SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

(a) Fill in the blanks from the choices given in brackets: [5]

(i) The energy required to remove an electron from a neutral isolated gaseous atom and convert it into a positively charged gaseous ion is called _____. *(electron affinity, ionisation potential, electronegativity)*

(ii) The compound that does not have a lone pair of electrons is _____. *(water, ammonia, carbon tetra chloride)*

(iii) When a metallic oxide is dissolved in water, the solution formed has a high concentration of _____ ions. *(H^+, H_3O^+, OH^-)*

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

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

(b) Choose the ***correct answer*** from the options given below: [5]

(i) A **chloride** which forms a precipitate that is soluble in excess of ammonium hydroxide, is:

1.Calcium chloride

2.Ferrous chloride

3. Ferric chloride

4. Copper chloride

(ii) If the molecular formula of an organic compound is $\mathbf{C_{10}H_{18}}$ it is:

1. alkene

2. alkane
3. alkyne
4. Not a hydrocarbon

(iii) Which of the following is a common characteristic of a **covalent compound**?

1. high melting point
2. consists of molecules
3. always soluble in water
4. conducts electricity when it is in the molten state

(iv) To increase the **pH** value of a neutral solution, we should add:

1. an acid
2. an acid salt
3. an alkali
4. a salt

(v) **Anhydrous iron(III) chloride** is prepared by:

1. direct combination
2. simple displacement
3. decomposition
4. neutralization

(c) Identify the **substance** underlined, in each of the following cases: [5]

(i) **Cation** that does not form a precipitate with ammonium hydroxide but forms one with sodium hydroxide.

(ii) The **electrolyte** used for electroplating an article with silver.

(iii) The **particles** present in a liquid such as kerosene, that is a non-electrolyte.

(iv) An **organic compound** containing -- COOH functional group.

(v) A **solid** formed by reaction of two gases, one of which is acidic and the other basic in nature.

(d) Write a *balanced chemical equation* for each of the following: [5]

(i) Action of cold and dilute Nitric acid on Copper.

(ii) Reaction of Ammonia with heated copper oxide.

(iii) Preparation of methane from iodomethane.

(iv) Action of concentrated sulphuric acid on Sulphur.

(v) Laboratory preparation of ammonia from ammonium chloride.

(e) State ***one*** relevant observation for each of the following reactions: [5]

(i) Addition of ethyl alcohol to acetic acid in the presence of concentrated Sulphuric acid.

(ii) Action of dilute Hydrochloric acid on iron (II) sulphide.

(iii) Action of Sodium hydroxide solution on ferrous sulphate solution.

(iv) Burning of ammonia in air.

(v) Action of concentrated Sulphuric acid on hydrated copper sulphate.

(f) (i) Draw the *structural formula* for each of the following: [5]

1. 2, 3 – dimethyl butane
2. diethyl ether
3. propanoic acid

(ii) From the list of terms given, choose the most appropriate term to match the given description.

(calcination, roasting, pulverisation, smelting)

1. Crushing of the ore into a fine powder.
2. Heating of the ore in the absence of air to a high temperature.

(g) (i) Calculate the number of gram atoms in 4.6 grams of sodium (Na = 23). [5]

(ii) Calculate the percentage of water of crystallization in $CuSO_4.5H_2O$

(H = 1, O = 16, S = 32, Cu = 64)

(iii) A compound of X and Y has the empirical formula XY_2. Its vapour density is equal to its empirical formula weight. Determine its molecular formula.

(h) Match the atomic number 2, 4, 8, 15, and 19 with each of the following: [5]

(i) A solid non-metal belonging to the third period.
(ii) A metal of valency 1.
(iii) A gaseous element with valency 2.
(iv) An element belonging to Group 2.
(v) A rare gas.

Comments of Examiners

(a) (i) Some candidates wrote only 'ionization' or selected the incorrect term 'electron affinity indicating that they were confused between ionization energy and electron affinity.

(ii) Many candidates selected the incorrect example of water or ammonia for a compound compound that does not have a lone pair of electrons.

(iii) Majority of the candidates answered correctly. A few chose H^+ or H_3O^+.

(iv) A few candidates made mistakes in selecting the gas released.

(v) Most of the candidates answered correctly. A few gave answers as CH_4 or C_3H_8.

(b)(i) Many candidates wrote *calcium chloride* instead of *copper chloride*.

(ii) *Alkene* or *alkane* was the occasional incorrect answer written by many candidates.

(iii) Some candidates gave the option of being *always soluble in water* while others mentioned *conducts electricity when it is in molten state.*

(iv) Most candidates answered correctly. A few candidates selected *an acid* or *an acid salt* indicating that they did not understand the relation between acidity or alkalinity with the pH of the solution.

(v) Many candidates made the mistake of choosing *decomposition* instead of *direct combination*.

