SECTION I (40 Marks)

*Attempt **all** questions from this Section*

Question 1

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

(i) An *electrolyte* which completely dissociates into ions is:

A. Alcohol

B. Carbonic acid

C. Sucrose

D. Sodium hydroxide

(ii) The most *electronegative element* from the following elements is:

A. Magnesium

B. Chlorine

C. Aluminium

D. Sulphur

(iii) The reason for using *Aluminium* in the alloy duralumin is:

A. Aluminium is brittle.

B. Aluminium gives strength.

C. Aluminium brings lightness.

D. Aluminium lowers melting point.

(iv) The *drying agent* used to *dry HCl* gas is:

A. Conc. H_2SO_4

B. ZnO

C. Al_2O_3

D. CaO

(v) A hydrocarbon which is a *greenhouse gas* is:

A. Acetylene

B. Ethylene

C. Ethane

D. Methane

(b) Fill in the blanks with the choices given in brackets: [5]

(i) Conversion of *ethanol to ethene* by the action of *concentrated sulphuric acid* is an example of _____. (dehydration / dehydrogenation / dehydrohalogenation)

(ii) When *sodium chloride* is heated with *concentrated sulphuric* acid *below 200^oC*, one of the products formed is _____. (sodium hydrogen sulphate / sodium sulphate / chlorine)

(iii) *Ammonia* reacts with *excess chlorine* to form _____. (nitrogen / nitrogen trichloride / ammonium chloride)

(iv) *Substitution reactions* are characteristic reactions of _____. (alkynes / alkenes / alkanes)

(v) In Period 3, the *most metallic* element is _____. (sodium / magnesium / aluminium)

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

(i) Reduction of copper (II) oxide by hydrogen.

(ii) Action of dilute sulphuric acid on sodium hydroxide.

(iii) Action of dilute sulphuric acid on zinc sulphide.

(iv) Ammonium hydroxide is added to ferrous sulphate solution.

(v) Chlorine gas is reacted with ethene.

(d) State one observation for each of the following: [5]

(i) Concentrated nitric acid is reacted with sulphur.

(ii) Ammonia gas is passed over heated copper (II) oxide.

(iii) Copper sulphate solution is electrolysed using copper electrodes.

(iv) A small piece of zinc is added to dilute hydrochloric acid.

(v) Lead nitrate is heated strongly in a test tube.

(e) (i) Calculate: [5]

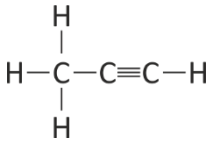
1. The number of moles in 12g of oxygen gas. [O = 16]

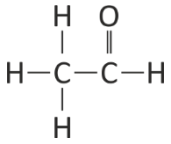
2. The weight of 10^{22} atoms of carbon.

[C = 12, Avogadro's No. = 6 x 10^{23}]

(ii) Molecular formula of a compound is $C_6H_{18}O_3$. Find its empirical formula.

(f) (i) Give the IUPAC name of the following organic compounds: [5]

1. 

2. 

(ii) What is the special feature of the structure of ethyne?

(iii) Name the saturated hydrocarbon containing two carbon atoms.

(iv) Give the structural formula of Acetic acid.

(g) Give the appropriate term defined by the statements given below: [5]

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

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

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

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

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

(h) Arrange the following according to the instructions given in brackets: [5]

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

(ii) Mg^{2+}, Cu^{2+}, Na^{1+}, H^{1+} (In the order of preferential discharge at the cathode)

(iii) Li, K, Na, H (In the decreasing order of their ionization potential)

(iv) F, B, N, O (In the increasing order of electron affinity)

(v) Ethane, methane, ethene, ethyne. (In the increasing order of the molecular weight) [H = 1, C = 12]

Comments of Examiners

(a) (i) This question was attempted well by majority of the candidates. Some candidates selected *Carbonic acid* instead of *Sodium hydroxide*.

(ii) Most of the candidates answered this question correctly. A few chose *Sulphur* over Chlorine.

(iii) A few candidates made the error of selecting the option *Aluminium is brittle*. Most candidates chose the correct option.

