ICSE 2025 EXAMINATION

Sample Question Paper - 12

Chemistry

Time: 2 hours.   **Total Marks: 80**

SECTION-A
(*Attempt **all** questions from this Section*)

Question 1

Choose one correct answer to the questions from the given options: [15]

(i) The inert gas which lies in the third period is:
   (a) Helium
   (b) Argon
   (c) Neon
   (d) Xenon

(ii) Which of the following doesn't represent oxidation?
   (a) Loss of electrons
   (b) Addition of oxygen
   (c) Addition of hydrogen
   (d) Increase in oxidation number

(iii) The observation when lead nitrate solution is added to sodium hydroxide, is :
   (a) Litmus indicator
   (b) Universal indicator
   (c) Acid-Base indicator
   (d) Neutral indicator

(iv) Gelatinous white precipitates soluble in excess of ammonium hydroxide are of:
   (a) Magnesium hydroxide
   (b) Calcium hydroxide
   (c) Zinc hydroxide
   (d) Calcium hydroxide

(v) **Assertion (A)**: 6 litres of H_2 reacts with 5.6 litres of Cl_2 gas to form 11.2 litres of HCl gas.

Reason (R): Hydrogen acts as limiting reagent if 6 litres of H_2 gas reacts with 5.6 litres of Cl_2 gas.

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

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

(c) A is true but R is false.

(d) A is false but R is true.

(vi) Pure metal is made .... during electrorefining.

(a) Anode

(b) Cathode

(c) Electrolyte

(d) None of these

(vii) The substance added to lower the fusion temperature from 2050°C to 950°C is:

(a) Cryolite

(b) Alumina

(c) Sodium aluminate

(d) Corundum

(viii) The ammonium salt which on heating sublimates is:

(a) Ammonium chloride

(b) Acidic oxide

(c) Amphoteric oxide

(d) Neutral oxide

(ix) The property of carbon to form long chains and rings is called:

(a) Catenation

(b) Polymerisation

(c) Cracking

(d) Hydrogenation

(x) In the special case of a covalent bond formed between two atoms in which both the electrons are contributed by one of the atoms whereas the other atom simply takes part in sharing is:

(a) Ionic bond

(b) Covalent bond

(c) Coordinate bond

(d) None of these

(xi) **Assertion (A)**: The pH of potassium hydroxide is more than 7.
Reason (R): The pH of a base is negative logarithm to the base 10 of the hydroxyl ion concentration expressed in moles per litre.
(a) Both A and R are true and R is the correct explanation of A.
(b) Bothe A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

(xii) Electrolysis of aqueous copper sulphate is carried by using:
(a) Copper anode graphite cathode
(b) Copper electrodes
(c) Platinum electrodes
(d) None of these

(xiii) Rita dissolved a white insoluble oxide by fusing with caustic soda or caustic potash. The oxide would be:
(a) Lead oxide
(b) Zinc oxide
(c) Ferric oxide
(d) Magnesium oxide

(xiv) Pine oil used in froth floatation process acts as a:
(a) Frother
(b) Skimmer
(c) Water repellant
(d) None of these

(xv) Alkanes are called as:
(a) olefins
(b) paraffins
(c) carotenes
(d) None of these

Question 2

(i) Study the diagram and answer the below questions: [5]
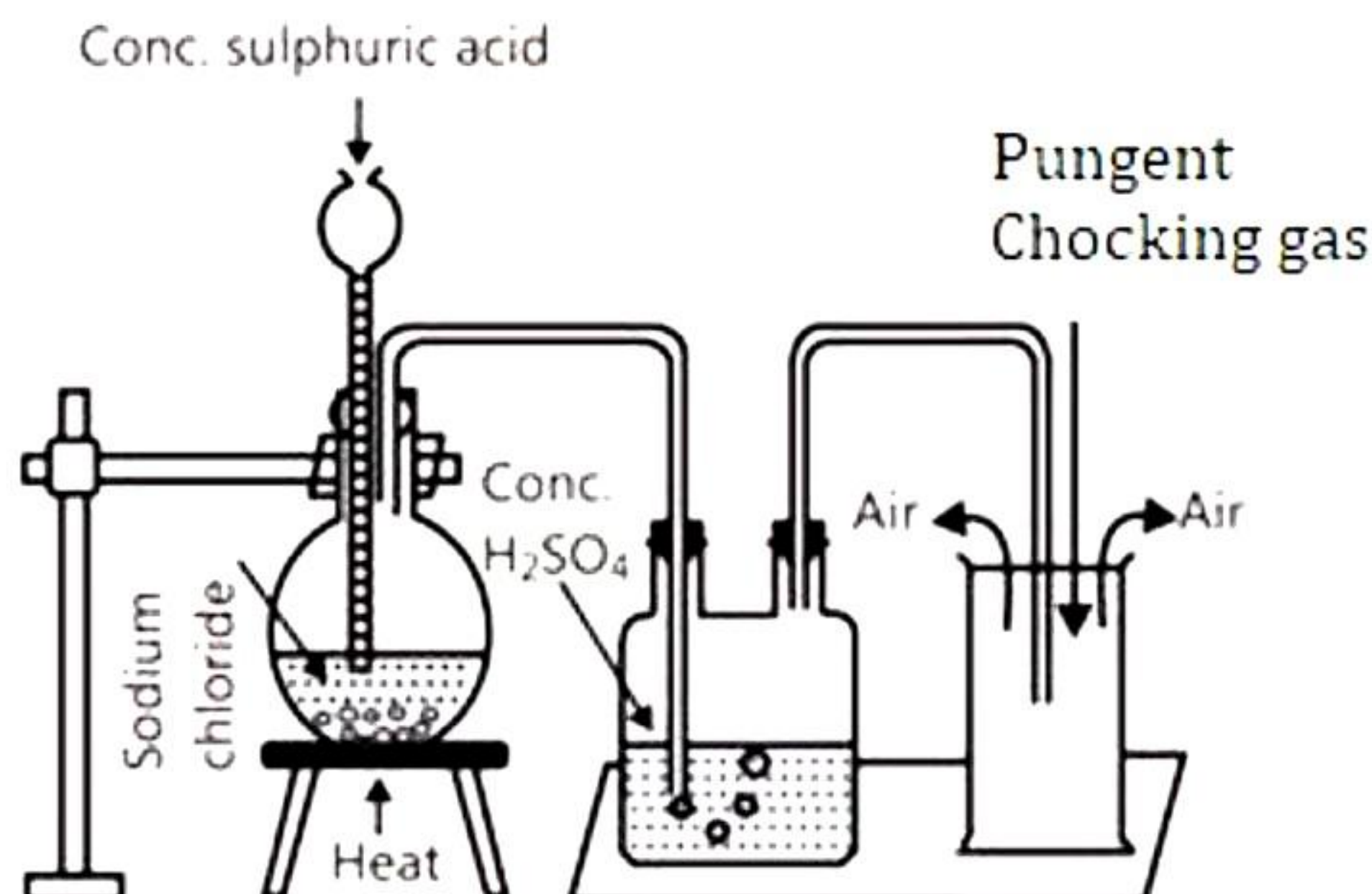
(a) Name the gas collected in the gas jar.
(b) Write a balanced chemical equation for the above preparation.
(c) How is the gas being collected?
(d) Name the drying agent in this experiment.
(e) How will you find that the gas jar is full of gas?