(c)(i) Some candidates either wrote the symbol of calcium without the charge or gave Cu^{2+} which was an incorrect answer.

(ii) Many candidates incorrectly named the substance as *silver argentocyanide* instead of *sodium argentocyanide* or named silver nitrate as the electrolyte.

(iii) Most candidates answered this part correctly.

(iv) Some candidates wrote *carbonic acid* or *carboxylic group*.

(v) Most of the candidates answered correctly.

Suggestions for teachers

- Teach students dot diagrams for several compounds, wherein both shared pairs and lone pairs can be thoroughly explained. Highlighting them with colours will establish clarity between covalent bond and coordinate bond.
- Draw the attention of students to the results of dissolving metallic oxides and non-metallic oxides in H_2O so that the formations of OH- and H+ ions can be explained.
- Familiarize students to the ways in which acids react differently with sulphites and sulphides and supplement this information with actual practical work.
- Emphasise to students that when alkenes react with hydrogen the number of carbon atoms do not change and substantiate this with reactions using structural formulae.
- Advise students to stick to the options given and to avoid expressing in the formula form. Make them aware of the inability of calcium salt solutions to form precipitate with NH_4OH and that all other salts included in the practical work form precipitates either soluble or insoluble in excess of NH_4OH.
- Develop an understanding of the students to establish the general formulae of hydrocarbons using a number of structural formulae and then test the application of the general formula with various molecular formulae.
- Teach students Introduction to pH scale to test for acidity, neutrality and alkalinity in detail.

(d)(i) Equation was written with concentrated HNO_3 instead of dilute HNO_3. NO_2 was given as a product instead of NO. Bal ancing was incorrect in many cases and some made errors in writing the formula of copper nitrate.

(ii) Some candidates wrote NO_2 instead of N_2 as the product while in some cases the equation was not balanced correctly.

(iii) A few candidates represented iodomethane as CH_4I instead of CH_3I and many candidates used molecular state of hydrogen (H_2) instead of nascent hydrogen (H).

(iv) In some cases, the products were incorrectl. Some wrote the reaction of S with concentrated HNO_3 instead of concentrated H_2SO_4 indicating not having read the question carefully.

(v) Many candidates chose NaOH as the alkali in the laboratory preparation of ammonia instead of $Ca(OH)_2$.

(e)(i) Many candidates wrote the equation or named the products or wrote the term *esterification* instead of writing the relevant *observation* of fruity smell.

(ii) Most candidates answered this part correctly. A few candidates committed errors such as writing the equation or gave the test for SO_2.

(iii)Some of the common errors were: *reddish brown precipitate* instead of *dirty green precipitate*. A few candidates mentioned "dirty green ferrous hydroxide" but failed to mention the word precipitate or insoluble compound.

(iv) Many candidates could not write the correct colour of the flame on burning ammonia.

(v) Most of the candidates ignored the colour change or the change from the crystalline state to amorphous state and instead mentioned the phenomenon of dehydration or the formation of anhydrous copper sulphate.

(f)(i) 1. Some candidates did not complete the structure with adequate number of H atoms.

2. Diethyl ether was confused with acetone or ketone group instead of oxygen linking the 2 ethyl groups. Some candidates erred by substituting the ethyl group with methyl group in ether.

3. Condensed formula of the acid group was given by some candidates; others made errors such as linking the C in the carboxylic group with H.

- Explain the differences between covalent and ionic compounds on the basis of the structure and the kind of forces in these compounds and then relate it to a number of examples.
- Allow the students to observe the effects of adding NaOH and NH_4OH to various salts solutions and noting the observations. Also test to ensure that they retain the observations associated with various cations.
- Explain students why silver nitrate, a soluble salt of silver, is not used for electroplating and instead sodium argentocyanide solution is used.
- Terms electrolytes and non-electrolytes should be thoroughly discussed in the class.
- Explain students why ammonia gas reacts with hydrogen chloride gas and how the resulting solid forms dense white fumes.
- Demonstrate to students the evolution of brown gas with conc. HNO_3 in the laboratory. Also show that no such brown gas is evolved with dil. HNO_3 This will help students in remembering the products as the conditions change form dil. HNO_3 to conc. HNO_3
- Teach students tabulating details of a functional group and the related compounds such as symbols of a functional group, its name and names of variety of compounds containing the functional group.
- Explain to students that the reaction between CuO and NH_3 is a redox reaction.
- Demonstrate to students various types of inorganic and organic reactions in the laboratory repeatedly for a long lasting impact.

(ii) Most of the candidates answered part 1 correctly. In part 2, a small fraction of candidates got confused between *roasting* and *calcination* as they focused on the high temperature mentioned in the question.