(iv) A few candidates got confused between the drying agent of ammonia and HCl gas and selected *CaO* instead of *conc.H_2SO_4*.

(v) Most candidates answered correctly, but some chose *Ethane* over *Methane*.

(b) (i) Several candidates were confused between dehydration and dehydrogenation.

(ii) Many candidates wrote *Chlorine* instead of *Sodium hydrogen Sulphate*.
Some made errors in writing the correct name by missing out the third word 'sulphate' which was printed on the next line.

(iii) A large number of candidates did not select the correct option.

(iv) Most candidates answered correctly but some wrote *alkenes* instead of *alkanes*.

(v) Almost all candidates attempted this subpart correctly.

(c) (i) Most candidates wrote the balanced chemical equation correctly. However, a few made the error of writing *CuO_2* for copper (II) oxide (CuO) and *2H* instead of H_2.

(ii) Some candidates wrote the formula of the product as *$NaSO_4$*.

(iii) Several candidates represented Zinc sulphide incorrectly as $ZnSO_3$ or $ZnSO_4$.
Some carelessly used HCl instead of H_2SO_4.

(iv) A large number of candidates made errors in writing the formula of ammonium sulphate or ferrous sulphate. In several cases, the equation was not balanced.

(v) Some candidates wrote the product as *$C_2H_2Cl_2$* instead of *$C_2H_4Cl_2$* in the chemical equation.

(d) (i) Many candidates either wrote the equation or named the product formed instead of stating the observation.

Suggestions for teachers

- Teach the concept of complete ionization and partial ionization with examples to give the thorough understanding of strong and weak electrolytes.
- Explain the trends in the properties of elements across a period/group with reference to the variation in electronic configuration.
- Familiarise students with the role of each metal used in an alloy.
- Make students aware of the impact of various gases on our environment.
- Explain the meaning of the terms with relevant examples.
- Emphasise on the variation of products when temperature conditions change.
- Advise students to reproduce the word correctly from the choices given.
- Explain the logic behind the products formed in the reaction between ammonia and chlorine with the varying conditions, as to, which one is in excess.
- Explain the concept of saturation and unsaturation to give them the understanding of the type of reaction (addition or substitution) that a particular organic substance would undergo.
- Ensure students have clarity regarding *molecules*, *moles* and *molecular weight*.
- Acquaint students with the following terms: number of moles, Avogadro's numbers of atoms/molecules, Relative atomic mass (RAM), Relative molecular mass (RMM), molar mass, molar volume, etc.

(ii) Several candidates incorrectly wrote the colour of copper as red or reddish or brown.

(iii) While most candidates answered correctly, some common incorrect responses were as follows:
- Cathode diminishes in size.
- Blue colour of copper sulphate fades.

In a few cases, the change was noted without mention of the electrode.

(iv) Instead of stating the test for the gas evolved, a large number of candidates identified it as H_2. Some candidates stated that the gas burns with a blue flame instead of stating that a burning splint is put off with a pop sound.

(v) On heating lead nitrate strongly in a test tube, products formed were listed by many candidates without any noticeable observations.

(vi) Some candidates wrote *yellow precipitate of PbO* is obtained instead of *yellow residue*.

(e) (i) Many candidates took the mass of one mole of oxygen gas as 16 instead of 32 and hence, could not calculate number of moles correctly.
In a number of cases, calculations for weight of 10^{22} atoms of carbon were incorrect indicating inadequate understanding of the concept.

(ii) Many candidates attempted well barring some who carried out elaborate calculations using percentage composition but ultimately could not write the empirical formula.

(f) (i) (1) Most candidates attempted this part well. However, some were confused between "yne" and "ene".

(2) In writing IUPAC name of the organic compound, many candidates wrote *ethanol* (alcohol) which was incorrect.

(ii) Some candidates mentioned the presence of a linear planar structure or three covalent bonds rather than presence of *triple covalent bond*.
Some gave incorrect answers such as, unsaturated compound or, undergoes addition reaction and so on.

(iii) Most candidates answered correctly while some stated it as *ethene* or *ethyne* instead of *ethane*.
A few candidates gave the general name for the homologous series instead of specific name.