(ii) Match the atomic number with the statement. [5]

Periodic property	Group	Period
(a) Ionisation energy	(1) _____	(2) _____
(b) Electron affinity	(3) _____	(4) _____
(c) Electronegativity	(5) _____	(6) _____
(d) Atomic size	(7) _____	(8) _____
(e) Reducing property	(9) _____	(10) _____

(iii) A to F below relate to the source and extraction of either zinc or aluminium. [5]
   A: Bauxite
   B: Coke
   C: Cryolite
   D: Froth floatation
   E: Sodium hydroxide solution
   F: Zinc blende
   (a) Write the three letters each from the above list which are relevant to
      1. Zinc   2. Aluminium
   (b) Fill in the blanks using the most appropriate words from A to F:
      1. The ore from which aluminium is extracted must first be treated with _____ so that pure aluminium oxide can be obtained.
      2. Pure aluminium oxide is dissolved in _____ to make a conducting solution. Write the formula of cryolite.

(iv) Name the following: [5]
   (a) A polar covalent compound
   (b) A regular tetrahedral molecule
   (c) A bond formed by transfer of electrons
   (d) A compound in which a shared pair of electrons are equally distributed between the reacting atoms.
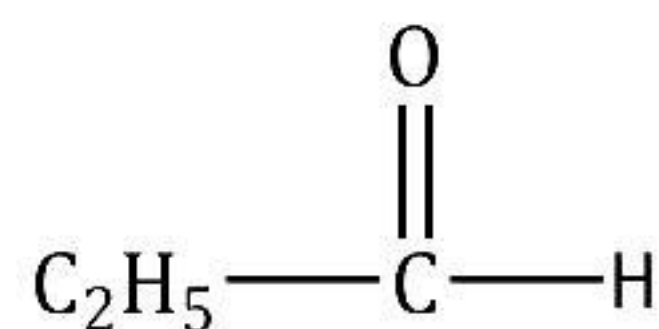   (e) A molecule with one lone pair and three bond pairs

(v) [5]
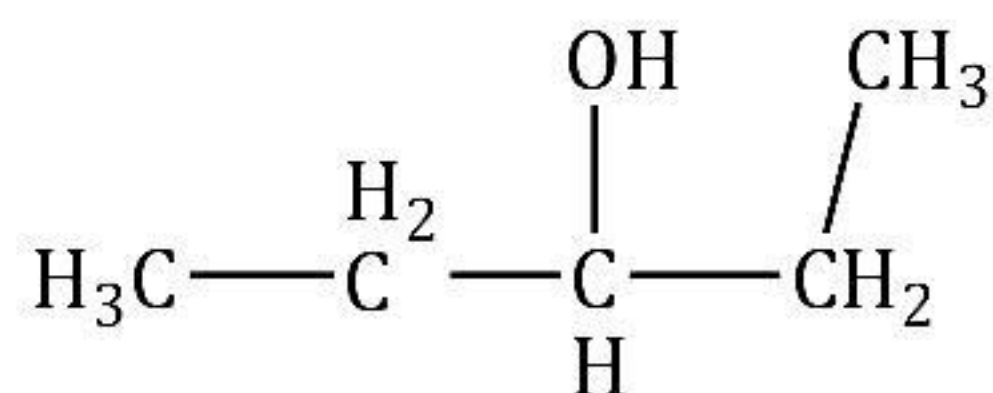   (a) Draw the structural formula for the following:
      1. Butanoic acid
      2. Pentan-2-yne
      3. Methanal

   (b) Name the following organic compounds in IUPAC system:
      1.

$$C_2H_5 - \overset{\overset{\displaystyle O}{\|}}{C} - H$$

      2.

$$H_3C - \overset{H_2}{C} - \underset{\underset{\displaystyle H}{|}}{\overset{\overset{\displaystyle OH}{|}}{C}} - CH_2 - CH_3$$

SECTION-B

(Attempt any four questions)

Question 3

(i) How strength of an acid is determined depending on concentration? [2]

(ii) Write the reactions for the laboratory preparation of hydrochloric acid from metallic chloride. [2]

(iii) A compound has the following percentage composition by mass: [3]
Carbon – 54.55%, Hydrogen – 9.09% and oxygen – 36.26%. Its vapour density is 44. Find the empirical and molecular formula of the compound.
(H = 1; C = 12; O = 16)

(iv) The following questions refer to the modern periodic table: [3]
   (a) What are Group 1 and 2 elements commonly called?
   (b) Write whether below given statements are True or False.
       1. The valency of elements in Group 18 elements is zero.
       2. Atomic size across a period goes on increasing.