(g)(i) Many candidates could not calculate the number of gram atoms correctly. Many others got confused between the number of gram atoms and number of atoms and ended up calculating number of atoms as $(4.6/23) \times 6.02 \times 10^{23}$.

(ii) Some candidates made errors in calculating the relative molecular mass of $CuSO_4.5H_2O$ wherein 5 molecules of water were calculated as 5x2+16 instead of 5(2+16). Another error made was in the calculation of percentage of water of crystallization wherein some candidates forgot to multiply the mass of water by 5.

(iii) Many candidates got confused between molecular weight and molecular formula.

(h)(i) Most candidates answered this part correctly. However, a few chose element with atomic number 19 instead of 15 or wrongly identified the element as K instead of phosphorus.

(ii) Some candidates opted for hydrogen but a vast majority answered this sub-part of the question correctly.

(iii) Some of the candidates either chose the atomic number 2 or 4 as the gaseous element with valency 2.

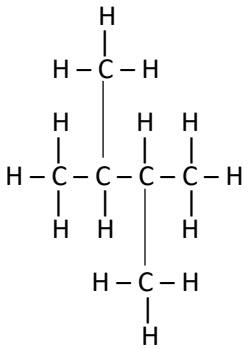
(iv) Most candidates answered correctly. A few gave the answer as 8, which was incorrect.

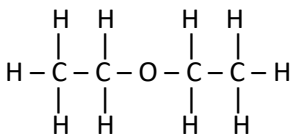
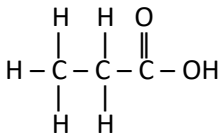
(v) Some candidates wrote atomic number 8 for a rare gas.

- Explain students the logic of balancing chemical equations and give adequate practice in writing balanced chemical equations correctly.
- Teach students that conc. sulphuric acid being an oxidizing agent oxidizes S to SO_2 while it itself gets reduced to SO_2 and hence only 2 products formed SO_2 and H_2O.
- Draw attention of the students to the fact that although an alkali reacts with an ammonium salt to release NH_3, NaOH is not used in the laboratory preparation as it is deliquescent. $Ca(OH)_2$ is used instead.
- Advise students to record any noticeable changes (colour changes or smell or formation of precipitate etc.) by giving first-hand experience to them in the laboratory.
- Practical work along with frequent testing or quizzing on the results of mixing solutions will help students learning better.
- Ask students to prepare charts of the observations for various chemical reactions, highlighted with appropriate colours/smell etc, to assist them in remembering these results.
- Ask students to prepare a comparative table that includes the name, molecular formula, condensed formula and structural formula of various organic compounds.
- Advise students to prepare charts for various functional groups specified in the syllabus.
- Frequent testing with varied instructions will assist students in dispelling any doubts and bring in clarity.

MARKING SCHEME

Question 1

(a)	(i)	Ionisation potential
	(ii)	carbon tetrachloride or CCl_4.
	(iii)	OH^- or hydroxyl ions
	(iv)	SO_2 or Sulphur dioxide
	(v)	C_2H_6 or ethane
(b)	(i)	4 or Copper chloride or $CuCl_2$
	(ii)	3 or alkyne
	(iii)	2 or consists of molecules
	(iv)	3 or an alkali
	(v)	1 or direct combination
(c)	(i)	Ca^{2+} or calcium ion
	(ii)	Sodium argentocyanide solution Na $[Ag(CN)_2]$
	(iii)	Free molecules
	(iv)	Carboxylic acid
	(v)	Ammonium chloride or NH_4Cl
(d)	(i)	$3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 4H_2O + 2NO$
	(ii)	$3CuO + 2NH_3 \rightarrow 3Cu + 3H_2O + N_2$
	(iii)	$CH_3I + 2(H) \xrightarrow[Alcohol]{Zn/Cu} CH_4 + HI$
	(iv)	$S + 2H_2SO_4 \rightarrow 2H_2O + 3SO_2$
	(v)	$Ca(OH)_2 + 2NH_4Cl \rightarrow CaCl_2 + 2H_2O + 2NH_3$
(e)	(i)	Fruity smell evolved.
	(ii)	Gas with a rotten egg smell evolved.
	(iii)	Dirty green precipitate formed, insoluble in excess NaOH.
	(iv)	Burns with a green flame.
	(v)	Blue crystals turn into white amorphous powder.
(f)	(i) 1.	