(iv) Several candidates wrote the structural formula of acetic acid correctly. However, some candidates wrote the condensed formula of CH_3 and COOH.

(g) (i) Most candidates answered this question correctly. Some candidates wrote the abbreviation as **EF**.

- Drill in the minds of the students that the Empirical formula can be obtained from the Molecular formula by reducing it to the simplest ratio. Give relevant examples.
- Point out to students that the carbon atom C with the double or triple bond or functional group, must be expressed in the lowest number.
- Stress on the difference between structural formula of alcohol and that of aldehyde. Give practice for greater clarity.
- Emphasise on the differences between saturated and unsaturated compounds /that saturated have all single bonds and unsaturated ones either have double or triple bonds.
- Advise students to draw comparative tables which include name, molecular formula, condensed formula and structural formula of various compounds differing in functional groups.
- Advise students to use standard abbreviations and symbols only in answering the questions.
- Draw the attention of the students to the two ways in which bond pair of electrons is shared, with relevant examples.
- Advise students to read the questions carefully, answer specifically, with reference to what has been asked and to use the option given in the question paper while writing the final answer.

(ii) Instead of stating the general term ‘Acid’ many candidates gave the specific name of an acid which were not acceptable.

(iii) Most candidates gave the appropriate term as *electron affinity* instead of *electronegativity*. Some candidates simply written the abbreviation form of *electronegativity*.

(iv) Most candidates mentioned the process correctly. However, a few candidates confused it with *roasting*.

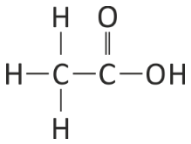
(v) Many candidates incorrectly termed it as *polar covalent bond*.

(h) In subparts (i) – (v), several candidates used the greater than (>) or less than (<) symbols incorrectly to arrange the given items according to the instructions given in the question, which was not required.
Some candidates simply arranged the items given in subparts (i) – (v), in reverse order.
In subpart (v), some candidates made unnecessary use of formula instead of choosing the names given.

MARKING SCHEME

Question 1

(a)	(i) D or Sodium Hydroxide or NaOH (ii) B or Chlorine or Cl_2 (iii) C or Aluminium brings lightness (iv) A or Concentrated H_2SO_4 (v) D or Methane or CH_4
(b)	(i) Dehydration (ii) Sodium hydrogen sulphate or $NaHSO_4$ (iii) Nitrogen trichloride or NCl_3 (iv) Alkanes (v) Sodium
(c)	(i) $CuO + H_2 \rightarrow Cu + H_2O$ (ii) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ (iii) $ZnS + H_2SO_4 \rightarrow ZnSO_4 + H_2S\uparrow$ (iv) $FeSO_4 + 2NH_4OH \rightarrow (NH_4)_2SO_4 + Fe(OH)_2$ (v) $H_2C = CH_2 + Cl_2 \rightarrow H_2C - CH_2$ (with Cl attached to each carbon: $ClH_2C - CH_2Cl$) *Or* $C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$

(d)	(i) Reddish brown or brown gas of nitrogen dioxide is formed. (ii) The black copper (II) oxide turns into a pink or reddish-brown substance. (iii) The colour of the electrolyte remains blue / anode diminishes in size or becomes thinner / cathode becomes thicker. (iv) Brisk effervescence / A gas given out extinguishes burning splinter and itself burns with pop sound. (v) A decrepitating sound is heard / A reddish brown gas is given out / A yellow residue is left behind.
(e)	(i) 1. Number of moles in 12 g of oxygen gas = $\frac{12}{32}$ = 0.375 moles 2. Weight of 10^{22} atoms of C = $\frac{12 \times 10^{22}}{6 \times 10^{23}}$ = 0.2 g (ii) Its empirical formula is C_2H_6O
(f)	(i) 1. Propyne 2. Ethanal (ii) Triple bond between 2 carbon atoms / H – C ≡ C – H (iii) Ethane (iv) 
(g)	(i) Empirical formula (ii) Acid (iii) Electronegativity (iv) Calcination (v) Non-polar covalent bond
(h)	(i) Pb, Zn, Ca, K (ii) Cu^{2+}, H^{1+}, Mg^{2+}, Na^{1+} (iii) H, Li, Na, K (iv) B, N, O, F (v) Methane, ethyne, ethene, ethane