Question 4

(i) Write any two structural isomers of pentane. [2]

(ii) Write four differences between ionic and covalent compounds. [2]

(iii) Write the following reactions: [3]
   (a) Conversion of impure bauxite to sodium aluminate
   (b) Conversion of sodium aluminate to aluminium hydroxide
   (c) Conversion of $Al(OH)_3$ to pure alumina

(iv) Write balanced equations for the following reactions: [3]
   (a) $Ca(NO_3)_2 + NaOH \rightarrow$
   (b) $ZnSO_4 + NH_4OH \rightarrow$
   (c) $Al + NaOH + H_2O \rightarrow$

Question 5

(i) As per Hall- Heroult process in electrolytic reduction of aluminium oxide, write the reactions taking place at the cathode and anode. [2]

(ii) Write reactions taking place at the cathode and anode in the electrolysis of fused lead bromide. [2]

(iii) Write common name and IUPAC name of the following compounds: [3]

S No	Formula	Common Name	IUPAC
(a)	C_3H_6		
(b)	C_2H_2		
(c)	CH_3OH		

(iv) Answer the following questions: [3]
    (a) Preparation of salt by Partial Replacement
    (b) Preparation of salt by Complete Replacement
    (c) Ionic Definition of Salt

Question 6

(i) Give reasons why: [2]
    (a) In the electroplating of an article with silver, the electrolyte sodium argentocyanide solution is preferred over silver nitrate solution.
    (b) Although copper is a good conductor of electricity, it is a non-electrolyte.

(ii) If a compound has empirical formula CH_2O and its molecular mass is 180, then calculate its molecular formula. [2]

(iii) Give examples for the following reactions: [3]
    (a) HCl with active metals
    (b) H_2SO_4 with bases
    (c) HCl with carbonates and bicarbonates

(iv) In Period 3 of the periodic table, Element B is placed to the left of Element A. On the basis of this information, choose the correct word from the brackets to complete the following statements: [3]
    (a) Element B would have (lower/higher) metallic character than Element A.
    (b) Element A would probably have (lesser/higher) electron affinity than Element B.
    (c) Element A would have (greater/smaller) atomic size than Element B.

Question 7

(i) [3]
    (a) An inorganic compound has the following percentage composition:
        P = 22.45%, Cl = 77.45%. Deduce the empirical formula of the compound.
        (P = 31, Cl = 35.5)
    (b) Calculate the percentage of iron in iron (III) oxide (Fe_2O_3).
        (O = 16, Fe = 56)

(ii) State the observations along with reactions at the anode and cathode during the electrolysis of copper sulphate solution using copper electrodes. [3]

(iii) Manjiri carried out an experiment in her laboratory in which at 27 °C and normal pressure, she reacted pure calcium carbonate and dilute hydrochloric acid in a round bottom flask. She observed that, out of this reaction, 2 litres of carbon dioxide gas got collected. [4]
  (a) Write balanced chemical equation for this reaction.
  (b) Calculate the mass of salt required.
  (c) Calculate the mass of the acid required.

Question 8
(i) Draw the electron dot structure of water and ammonia. [2]

(ii) How is the strength of an acid or base measured? [2]

(iii) The following questions are related to iron: [3]
  (a) Name the acid with which iron is rendered passive.
  (b) Name an alloy of iron and carbon.
  (c) Name the process by which iron ore is concentrated.

(iv) An element X has atomic number 9. Answer the following questions. [3]
  (a) State the period & group to which it belongs:
  (b) Is it a metal or Non Metal?
  (c) Write the formula between Y and alkaline earth metal.
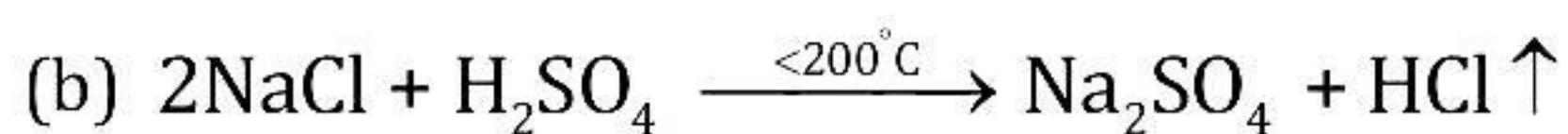
Solution

Solution 1
(i)   (b)
(ii)   (c)
(iii) (b)
(iv)   (c)
(v)   (a)
(vi)   (b)
(vii) (a)
(viii) (a)
(ix)   (a)
(x)   (c)
(xi)   (c)
(xii) (c)
(xiii) (b)
(xiv) (c)
(xv)   (b)

Solution 2
(i)

   (a) HCl (Hydrogen chloride gas)

   (b) $2NaCl + H_2SO_4 \xrightarrow{<200^{\circ}C} Na_2SO_4 + HCl\uparrow$

   (c) The HCl gas is collected by upward displacement of air as it is 1.28 times heavier than air.

   (d) Conc. H_2SO_4.

   (e) When the jar is completely filled with hydrogen chloride, fumes appear above the jar's mouth. White fumes appear on exposing hydrogen chloride gas to air since it forms hydrochloric acid with atmospheric water vapour. This jar when brought near a rod dipped in ammonium hydroxide gives dense white fumes, which indicate the formation of ammonium chloride, as per the reaction given below.
   $HCl + NH_4OH \rightarrow NH_4Cl + H_2O$
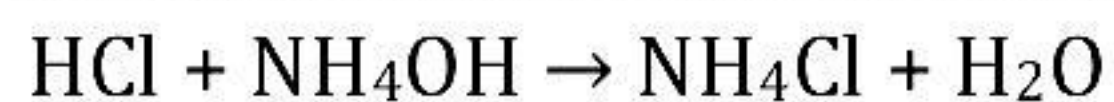
(ii)
  (a) (1) decreases   (2) increases
  (b) (3) decreases   (4) increases
  (c) (5) decreases   (6) increases
  (d) (7) increases   (8) decreases
  (e) (9) increases   (10) decreases