	2.  3.  (ii) 1. Pulverisation 2. Calcination
(g)	(i) Number of g-atoms = $\frac{4.6}{23} = 0.2$ (ii) Molecular mass of $CuSO_4.5H_2O$ = 64+32+64+5(18) = 250 % of water of crystallization = $\frac{5\times18}{250} \times 100 = 36\%$ (iii) n = $\frac{Molecular\ formula\ weight}{Empirical\ formula\ weight} = \frac{2\times VD}{EFwt} = 2$ $\therefore$ Molecular formula = $2(XY_2) = X_2Y_4$
(h)	(i) Z = 15 (ii) Z = 19 (iii) Z = 8 (iv) Z = 4 (v) Z = 2

SECTION II (40 Marks)

*Attempt **any four** questions from this Section*

Question 2

(a) Arrange the following as per the instruction given in the brackets: [4]

(i) He, Ar, Ne *(Increasing order of the number of electron shells)*

(ii) Na, Li, K *(Increasing Ionisation Energy)*

(iii) F, Cl, Br *(Increasing electronegativity)*

(iv) Na, K, Li *(Increasing atomic size)*

(b) State the *type of Bonding* in the following molecules: [2]

(i) Water

(ii) Calcium oxide

(c) Answer the following questions: [2]

(i) How will you distinguish between Ammonium hydroxide and Sodium hydroxide using copper sulphate solution?

(ii) How will you distinguish between dilute hydrochloric acid and dilute sulphuric acid using lead nitrate solution?

(d) Identify the salts **P** and **Q** from the observations given below: [2]

(i) On performing the flame test salt **P** produces a lilac coloured flame and its solution gives a white precipitate with silver nitrate solution, which is soluble in Ammonium hydroxide solution.

(ii) When dilute HCl is added to a salt **Q**, a brisk effervescence is produced and the gas turns lime water milky.

When NH_4OH solution is added to the above mixture (after adding dilute HCl), it produces a white precipitate which is soluble in excess NH_4OH solution.

Comments of Examiners

(a)(i) Some candidates got confused between the symbols '>' and '<'. Hence, the order of the elements was incorrectly written as He> Ne>Ar.

(ii) *Na, Li, K,* or *Li, Na, K* were the common errors made by some candidates.

(iii) Incorrect order was written by a number of candidates.

(iv) Incorrect answers were given by some candidates.

(b)(i) Some of the errors made by candidates were, 'coordinate bond' instead of 'covalent bond' in the case of water, indicating that candidates got confused with hydronium ion.

(ii) Some candidates associated 'covalent bond' with calcium oxide instead of the 'ionic bond'.

(c)(i) Many candidates could not use the word *precipitate* in the correct place or failed to record the formation of ink blue solution with NH_4OH and instead recorded the formation of deep blue precipitate with excess NH_4OH, without mentioning the blue precipitate of $Cu(OH)_2$.

(ii) Many candidates failed to correctly distinguish between dilute HCl and dilute H_2SO_4 as the solubility of white precipitate formed with HCl on

Suggestions for teachers

- Teach students Periodic Properties and variations of Properties (Physical and Chemical) in detail.
- Regular exercises in the application of the knowledge of trends in periodic properties in the periodic table, must be given for practice.
- Teach chemical bonding in detail to the students and dispel the confusion about the coordinate bond in water by showing a comparison between water and hydronium ion using dot diagram and highlighting the shared pairs and lone pairs with colours.
- Explain the importance of practical work to the students.
- Train students to analyse the data given keeping in mind the basic tests for the cations and anions and to present observations in tabular form.

heating was not included and instead, formation of brown NO_2 gas with H_2SO_4 was mentioned which was not possible.

(d) (i) Many candidates failed to identify the salt as KCl and instead, resorted to guess work.

(ii) Some candidates identified $ZnCO_3$ correctly while others listed either $Zn(HCO_3)_2$ or $ZnSO_4$ or $ZnSO_3$ Some included Pb^{2+} salts as well.

MARKING SCHEME **Question 2**	
(a)	(i) He, Ne, Ar (ii) K, Na, Li (iii) Br, Cl, F (iv) Li, Na, K
(b)	(i) Covalent bond (ii) Ionic or electrovalent bond
(c)	(i) On adding copper sulphate solution to both, the one that forms a blue precipitate that is insoluble in excess of the reagent is NaOH. The other solution forms a pale blue precipitate that dissolves in excess reagent to form an ink blue solution and this is NH_4OH. (ii) On adding lead nitrate solution to both, they form white precipitate but the one in which the white precipitate disappears on heating is HCl, while in H_2SO_4, the white precipitate remains insoluble on heating.
(d)	(i) KCl or potassium chloride (ii) $ZnCO_3$ or Zinc carbonate

Question 3

(a) Draw an *electron dot diagram* to show the formation of each of the following compounds: [4]

(i) Methane

(ii) Magnesium Chloride

[H = 1, C = 6, Mg = 12, Cl = 17]

(b) State the ***observations*** at the anode and at the cathode during the electrolysis of: [4]

(i) fused lead bromide using graphite electrodes.

(ii) copper sulphate solution using copper electrodes.

(c) Select the ion in each case, that would get selectively discharged from the aqueous mixture of the ions listed below: [2]

(i) SO_4^{2-}, NO_3^- and OH^-

(ii) Pb^{2+}, Ag^+ and Cu^{2+}

Comments of Examiners

(a) (i) Mistakes were made by many candidates in the dot diagrams.