SECTION II (40 Marks)

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

Question 2

(a) Draw the electron dot structure of: [3]

(i) Nitrogen molecule [N = 7]

(ii) Sodium chloride [Na = 11, Cl = 17]

(iii) Ammonium ion [N = 7, H = 1]

(b) The pH values of three solutions A, B and C are given in the table. Answer the following questions: [3]

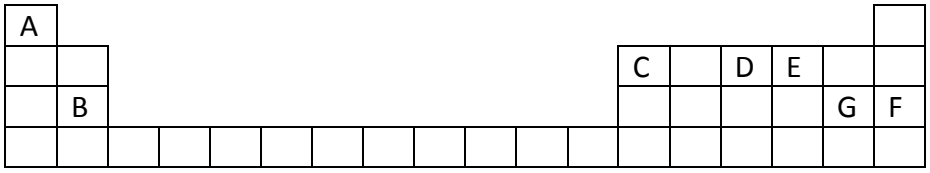
Solution	pH value
A	12
B	2
C	7

(i) Which solution will have no effect on litmus solution?

(ii) Which solution will liberate CO_2 when reacted with sodium carbonate?

(iii) Which solution will turn red litmus solution blue?

(c) Study the extract of the Periodic Table given below and answer the questions that follow. Give the alphabet corresponding to the element in question. DO NOT repeat an element. [4]



(i) Which element forms electrovalent compound with G?

(ii) The ion of which element will migrate towards the cathode during electrolysis?

(iii) Which non-metallic element has the valency of 2?

(iv) Which is an inert gas?

Comments of Examiners

(a) While a number of candidates drew the electron dot structures asked for correctly, others committed the following errors:

(i) Candidates drew the orbit structure or showed electron pairs along with the bonds. Some forgot the lone pair of electrons of N.

(ii) Electrons of sodium were not differently represented from chlorine; transfer of electron and ion formation was not shown. A few candidates drew the orbital diagram instead of the electron dot diagram.

(iii) Coordinate bond was not shown by some candidates. Overall positive charge was not shown on the ion in a few cases. Some drew the structure of *ammonia* instead of *ammonium.*

(b) Most candidates answered the pH value related questions correctly. However, some candidates failed to associate the nature of the substance with the correct pH value. Some attached names to the solutions instead of using the symbols A, B and C.

(c) Some candidates identified the elements instead of using the given letters of alphabets. In a few cases, the position of metals and non-metals was not clear. Despite the clear instructions not to repeat elements some candidates repeated certain elements.

Suggestions for teachers

- Clarify the difference between electron dot and orbital diagram and explain that after bonding, each atom must have an octet structure. Compare dot structure with structural formula for shared pairs. Emphasise that lone pair must not be missed out.
- Ask students to differentiate between electrons of unlike atoms. Lay emphasis on writing the positive charge on the ion.
- Show the association between pH scale and the nature of substances clearly to the students. Explain clearly the properties of acids and alkalis.
- Instruct students to read the questions carefully and answer as per instructions given. Guided practice will assist students in performing better.

MARKING SCHEME

Question 2

(a)	(i) $:N::N:$ $:N\equiv N:$ (ii) $Na^{\odot} + :\ddot{Cl}: \longrightarrow Na^{1+}\ :\ddot{Cl}:^{1-}$ *or* $Na^{1+}\ Cl^{1-}$ (iii) $H_x\overset{H}{\underset{H+}{N}}H \longrightarrow \left[H-\overset{H}{\underset{H}{N}}-H\right]^{1+}$
(b)	(i) C / pH 7 (ii) B / pH 2 (iii) A / pH 12

(c)	(i) B (ii) A (iii) E (iv) F

Question 3

(a) Name the particles present in: [3]

(i) Strong electrolyte

(ii) Non- electrolyte

(iii) Weak electrolyte

(b) Distinguish between the following pairs of compounds using the reagent given in the bracket. [3]