(iii)
  (a) (1) B, D, F   (2) A, C, E
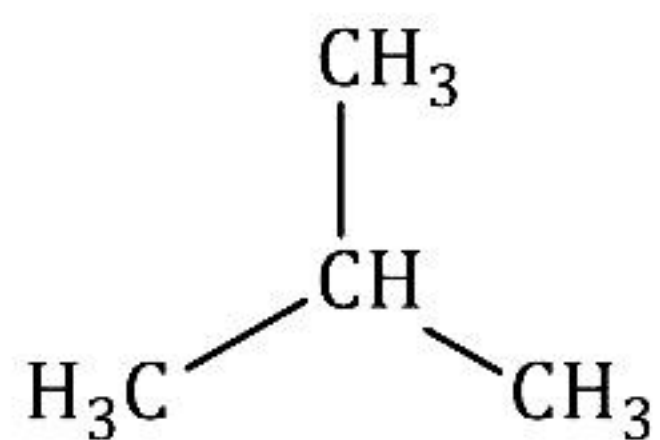 (b) (1) E   (2) C
  (c) Na_3AlF_6

(iv)
  (a) HCl
  (b) Methane
  (c) Electrovalent bond
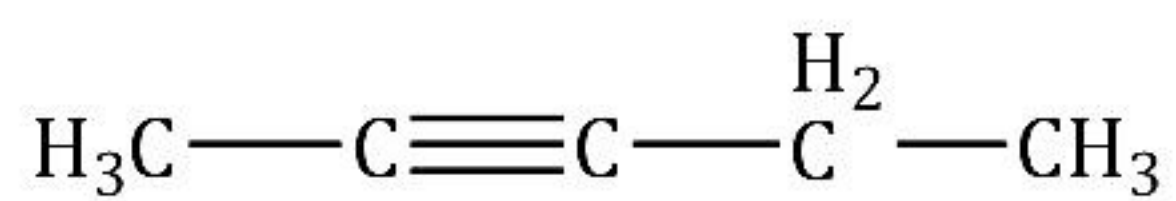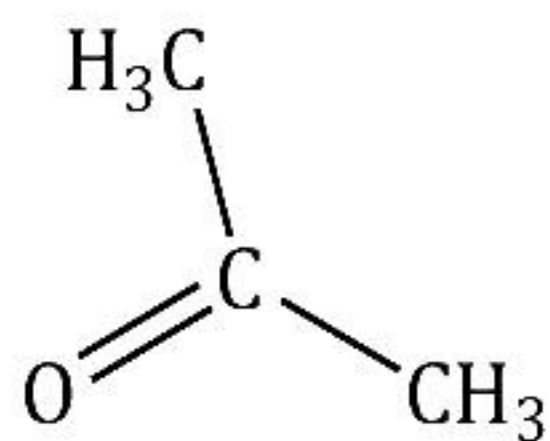 (d) Non-polar covalent bond
  (e) Ammonia
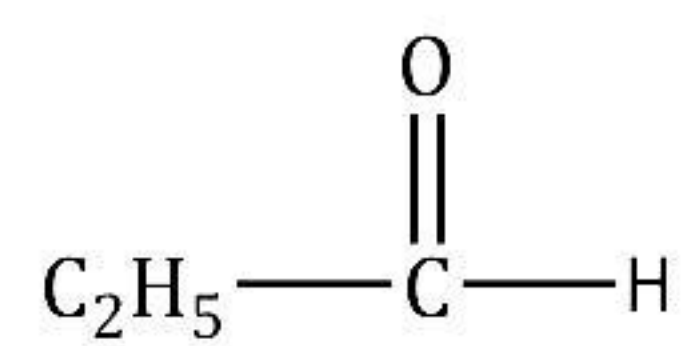
(v)
  (a)
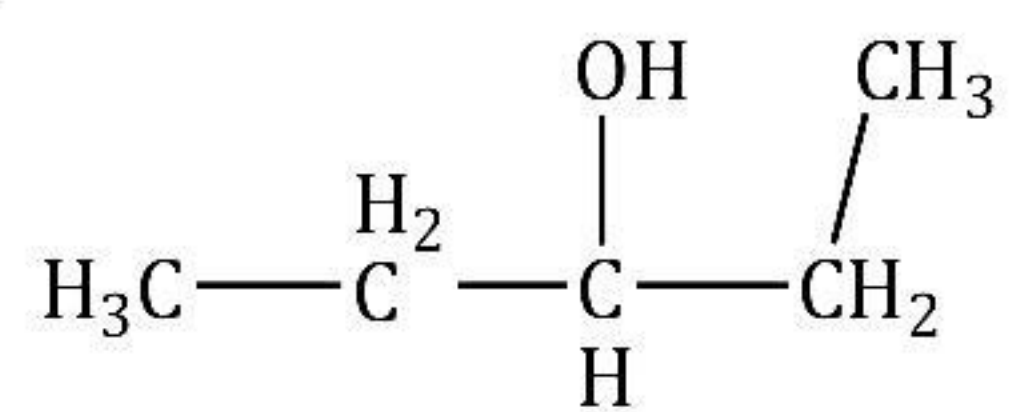   1.

Isobutane

    2.

Pent-2-yne

    3.

Propanone

(b)

1.

$$C_2H_5 - \overset{\overset{\displaystyle O}{\|}}{C} - H$$

Propanal

2.

$$H_3C - \overset{H_2}{C} - \overset{\overset{\displaystyle OH}{|}}{\underset{\displaystyle H}{C}} - CH_2 - CH_3$$

Pentan-3-ol

SECTION-B

(Attempt any four questions)