(ii) Some candidates showed sharing of electrons instead of transfer of electrons between Mg and Cl atoms. Some others forgot to show the charge on each ion.

(b) (i) Several candidates misinterpreted the question and wrote equations instead of the observations at the electrodes. Some candidates did not give appropriate observations such as reddish-brown fumes of bromine and described them as red or orange while the grey deposit of lead was described as greyish white or greyish black deposit. Some others interchanged the electrodes.

(ii) Some candidates did not associate the correct electrodes with the observations given. Others gave equations instead of observations.

(c) (i) Most of the candidates answered this part correctly. A few candidates randomly selected SO_4^{2-} or NO_3^- ions.

(ii) Many candidates incorrectly picked up Cu^{2+} ions.

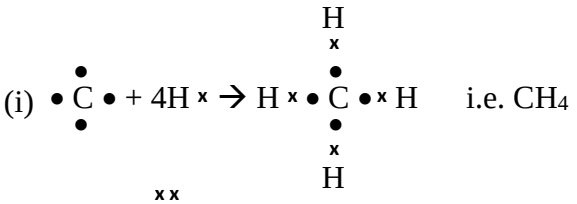
Suggestions for teachers

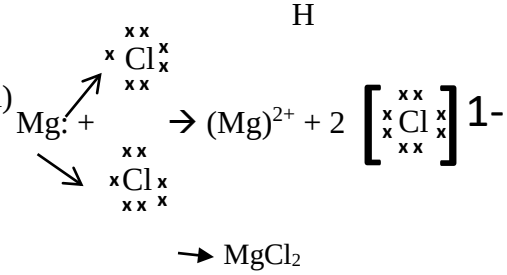
- Draw the attention of students to the fact that sharing of electrons cannot include '+' sign or a straight line. The single bonds may be shown in the next step.
- Insist that students show both the transfer of electrons and subsequent formation of positive magnesium (MgZ^+) ion and negative chloride (Cl^-) ions.
- Advise students to read questions carefully and understand and remember the appearance of various products at the electrodes during electrolysis.
- Ensure students know the rules for selective discharge of ions at the electrodes (cations & anions).

MARKING SCHEME

Question 3

(a)

(i)  i.e. CH_4

(ii) 

→ $MgCl_2$

(b)

(i) Reddish brown fumes at the anode

Silvery grey deposit at the cathode

(ii) Size of the anode decreases or anode gets consumed

Reddish brown deposit of copper at the cathode.

(c)

(i) OH^- ions

(ii) Ag^+ ions

Question 4

(a) Certain blank spaces are left in the following table and these are labelled as **A, B, C, D** and **E**. Identify each of them. [5]

	Lab preparation of	Reactants used	Products formed	Drying agent	Method of collection
(i)	HCl gas	NaCl + H_2SO_4	**A** _____	concentrated H_2SO_4	**B** _____
(ii)	NH_3 gas	**C** _____	$Mg(OH)_2$ NH_3	**D** _____	**E** _____

(b) Write balanced chemical equations to show: [3]

(i) The oxidizing action of concentrated Sulphuric acid on Carbon.

(ii) The behavior of H_2SO_4 as an acid when it reacts with Magnesium.

(iii) The dehydrating property of concentrated Sulphuric acid with sugar.

(c) Write balanced chemical equations to show how SO_3 is converted to Sulphuric acid in the *contact process*. [2]

Comments of Examiners

(a) (i) In this part of the question, blank space A was correctly answered by most candidates. A few ignored the condition 'laboratory preparation' and wrote the products formed as Na_2SO_4 + HCl instead of $NaHSO_4$ + HCl.

For the blank space B pertaining to method of collection of HCl gas, many candidates wrote *downward displacement of air*, which was incorrect.

(ii) For the blank space C, some candidates wrote, ammonium chloride and alkali or $Mg(NO_3)_2$ and water instead of Mg_3N_2 and H_2O.

For the blank space D, many candidates wrote slaked lime /Soda lime / concentrated H_2SO_4 instead of quicklime or CaO.

For the blank space E pertaining to method of collection of NH_3 gas, some candidates wrote downward displacement/ downward displacement of water, which were the incorrect answers.

(b)(i) Most of the candidates either wrote incorrect products or did not balance the equation.

(ii) Almost all the candidates wrote this equation correctly. A few candidates wrote H_2O instead of H_2.

(iii) Many candidates wrote the formula for sugar as $C_6H_{12}O_6$ (glucose) which is incorrect.

(c)(i) Many candidates forgot the two-step conversion of SO_3 to H_2SO_4 through the formation of oleum and diluting it in the second step; Instead, they treated SO_3 directly with water to get sulphuric acid.