(i) Manganese dioxide and copper (II) oxide. (using concentrated HCl)

(ii) Ferrous sulphate solution and ferric sulphate solution. (using sodium hydroxide solution)

(iii) Dilute hydrochloric acid and dilute sulphuric acid. (using lead nitrate solution)

(c) Choose the method of preparation of the following salts, from the methods given in the list: [4]

[List: A. Neutralization B. Precipitation

C. Direct combination D. Substitution]

(i) Lead chloride

(ii) Iron (II) sulphate

(iii) Sodium nitrate

(iv) Iron (III) chloride

Comments of Examiners

(a) Majority of the candidates named the particles present in Strong electrolyte, Non-electrolyte and Weak electrolyte correctly. However, some candidates listed examples instead of stating the presence of ions or molecules depending on the type of electrolyte.

(b) (i) Some of the candidates gave the equation instead of writing the observation to distinguish between the given pairs of compounds. With the reagent given, the result of adding it to one substance was specified by several candidates but not for the other substance.

(ii) Some candidates interchanged the colours of the two ions, ferrous and ferric.

(iii) White precipitate was mentioned by several candidates but the effect of heat on both was not mentioned.

(c) (i) Several candidates incorrectly chose *neutralization* instead of *precipitation.*

(ii) Some candidates erred by writing *precipitation* instead of *substitution.*

(iii) This subpart of the question was attempted correctly by most candidates.

(iv) Most candidates attempted this subpart correctly.

Suggestions for teachers

- Discuss in detail the types of electrolytes on the basis of dissociation /ionization whether complete/partial or no dissociation/ionization.
- Ask students to specify the effect of the reagent on both the substances when a single test is used.
- Supplement theory adequately with practical work, which may be done by the students themselves or through demonstration. Instruct students to record observations.
- Never disregard the importance of practical work.

MARKING SCHEME

Question 3

(a)	(i) Only ions (ii) Only molecules (iii) Both molecules and ions
(b)	(i) On adding concentrated hydrochloric acid if a greenish yellow gas is evolved it is Manganese dioxide. If no gas is evolved it is CuO. (ii) On adding sodium hydroxide solution if a dirty green precipitate is formed it is ferrous sulphate solution. If a reddish-brown precipitate is formed, it is Ferric sulphate solution. (iii) On adding lead nitrate solution, if white precipitate is formed which dissolves on heating, then it is dilute HCl. If white precipitate formed does not dissolve on heating, it is dilute H_2SO_4.
(c)	(i) B or Precipitation (ii) D or Substitution (iii) A or Neutralization (iv) C or Direct combination

Question 4

(a) Complete the following equations: [3]

(i) $S + \text{conc. } HNO_3 \rightarrow$

(ii) $C + \text{conc. } H_2SO_4 \rightarrow$

(iii) $Cu + \text{dil. } HNO_3 \rightarrow$

(b) Write a balanced chemical equation for the preparation of: [3]

(i) Ethene from bromoethane

(ii) Ethyne using calcium carbide

(iii) Methane from sodium acetate.

(c) Name the following organic compounds: [4]

(i) The compound with 3 carbon atoms whose functional group is a carboxyl.

(ii) The first homologue whose general formula is C_nH_{2n}.

(iii) The compound that reacts with acetic acid to form ethyl ethanoate.

(iv) The compound formed by complete chlorination of ethyne

Comments of Examiners

(a) (i) A large number of candidates made errors in balancing of the equation and/or writing the products. Many candidates wrote SO_2 as a product instead of H_2SO_4.

(ii) Although CO_2 was the product, several candidates wrote H_2CO_3.

(iii) Many candidates wrote NO_2 as a product instead of NO.

(b) (i) In writing a balanced chemical equation for the preparation of Ethene from bromoethane, the formula for bromoethane was written as C_2H_6Br in place of C_2H_5Br by some candidates.
Several candidates used chloroethane instead of bromoethane.

(ii) In writing a balanced chemical equation for the preparation of Ethyne using calcium carbide, some candidates wrote the product as CaO instead of $Ca(OH)_2$.