Solution 3

(i) Depending on Concentration

The concentration of an acid means the amount of acid present in a definite amount of its aqueous solution.
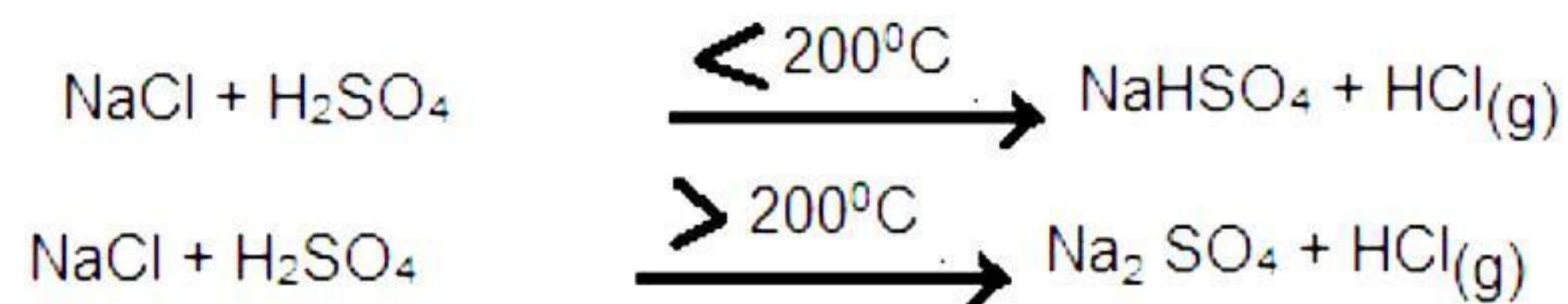
- Concentrated Acid

  An acid which contains a very small amount of water or no water is called a concentrated acid.

- Dilute Acids

  An acid which contains far more amount of water than its own mass is known as a dilute acid.

(ii) Laboratory preparation of Hydrogen Chloride: Hydrogen chloride gas is prepared by heating a metallic chloride (NaCl) with conc. sulphuric acid (H_2SO_4).

Reaction:

$$NaCl + H_2SO_4 \xrightarrow{\; <200^0C \;} NaHSO_4 + HCl_{(g)}$$

$$NaCl + H_2SO_4 \xrightarrow{\; >200^0C \;} Na_2SO_4 + HCl_{(g)}$$

(iii)

Name of element	%	Atomic mass	Relative number of atoms	Simple ratio
C	54.55	12	4.54	2
H	9.09	1	9.09	4
O	36.26	16	2.26	1

Empirical formula = C_2H_4O

Mol. mass = 2 × 44 = 88

$$n = \frac{88}{44} = 2$$

Molecular formula = $C_4H_8O_2$

(iv)
    (a) Group 1 – Alkali metals, Group 2 – Alkaline earth metals
    (b)
        1. True
        2. False
    The correct statement is:
    Atomic size goes on decreasing across a period.
    Reason: In a period, the size of an atom decreases from left to right. This is because the nuclear charge increases from left to right in the same period, thereby bringing the outermost shell closer to the nucleus.
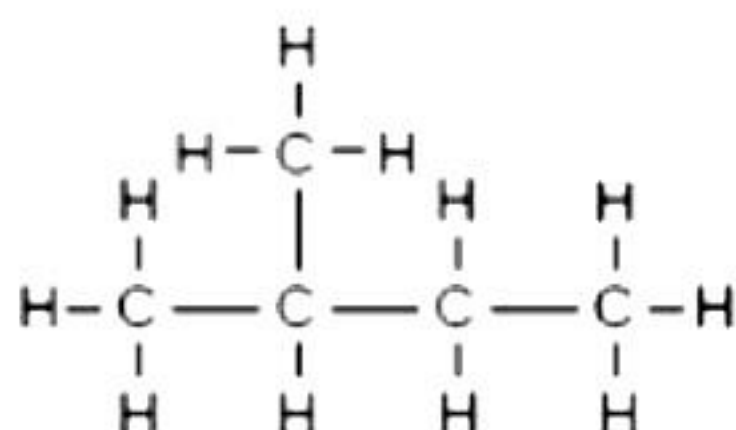   In the third period, Sodium is the largest in size.
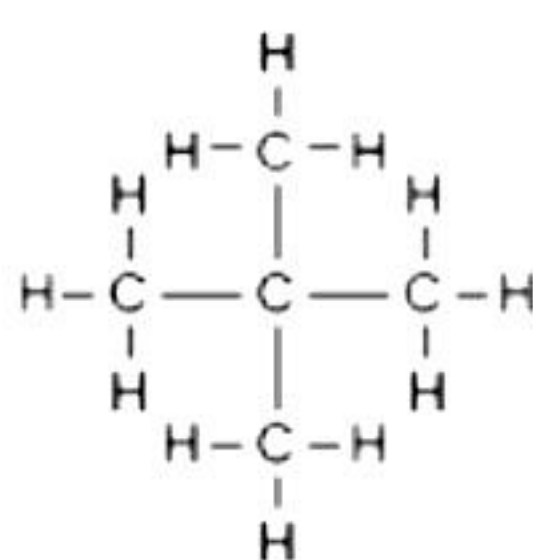   Na > Mg > Al > Si > P > S > Cl
    186pm 160pm 143pm 117pm 110pm 104pm 99pm

Solution 4

(i)   Pentane has molecular formula C_5H_{12}.
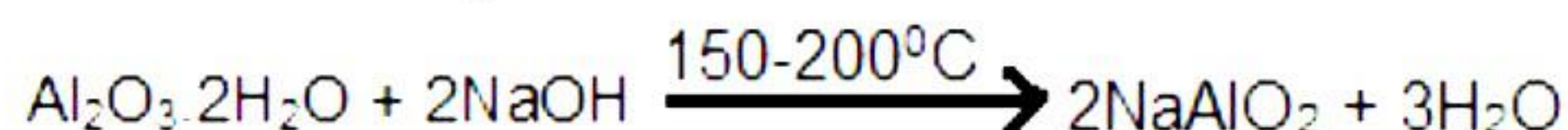

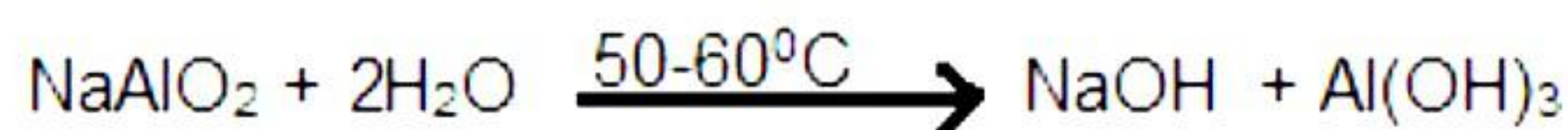Iso-pentane   Neo pentane

(ii)