Suggestions for teachers

- Stress on the conditions of temperature < 2000 °C during laboratory preparation of HCl and point out clearly the products formed i.e. $NaHSO_4$ and HCl.
- Advise students to correlate the knowledge of density and solubility of gases in deciding the method of collection of the gas.
- Familiarise students with the reaction between metal nitride and H_2O yielding metal hydroxide and ammonia. Also draw attention of students to the variation in formula with similar sounding words, like nitride, nitrite and nitrate.
- Acquaint students about the difference in products formed when a metal/ metal oxide reacts with an acid.
- Draw students' attention to the basic nature of ammonia and hence the use of a basic drying agent such as quicklime and not an acidic one like concentrated H_2SO_4.
- Explain clearly the dehydrating action of sulphuric acid and ensure that students differentiate clearly between cane sugar and glucose.
- Explain oxidising action of sulphuric acid in steps for better understanding and recall. This way both products and balancing is taken care of. Also teach them the outcome of adding water to Sulphur trioxide in the Contact process.

MARKING SCHEME

Question 4

(a)	A – $NaHSO_4 + HCl$ B – upward displacement of air C – $Mg_3N_2 + H_2O$ D – Quicklime or CaO E – downward displacement of air
(b)	(i) $C + 2H_2SO_4 \rightarrow CO_2 + 2H_2O + 2SO_2$ (ii) $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$ (iii) $C_{12}H_{22}O_{11} \xrightarrow[H_2SO_4]{Conc.} 12C + 11H_2O$
(c)	(i) $SO_3 + H_2SO_4 \xrightarrow[Conc.]{} H_2S_2O_7$ (ii) $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

Question 5

(a) (i) Propane burns in air according to the following equation: [4]

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$.

What volume of propane is consumed on using 1000 cm^3 of air, considering only 20% of air contains oxygen?

(ii) The mass of 11.2 litres of a certain gas at s.t.p. is 24 g. Find the *gram molecular mass* of the gas.

(b) A gas cylinder can hold 1 kg of hydrogen at room temperature and pressure: [4]

(i) Find the number of moles of hydrogen present.

(ii) What weight of CO_2 can the cylinder hold under similar conditions of temperature and pressure? (H= 1, C = 12, O = 16)

(iii) If the number of molecules of hydrogen in the cylinder is X, calculate the number of CO_2

molecules in the cylinder under the same conditions of temperature and pressure.

(iv) State the law that helped you to arrive at the above result.

(c) Write a *balanced chemical equation* for the preparation of each of the following salts: [2]

(i) Copper carbonate

(ii) Ammonium sulphate crystals

Comments of Examiners

(a)(i) Many considered the volume of Oxygen to be 100 cm^3; the volume of propane calculated was incorrect as many candidates ignored the statement *20% of air contains oxygen*.

(ii) Many candidates answered correctly. Some calculated as (11.2/24) x 22.4 which was incorrect.

(b)(i) Most of the candidates answered this part of the question correctly. A few candidates considered the molecular mass of hydrogen as 1 g and hence the calculation went wrong.

(ii) Many candidates wrote that weight of CO_2 held in the cylinder under similar conditions of temperature and pressure was 44 kg.

(iii) While many candidates answered this part correctly, some gave the answer as 6.02 x $10^{23.\backslash}$.

(iv) Many candidates wrote the name of the law instead of stating the law.

(c)(i) Instead of using soluble carbonates such as Na_2CO_3 or K_2CO_3 many candidates used H_2CO_3.

(ii) Some candidates erred by choosing either NH_3 or NH_4Cl as reactant in the preparation of ammonium sulphate. Some candidates did not balance the equation correctly.

Suggestions for teachers

- Drill students to identify the law to be applied if the reactants involved are gases.
- Familiarize students with the equivalent correspondence between number of moles, molar mass and molar volume.
- Drill into the minds of the students that the molecular mass is determined from the molecular formula.
- Advise students to read the questions carefully and check the application of the law to the data given correctly.
- Train students to apply Avogadro's law correctly. Ensure students can state the law using the correct terms and conditions.
- Insist on students having knowledge of solubility of salts. Also familiarize the students with the fact that generally all the salts of sodium, potassium and ammonium are soluble and hence titration is employed as a procedure to carry out neutralization reactions.