(iii) The formula of *sodium acetate* was written incorrectly by some candidates.

(c) (i) Some candidates incorrectly drew the structural formula when the name of the organic compound was asked.

(ii) Several candidates gave incorrect answers like, alkene, ethyne or acetylene.

(iii) For the compound that reacts with acetic acid to form ethyl ethanoate, reactants listed by many candidates were incorrect.

(iv) Most candidates answered this subpart correctly. However, some candidates wrote incorrect numbering of the C atoms having the chlorine atoms.

Suggestions for teachers

- Give adequate practice in writing of balanced chemical equations with necessary conditions. Use of structural formulae for organic compounds will help students to write equations correctly.
- Ask students to prepare a chart on various homologous series with the first member listed along with other properties.
- Ensure that students know the common names along with the IUPAC names, wherever possible.

MARKING SCHEME

Question 4

(a)	(i) $S + 6HNO_3 \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$ (ii) $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$ (iii) $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$
(b)	(i) $C_2H_5Br + KOH \xrightarrow[(alc.)]{} C_2H_4 + KBr + H_2O$ (ii) $CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2$ (iii) $CH_3COONa + NaOH \rightarrow CH_4 + Na_2CO_3$
(c)	(i) Propanoic acid (ii) Ethene or ethylene (iii) Ethanol or ethyl alcohol (iv) 1, 1, 2, 2 – tetra chloro ethane

Question 5

(a) Give the chemical formula of: [3]

(i) Bauxite

(ii) Cryolite

(iii) Sodium aluminate

(b) Answer the following questions based on the extraction of aluminium from alumina by **Hall-Heroult's Process**.: [3]

(i) What is the function of cryolite used along with alumina as the electrolyte?

(ii) Why is powdered coke sprinkled on top of the electrolyte?

(iii) Name the electrode, from which aluminium is collected.

(c) Match the alloys given in column I to the uses given in column II: [4]

COLUMN I		COLUMN II	
(i)	Duralumin	A.	Electrical fuse
(ii)	Solder	B.	Surgical instruments
(iii)	Brass	C.	Aircraft body
(iv)	Stainless Steel	D.	Decorative articles

Comments of Examiners

(a) In writing the chemical formula of bauxite, many candidates either wrote incorrect number of water molecules or did not write them at all.
In subparts(ii) and (iii), some candidates wrote incorrect formulae.
(b) Most candidates answered this question correctly.
(c) Some candidates mismatched Column I and Column II, as they were not sure of the uses of alloys.

Suggestions for teachers

- Give regular practice through class tests, games, quizzes to ensure that students learn the details.
- Teach students metallurgy in detail.
- Frequently revise names of common ores of aluminium, iron and zinc.
- Discuss the questions based on the extraction of aluminium from alumina by Hall-Heroult's process in class.

MARKING SCHEME Question 5	
(a)	(i) $Al_2O_3.2H_2O$ (ii) Na_3AlF_6 (iii) $NaAlO_2$
(b)	(i) Cryolite reduces the fusion temperature of the mixture / Cryolite increases the mobility of the ions / increases the conductivity of the electrolyte / Acts as solvent for alumina. (ii) Powdered coke protects the graphite rods of the anode from oxidation by oxygen released at the anode / Powdered coke prevents the loss of heat from the electrolyte. (iii) Cathode
(c)	(i) Duralumin: C or Aircraft body. (ii) Solder: A or Electrical fuse (iii) Brass: D or Decorative articles (iv) Stainless Steel: B or surgical instruments

Question 6

(a) Identify the substances underlined: [3]

(i) The <u>catalyst</u> used to oxidise ammonia.

(ii) The <u>organic compound</u> which when solidified, forms an ice like mass.

(iii) The <u>dilute acid</u> which is an oxidizing agent.

(b) Copper sulphate solution reacts with sodium hydroxide solution to form a precipitate of copper hydroxide according to the equation: [3]

$$2NaOH + CuSO_4 \rightarrow Na_2SO_4 + Cu(OH)_2 \downarrow$$

(i) What mass of copper hydroxide is precipitated by using 200 gm of sodium hydroxide?

