogen as 120 cc, ignoring the resultant oxygen mixture and lost marks. Additionally, some calculated only the used oxygen as 180 cc and did not continue with the excess oxygen calculation and got the answer incorrect.

(iv) (a) Most candidates identified the elements given as A, B, and C. The majority wrote the formulas as 'CaO', 'CCl_4', instead of 'AB', or 'DC_4'. While, most candidates answered correctly with 'AB', a few misunderstood and wrote 'A_2B_2'.

(b) Many candidates answered 'D' correctly, but some selected multiple options from the table and answered incorrectly.

Suggestions for teachers

- Emphasize the formation of insoluble reddish-brown precipitate, specific to ferric ions, when treated with sodium hydroxide or ammonium hydroxide, whether added in small amounts or in excess.
- Familiarize students with practical demonstrations to illustrate the formation of this precipitate when alkali is added to ferric salts.
- Encourage hands-on laboratory experience to enhance observation skills.
- Emphasize that silver nitrate is used to detect chloride ions by forming a white precipitate of silver chloride.
- Emphasize that when a bond forms between dissimilar atoms with a small electronegativity difference, it results in non-polar covalent compounds.
- Clearly differentiate between polar and non-polar covalent compounds based on electron distribution and charge separation using various examples.
- Provide ample examples and ensure practice of reactions at the cathode and anode under different conditions.
- Emphasize that Guy Lussac's Law applies only to gases, not liquids or solids.
- Ensure adequate practice of various numericals and regular stepwise working must be insisted upon.
- Provide ample practice on the mole concept and stoichiometry, using diverse data, and teach students to complete problems correctly as given in the question paper.
- Instruct students not to identify the given elements until asked.
- Facilitate practice of forming formulas using the given letters and conduct tests to familiarize them with these types of questions.
- Insist on writing the given letter to answer the questions and identify the element.
- Explain catenation and the elements that perform it, including reasons.
- Emphasize writing formulas based on the provided information, especially electronic configuration or atomic number.
- Provide more practice with different examples to help students understand and correctly answer these types of questions.

MARKING SCHEME Question 7	
(i)	(a) Fe^{+3} / Ferric /Iron(III) (b) Cl^{-1} / Chloride /SO_4^{2-}/ sulphate
(ii)	(a) Non polar (b) Oxygen/ O_2
(iii)	O_2 used $\frac{3}{4}$ x 240 = 180 c.c. / $\frac{3}{4}$ x 240 or 180 c.c. Excess O_2 = 300 – 180 = 120 c.c. or 120 / N_2 produced = $\frac{2}{4}$ x 240 = 120 c.c. / $\frac{2}{4}$ x 240 /120 c.c. Resultant mixture contains 120 c.c. of O_2 and 120 c.c. of N_2
(iv)	(a) 1. AB /CaO 2. DC_4 /CCl_4 (b) D/ carbon

Question 8

(i) Choose the correct answer from the list given below: **[2]**

zinc blende, C_2H_2, calamine, CH, haematite

(a) The ore which can be concentrated by magnetic separation.

(b) Empirical formula of Ethyne.

(ii) Give balanced equation for the following reactions: **[2]**

(a) Copper reacts with concentrated Nitric acid.

(b) Aluminium nitride is treated with warm water.

(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

(iv) Hydrogen chloride gas is prepared in the laboratory by the action of concentrated sulphuric acid on sodium chloride. **[3]**

(a) Give balanced chemical equation for the above reaction.

(b) State the method of collection of the gas formed above.

(c) What is the property of sulphuric acid that makes it a suitable reagent for the reaction?

Comments of Examiners

(i) (a) Most candidates correctly identified 'haematite' as the answer. However, a few candidates incorrectly chose Zinc blende.

(b) Many candidates incorrectly wrote the empirical formula of Ethyne as 'C_2H_2' instead of 'CH' while many candidates correctly identified the empirical formula of Ethyne as 'CH.'

(ii) (a) Many candidates were unable to provide balanced equations, often getting the products incorrect. Some candidates wrote the reactions of dilute nitric acid instead of concentrated Nitric acid.