MARKING SCHEME

Question 5

(a)	(i)	Oxygen consumed = $\frac{20}{100} \times 1000 = 200\ cm^3$ $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ 1vol + 5vol → 3vol ? + 200 cm^3 ∴ Volume of propane consumed = $\frac{200}{5} = 40$ cm^3
	(ii)	11.2 L of gas at stp weighs 24 g ∴ 22.4 L of gas at stp weighs = $\frac{24 \times 22.4}{11.2}$ = 48 g
(b)	(i)	Number of moles of hydrogen = $\frac{1000}{2} = 500$
	(ii)	Mass of CO_2 = $500 \times (12 + 32) = 500 \times 44 = 22000$ g = 22 kg
	(iii)	Number of molecules of CO_2 = X
	(iv)	According to Avogadro's law, equal volumes of all gases contain the same number of molecules under the same conditions of temperature and pressure.
(c)	(i)	Any soluble salt of copper reacted with sodium, potassium or ammonium carbonate solution $CuCl_2 + Na_2CO_3 \rightarrow CuCO_3 + 2NaCl$
	(ii)	$2NH_4OH + H_2SO_4 \rightarrow (NH_4)_2SO_4 + 2H_2O$

Question 6

(a) Give a *balanced chemical equation* for each of the following: [4]

(i) Action of concentrated Nitric acid on Sulphur.

(ii) Catalytic oxidation of Ammonia.

(iii) Laboratory preparation of Nitric acid.

(iv) Reaction of Ammonia with Nitric acid.

(b) Identify the ***term*** or ***substance*** based on the descriptions given below: [4]

(i) Ice like crystals formed on cooling an organic acid sufficiently.

(ii) Hydrocarbon containing a triple bond used for welding purposes.

(iii) The property by virtue of which the compound has the same molecular formula but different structural formulae.

(iv) The compound formed where two alkyl groups are linked by $-\overset{\overset{O}{||}}{C}-$ group.

(c) Give a *balanced chemical equation* for each of the following: [2]

(i) Preparation of ethane from Sodium propionate

(ii) Action of alcoholic KOH on bromoethane.

Comments of Examiners

(a) (i) Some candidates committed common mistakes by writing SO_2 as a product.

(ii) Many candidates wrote the product as NO_2 instead of NO.

(iii) Most candidates answered this sub-part correctly. Some candidates recorded the products as $NaSO_4$ instead of $NaHSO_4$.

(iv) Most of the candidates answered correctly. A few got confused with the formula of ammonia as NH_4.

(b) (i) Most of the candidates answered this part correctly. Some candidates failed to associate the word 'glacial' with acetic acid.

(ii) Many candidates wrote alkyne instead of ethyne or acetylne.

(iii) Some candidates wrote 'Isotopes' or 'Homologous series' instead of 'Isomerism'.

(iv) A few candidates referred to the compound as 'Keto group' or 'aldehyde group'.

(c) (i) Most of the candidates answered this part correctly.

(ii) In several cases the chemical reaction was written using aqueous KOH instead of with *alcoholic* KOH.

Suggestions for teachers

- Explain students that normally Nitrogen is chemically unreactive but it reacts when catalyst such as Pt and a temperature of 700 – 800 °C is used and gets oxidized to NO.
- Clarify to students the variation in the products of oxidation of ammonia on burning in air and using a catalyst.
- Guide students that NH_3 is basic therefore it reacts with an acid to form neutral salt.
- Familiarise students with the various forms of same organic substances.
- Develop clarity among the various terms in organic chemistry by discussing the meanings of similarly sounding or meaning words.
- Spend adequate time in making the students conversant with various terms and definitions.
- Familiarize students with the various functional groups along with the associated names and reinforce this knowledge with several examples, for practice / drill work.
- Draw the attention of students to the possible errors that they could make while drawing the structural formulae.
- Emphasize the fact that alcoholic KOH is a dehydrohalogenation reaction. Aqueous KOH reaction is a hydrolysis or substitution reaction.

MARKING SCHEME

Question 6

(a)	(i)	$S + 6HNO_3 \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$
	(ii)	$4NH_3 + 5O_2 \xrightarrow[700-800^oC]{Pt} 4NO + 6H_2O$
	(iii)	$NaNO_3 + \underset{Conc.}{H_2SO_4} \xrightarrow{<200^oC} NaHSO_4 + HNO_3$
	(iv)	$NH_3 + HNO_3 \rightarrow NH_4NO_3$
(b)	(i)	glacial acetic acid
	(ii)	acetylene or ethyne
	(iii)	Isomerism
	(iv)	Ketone
(c)	(i)	$C_2H_5COONa + NaOH \xrightarrow[\text{or CaO}]{\text{soda lime}} C_2H_6 + Na_2CO_3$
	(ii)	$C_2H_5Br + \underset{\text{alcoholic}}{KOH} \rightarrow KBr + H_2O + C_2H_4$

Question 7

(a) Name the following: [4]

(i) The process of coating of iron with zinc.

(ii) An alloy of lead and tin that is used in electrical circuits.

(iii) An ore of zinc containing its sulphide.

(iv) A metal oxide that can be reduced by hydrogen.

(b) Answer the following questions with respect to the electrolytic process in the extraction of aluminum: [3]

(i) Identify the components of the electrolyte other than pure alumina and the role played by each.