[H = 1, O = 16, Na = 23, S = 32, Cu = 64]

(ii) What is the colour of the precipitate formed?

(c) Find the **empirical formula** and the **molecular formula** of an organic compound from the data given below: [4]

C = 75.92%, H = 6.32% and N = 17.76%

The vapour density of the compound is 39.5.

[C = 12, H = 1, N = 14]

Comments of Examiners

(a) (i) Most candidates identified the catalyst used to oxidise ammonia correctly. However, a few candidates mentioned incorrect catalyst such as Fe/ V_2O_5/CaO.

(ii) Almost all candidates answered correctly.

(iii) Many candidates listed HCl or H_2SO_4 as an oxidising agent instead of nitric acid.

(b) (i) Some candidates used Gay Lussac's law instead of mole concept or calculated the molecular mass incorrectly. Some candidates failed to use the stoichiometric coefficients i.e. ***2*** in the case of NaOH.

(ii) Most of the candidates attempted this part well.

Some candidates incorrectly wrote the colour of the precipitate as brown or white.

(c) Many candidates determined the empirical formula correctly but failed in calculating the value of ***n*** and hence, erred in the molecular formula.

Suggestions for teachers

- Maintain a comparative chart for the various processes consisting of reactants, catalysts, temperature / pressure condition, equation, etc.
- Teach students the fact that only nitric acid in dilute and concentrated form can act as an oxidizing agent.
- Train students to answer the molar relationship using the coefficients in the equation and compute the answer accurately.
- Instruct students to focus on practical work and the noting of results.
- Insist on stepwise working of numerical problems and give adequate practice.

MARKING SCHEME

Question 6

(a)	(i) Platinum or Pt. (ii) Acetic acid or ethanoic acid or CH_3COOH (iii) HNO_3 or nitric acid.
(b)	(i) RMW of NaOH = 40, $Cu(OH)_2$ = 98 $\therefore$ 2 x 40 g precipitate = 98 g $\therefore$ 200 g precipitate = $\frac{98\times200}{80}$ = 245 g (ii) Pale blue

(c)

Element	% composition	Atomic weight	Relative no. of atoms	Simplest Ratio
C	75.92	12	75.92/12 = 6.32	6.32/1.26 = 5
H	6.32	1	6.32/1 = 6.32	6.32/1.26 = 5
N	17.76	14	17.76/14 = 1.26	1.26/1.26 = 1

Empirical formula is: C_5H_5N

Empirical formula weight = 60+5+14 = 79

$$n = \frac{molecular\ weight}{empirical\ formula\ weight} = \frac{2\times39.5}{79} = \frac{79}{79} = 1$$

Molecular formula = C_5H_5N

Question 7

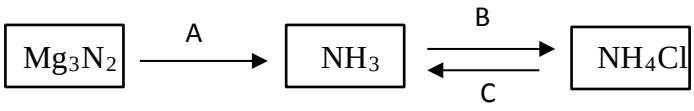
(a) Name the gas evolved in each of the following cases: [3]

(i) Alumina undergoes electrolytic reduction.

(ii) Ethene undergoes hydrogenation reaction.

(iii) Ammonia reacts with heated copper oxide.

(b) Study the flow chart given and give balanced equations to represent the reactions **A, B** and **C**: [3]



(c) Copy and complete the following table which refers to the **industrial method for the preparation** of ammonia and sulphuric acid: [4]

Name of the compound	Name of the process	Catalytic equation (with the catalyst)
Ammonia	(i)_____	(ii)_____
Sulphuric acid	(iii)_____	(iv)_____

Comments of Examiners

(a) (i) Some candidates wrote the name of the gas evolved on electrolytic reduction of alumina as CO_2 instead of O_2. A few candidates wrote the symbol of nascent oxygen, that was not acceptable.

(ii) Several candidates wrote H_2 is evolved in the hydrogenation reaction of ethene, which was an incorrect answer.

(iii) In the reaction of ammonia with heated copper oxide, the gas evolved was incorrectly written as N, NO or NO_2.