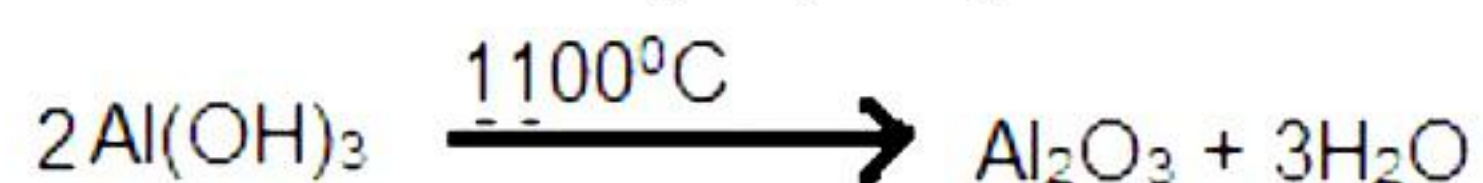| Electrovalent compounds	Covalent compounds
These are hard solids consisting of ions.	These are gases, liquids or soft solids.
These are non-volatile, with high boiling and high melting points.	These are volatile, with low boiling and low melting points.
They are good conductors of electricity in the fused state.	They are non-conductors of electricity in solid, molten or aqueous state.
The dissociation of molecules into ions occurs when the current passes through them.	The dissociation of molecules into ions does not occur.

(iii)

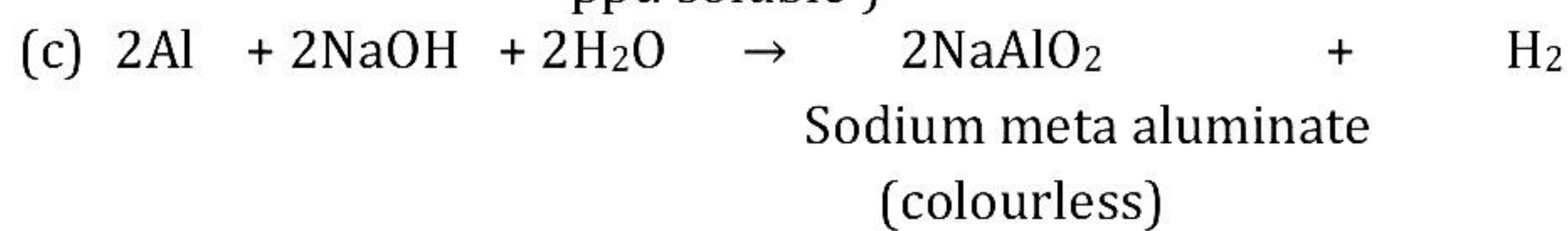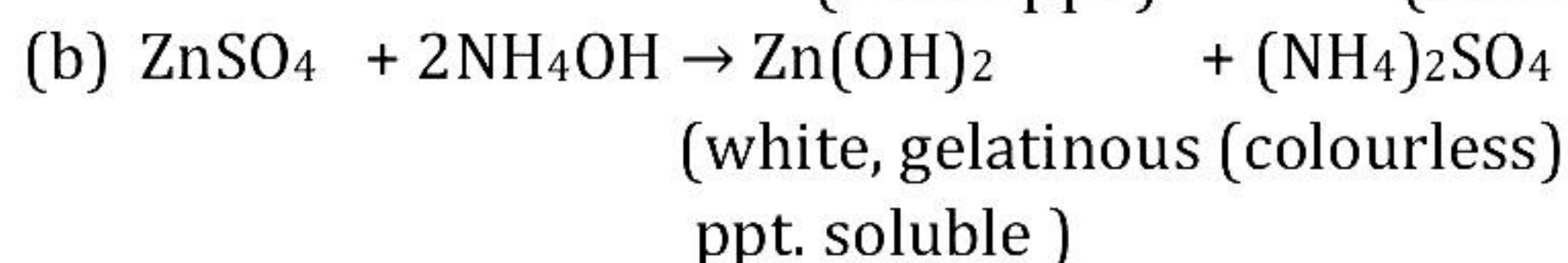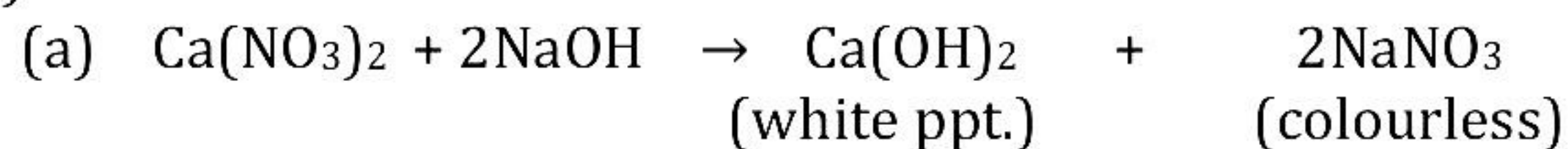(a) Conversion of impure bauxite to sodium aluminate

$$Al_2O_3.2H_2O + 2NaOH \xrightarrow{150\text{-}200^0C} 2NaAlO_2 + 3H_2O$$

(b) Conversion of sodium aluminate to aluminium hydroxide

$$NaAlO_2 + 2H_2O \xrightarrow{50\text{-}60^0C} NaOH + Al(OH)_3$$

(c) Conversion of $Al(OH)_3$ to pure alumina

$$2Al(OH)_3 \xrightarrow{1100^0C} Al_2O_3 + 3H_2O$$

(iv)

(a) $Ca(NO_3)_2 + 2NaOH \rightarrow Ca(OH)_2 + 2NaNO_3$
   (white ppt.)   (colourless)

(b) $ZnSO_4 + 2NH_4OH \rightarrow Zn(OH)_2 + (NH_4)_2SO_4$
   (white, gelatinous (colourless)
   ppt. soluble)