(b) Several candidates wrote the products and balanced equations correctly. However, some candidates incorrectly wrote 'Aluminium oxide' as the product. A few candidates struggled with the correct formula for Aluminium nitride, while others had trouble writing the correct products.

(iii)(a) Many candidates incorrectly chose a combination or neutralization reaction while some candidates correctly identified the method as displacement reaction.

(b) Most candidates correctly identified the reaction as neutralization, but few of them were confused and wrote the answer as direct combination or displacement reaction.

(c) Few candidates found the method of preparation of Calcium Carbonate from Calcium Chloride difficult. Most candidates correctly identified it as precipitation while a few incorrectly answered as direct combination or neutralization.

(iv)(a) Many candidates incorrectly used higher temperatures in the equations for sulphuric acid reactions. While, some candidates were unable to write the correct product or formulas and were confused about the laboratory preparation of 'HCl,' and some provided multiple incorrect equations for the formation of hydrogen chloride gas.

(b) Many candidates provided incorrect answers, such as upward displacement of gas or downward delivery of air. While,

Suggestions for teachers

- Emphasize learning the names of ores used in extracting important metals.
- Teach the concept on the ores used in metal extraction, including their formulas, common names, and chemical names.
- Acquaint students with the empirical formula which is the simplest formula that shows the simplest whole number ratio of atoms of different elements in a compound and emphasise on the same.
- Familiarize students with the common names and functional groups of organic compounds, with emphasis on writing correct formulas for saturated and unsaturated hydrocarbons and understanding functional groups and IUPAC nomenclature.
- Emphasize the general formula for alkane, alkene, and alkyne.
- Clearly explain the differences between saturated and unsaturated hydrocarbons through structures.
- Demonstrate how concentrated Nitric acid oxidizes nascent oxygen to water, releasing Nitrogen dioxide and forming Copper Nitrate.
- Explain the differences between dilute and concentrated reactions of copper with nitric acid, including products and observations.
- Teach students to balance equations and provide simple tips for easy understanding and balancing.
- Teach the preparation of ammonia with metal nitrides. making it an alternative method of laboratory preparation.
- Provide frequent short tests and worksheets with equations to analyze student skills.
- Emphasize the fact that salts of active metals can be prepared by displacement reactions, where dilute acids react with active metals to form salts.
- Demonstrate these reactions to help students retain the facts and explain the preparation of salts.
- Familiarize students with the general solubility of salts and emphasize, titration is a common method used to conduct neutralization reactions with suitable bases.
- Provide extensive practice in writing equations for the preparation of salts through various methods.

few candidates correctly identified the collection of 'HCl' gas as upward displacement of air, or downward delivery of gas.

(iv)(c) Most candidates correctly identified the non-volatile nature of sulphuric acid in their answers. However, a few candidates lost marks by incorrectly describing it as a dehydrating agent or a dibasic acid.

Suggestions for teachers

- Illustrate preparing insoluble salts through precipitation methods, emphasizing the solubility of salts and reasons for each method.
- Teach students to prepare calcium carbonate and other compounds through precipitation reactions, with relevant observations and practice exercises.
- Emphasize on the products formed with different temperature conditions for above and below 200°C.
- Emphasize to students that 'HCl' gas is denser than air, causing it to displace air upward during collection and explain the process of gas collection and the reason for it to ensure understanding.
- Familiarize students with various properties of Sulphuric acid and focus on five different properties of sulphuric acid, each with an equation to illustrate the concept.

MARKING SCHEME

Question 8

(i)	(a) Haematite (b) CH
(ii)	(a) $Cu + conc.4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$ (b) $AlN + 3H_2O \rightarrow Al(OH)_3 + NH_3$
(iii)	(a) Displacement reaction / 3 (b) Neutralization / 4 (c) Precipitation / 1
(iv)	(a) $NaCl + conc.\ H_2SO_4 \rightarrow NaHSO_4 + HCl$ (b) Upward displacement of air / downward delivery /of gas. (c) Non / Least/ less volatile acid

Note: For questions having more than one correct answer/solution, alternate correct answers/solutions, apart from those given in the marking scheme, have also been accepted.