(b) After studying the given flow chart, many candidates gave correct balanced equations to represent reactions A, B and C. However, in some scripts following errors were noticed:

- For reaction A, MgO was written as the product instead of $Mg(OH)_2$
- For reaction C, some candidates failed to use an alkali.

(c) The table referring to the **industrial method for the preparation** of ammonia and sulphuric acid was completed correctly by a number of candidates. Some common errors made by candidates:

(i) Name of the process was incorrectly written as Ostwald's process/Baeyer's process

(ii) The catalyst listed was platinum/nickel, etc.

(iii) Haber's Process was written instead of Contact Process.

(iv) Incorrect equation was given.

Suggestions for teachers

- Train students to learn the reactions in terms of reactants, products, conditions, equations and observations.
- Give enough practice to students in writing the different types of balanced chemical reactions.
- Explain to students that a metal nitride with warm water gives metal hydroxide and ammonia; an ammonium salts reacts with an alkali and gives NH_3 gas.
- Motivate students to prepare comparative charts, power point presentations or quizzes, etc to study facts.
- Clarify industrial methods for the preparation of ammonia and sulphuric acid thoroughly.
- Give frequent revision tests.

MARKING SCHEME

Question 7

(a)	(i) Oxygen gas or O_2 (ii) Ethane gas or C_2H_6 (iii) Nitrogen or N_2
(b)	A. $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$ B. $NH_3 + HCl \rightarrow NH_4Cl$ *Or* $8NH_3 + 3Cl_2 \rightarrow 6NH_4Cl + N_2$ C. $NH_4Cl + NaOH \rightarrow NaCl + NH_3 + H_2O$ Or with any other alkali.
(c)	(i) Haber's Process (ii) $N_2 + 3H_2 \xrightarrow{Fe} 2NH_3$ (iii) Contact Process (iv) $2SO_2 + O_2 \xrightarrow{V_2O_5} 2SO_3$ *Or* $2SO_2 + O_2 \xrightarrow{Pt} 2SO_3$

GENERAL COMMENTS

Topics found difficult/ confusing by candidates

- Observations based on practical chemistry.
- Writing correct balanced chemical equations.
- Methods of preparation of salts.
- Structural formulae of compounds with functional groups and IUPAC nomenclature.
- Distinguishing between substances on the basis of test/reagent given.
- Numerical problems based on mole concept.
- Conversion of molecular formula to empirical formula.
- Electron dot diagram.
- Arranging elements as per the trends in properties across a period and down a group.
- Difference between the terms dehydration and dehydrogenation.
- Identification of terms such as electronegativity etc. on the basis of descriptions given.
- Catalysts used in various industrial processes.
- Components of alloys and their application.
- Difference in structure of an aldehyde and alcohol.
- Connecting the type of solution to its pH value based on certain observations.

Suggestions for candidates

- Avoid selective study.
- Learn definitions and highlight key words.
- Learn symbols of elements and their valencies. Practice writing balanced chemical equations with necessary conditions.
- Practice drawing of dot diagrams.
- Practice drawing of Structural formulae of organic compounds.
- Create charts with a comparative study on Hydrocarbons – alkanes, alkenes and alkynes including the equations and conditions and various industrial processes.
- Learn trends in properties across a period and draw a group.
- Be thorough with observations in practical chemistry and use colours to highlight observations along with tests to differentiate between substances.
- In a chemical equation, write an acid with its strength(dilute/concentration) Name organic chemical compounds only using IUPAC nomenclature.
- Select only one reagent when distinguishing between substances and state the result with each substance.
- Follow confirmatory test for colourless gases.
- Focus on observations such as specific smell or specific colour of precipitate or change in colour between reactants and products.
- Understand the role of substances used in the extraction of metals in metallurgy.
- Practice numerical problems regularly, solve numericals stepwise with correct formula and write the answer with correct unit.
- Pay special attention to reactions involving variations in products formed when conditions change using the same reactants.
- Solve the previous years' papers to become familiar with the mode of questioning and marking system.
- Read the questions carefully and then answer accordingly what has been asked.