(c) $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + H_2$
   Sodium meta aluminate
   (colourless)

Solution 5

(i)

Cathode: $2Al^{3+} + 6e^- \rightarrow 2Al$

Anode: $3O^{2-} - 6e^- \rightarrow 3[O] \rightarrow 3O_2$

(ii) Overall reaction: $PbBr_2 \longrightarrow Pb^{2+} + 2Br^-$

Reaction at the cathode: $Pb^{2+} + 2e^- \longrightarrow Pb$

Reaction at the anode: $Br^- - e^- \longrightarrow Br$

$Br + Br \longrightarrow Br_2$
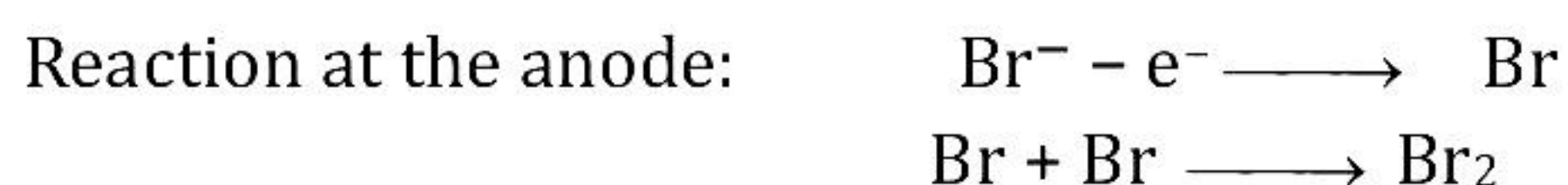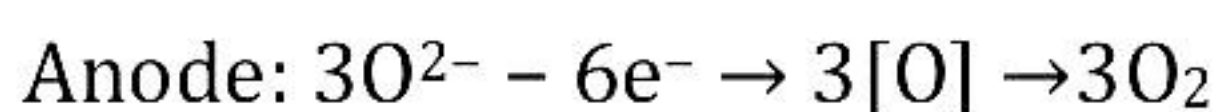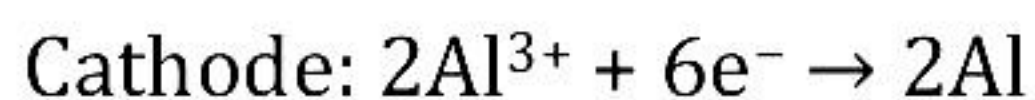
(iii)

S No	Formula	Common Name	IUPAC
(a)	C3H6	Propylene	Propene
(b)	C2H2	Acetylene	Ethyne
(c)	CH3OH	Methyl alcohol	Methanol

(iv)

(a) Partial Replacement

$NaOH + H_2SO_4 \longrightarrow NaHSO_4 + H_2O$

(b) Complete Replacement

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

(c) Ionic Definition of Salt

A salt is an ionic compound that dissociates in water to yield a positive ion other than hydrogen ion (H^+) and a negative ion other than hydroxyl ion (OH^-).

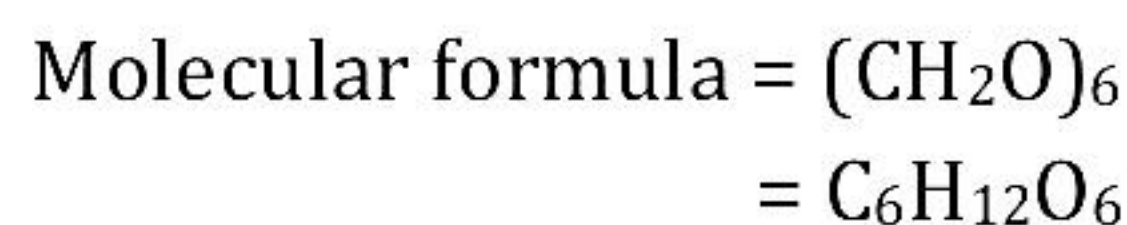$$NaCl + H_2O \longrightarrow Na^+ + Cl^-$$

Solution 6

(i)

(a) If silver nitrate solution is used directly instead of double cyanide of silver and sodium, then the deposition of silver will be very fast and hence not very smooth and uniform.

(b) Copper has no mobile electrons in the solid state, and an electrolyte should dissociate into oppositely charged ions to conduct electricity.

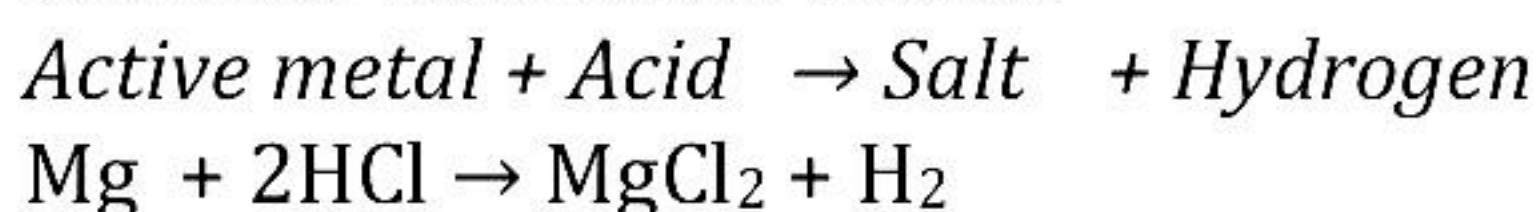Hence, copper is a non-electrolyte.