(ii) Explain why powdered coke is sprinkled over the electrolytic mixture.

(c) Complete the following by selecting the correct option from the choices given: [3]

(i) The metal which does not react with water or dilute H_2SO_4 but reacts with concentrated H_2SO_4 is _____. *(Al/Cu/Zn/Fe)*

(ii) The metal whose oxide, which is amphoteric, is reduced to metal by carbon reduction _____. *(Fe/Mg/Pb/Al)*

(iii) The divalent metal whose oxide is reduced to metal by electrolysis of its fused salt is _____. *(Al/Na/Mg/K).*

Comments of Examiners

(a) (i) Some candidates answered gave the answer as 'electroplating' which was incorrect.

(ii) A number of candidates were not able to answer this part correctly.

(iii) *Zinc sulphide* or *Galena* were written by many candidates instead of *Zinc blende*.

(iv) Some candidates gave the answer as zinc oxide or oxides of reactive metals such as Aluminum which is incorrect.

(b) (i) Most of the candidates answered this part correctly.

(ii) Incomplete answers such as – to prevent burning of electrodes / prevent radiation/ reacts with oxygen, were written by some candidates.

(c) (i) Many candidates selected an incorrect metal.

(ii) Several candidates gave the answer as *Al* instead of *Pb*. Candidates seemed to have got confused between Al and Pb as both form amphoteric oxides.

(iii) Aluminium was incorrectly selected by many candidates, ignoring the instruction of choosing a *divalent metal*.

Suggestions for teachers

- Explain about electrolysis and its applications in detail with examples.
- Tabulate the information about the main composition (main metals) with the important properties and uses of alloys. This would assist students in remembering the details.
- Ask students to commit to memory the names and formulae of important ores of the metals listed in the syllabus.
- Teach activity series thoroughly and give frequent practice.
- Insist on students writing complete answers especially while stating the role played by chemicals.
- Explain to students that although both Al and Pb can form amphoteric oxides, Aluminum being highly electropositive having a strong affinity for oxygen, cannot be reduced by carbon.
- Advise students to refrain from answering in haste and ensure that instructions are read carefully.

MARKING SCHEME

Question 7

(a)	(i) Galvanizing (ii) Solder or fuse metal (iii) Zinc blende (iv) Copper oxide
(b)	(i) Cryolite – lowers the fusion temperature of the electrolyte. Fluorspar – increases the conductivity of the electrolyte or acts as a solvent. (ii) to prevent the heat loss from the electrolyte.
(c)	(i) Cu or Copper (ii) Pb or Lead (iii) Mg or magnesium

GENERAL COMMENTS

Topics found difficult/ confusing by candidates

- Practical Chemistry and related observations.
- Properties of ionic and covalent compounds.
- Methods of preparation of salts.
- Names of functional groups or their presentation.
- Balancing of chemical equations.
- Drawing of structural formulae.
- Numerical problems based on mole concept and application of Gay Lussac's and Avogadro's Laws.
- Arranging elements of periodic table as per the trends in properties across a period and down a group.
- Identifying substances based on analytical chemistry.
- Selective discharge of ions in electrolysis.

Suggestions for candidates

- Read each question carefully and take note of all the instructions and conditions mentioned in the question.
- When a question demands observations, it is not necessary to identify the substance. Observations could include specific smell or specific colour of precipitate or loss of colour and so on.
- Any distinguishing test must involve only one reagent or test that would give different results with the two substances being distinguished.
- While solving numerical problems, show step by step working.
- While answering questions on periodic table do not try identifying the element unless specified in the question. Writing down the electronic configuration with the atomic numbers known, helps in answering questions on trends in properties across the periodic table.
- Practice drawing dot diagrams and make note of shared pairs and lone pairs.
- Ionic bond formation must include depicting the ions formed with appropriate charges, pattern and with a little understanding, writing chemical equations becomes easy.

- Laws and definitions must be learnt well and reproduced with the correct terms.
- Chemical reactions of compounds must not be learnt in isolation. A comparative study brings forth a pattern and with a little understanding, writing chemical equations becomes easy.
- Practice drawing the structures pf organic compounds keeping the tetravalency of carbon in mind and the IUPAC rules for naming.
- Make sure the names of functional groups and the names of compounds in organic chemistry are not confused.
- Reactions without including specific conditions are incomplete and hence these must be included, especially in organic chemistry.
- Knowledge of solubilities of salts is essential especially in deciding the methods of preparation of salts.
- Certain reactions having the same reactants end up having varied products as a result of change in conditions. Such reactions must be noted.
- Solving questions papers of the previous years' examinations will certainly give insights into the kind of questions and help in performing well.
- Avoid selective study and ensure all the topics mentioned in the syllabus are covered, assisted by written work.