(ii)   Empirical formula weight of CH_2O = 12 + 2 + 16

$$\therefore \quad n = \frac{\text{Molecular weight}}{\text{Empirical formula weight}}$$

$$= \frac{180}{30} = 6$$

Molecular formula = $(CH_2O)_6$

$$= C_6H_{12}O_6$$

(iii)

(a) Reaction with active metals

Active metal + Acid → Salt + Hydrogen

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

(b) Reaction with bases - Neutralisation

Base + Acid → Salt + Water

$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$
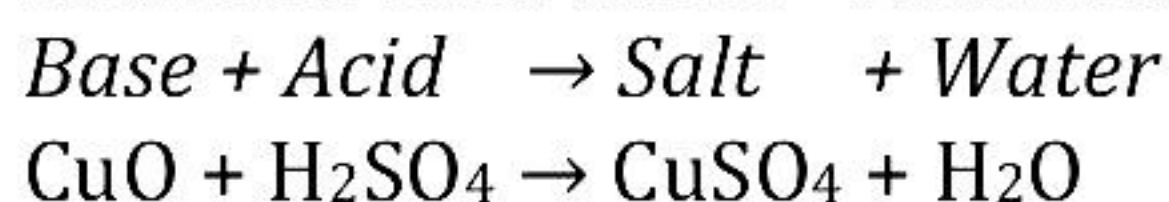
(c) Reaction with carbonates and bicarbonates

Carbonate/bicarbonate + Acid → Salt + Water + Carbon dioxide

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$
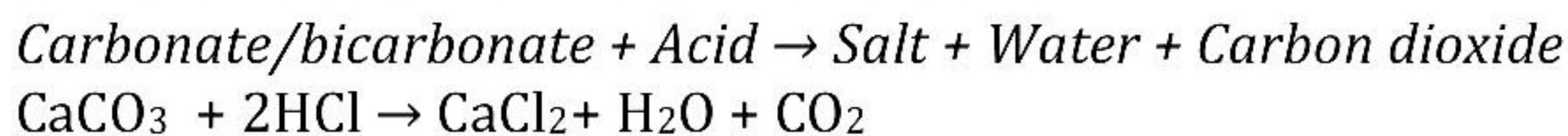
(iv)

(a) Element B would have <u>higher</u> metallic character than Element A.

(b) Element A would probably have <u>higher</u> electron affinity than Element B.

(c) Element A would have <u>smaller</u> atomic size than Element B.

Solution 7

(i)

   (a)

Element	%	At. wt.	Relative no. of atoms	Simplest ratio
P	22.45	31	22.45 ÷ 31 = 0.72	0.72 ÷ 0.72 = 1
Cl	77.45	35.5	77.45 ÷ 35.5 = 2.18	2.18 ÷ 0.72 = 3

Empirical formula = PCl_3

   (b) Molar mass of Fe_2O_3 = 112 + 48 = 160

$$\% \text{ of Fe} = \frac{112}{160} \times 100 = 70\%$$

(ii)   Observations:

Anode: Nothing gets deposited on the anode because the copper anode dissolves during the reaction as Cu^{2+} ions are formed.
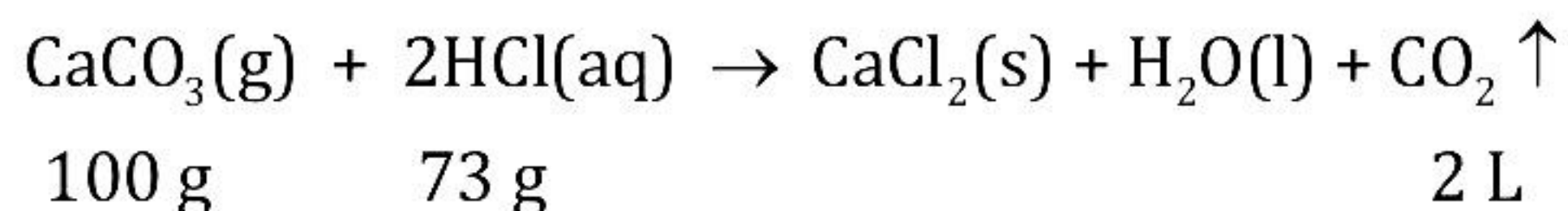
Reaction at anode: $Cu - 2e^- \rightarrow Cu^{2+}$

Cathode: Reddish brown Cu is deposited.

Reaction at cathode: $Cu^{2+} + 2e^- \rightarrow Cu$

(iii)

   (a)

$$CaCO_3(g) + 2HCl(aq) \rightarrow CaCl_2(s) + H_2O(l) + CO_2 \uparrow$$
$$\quad 100\,g \qquad\quad 73\,g \qquad\qquad\qquad\qquad\qquad 2\,L$$

   (b)

V_1 = 2 liters

V_2 =?

T_1 = (273 + 27) = 300K

T_2 = 273K

$V_1/T_1 = V_2/T_2$

$V_2 = V_1T_1 / T_1$

$V_2 =$

$$\left[\frac{2 \times 273}{300}\right] L$$

Now at STP 22.4 liters of CO_2 are produced using $CaCO_3$ = 100 g

So, (2 × 273 / 300) liters are produced from by =

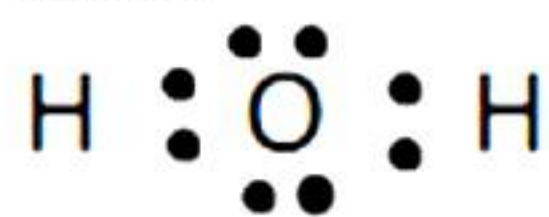$$\left[\frac{2 \times 273 \times 100}{300 \times 22.4}\right] L$$

=8.125g

(c) 22.4 liters are CO₂ are prepared from acid =73 g

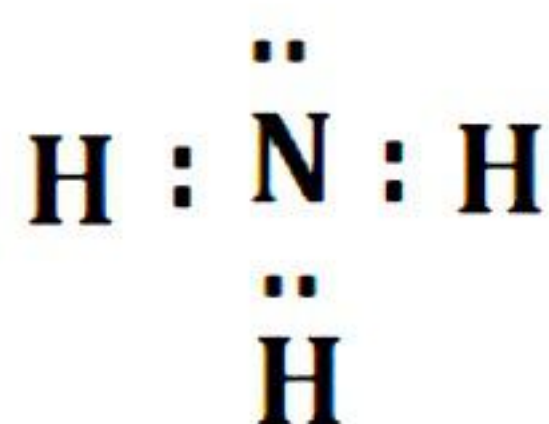$$\left[\frac{2 \times 273 \times 73}{300 \times 22.4}\right]L$$
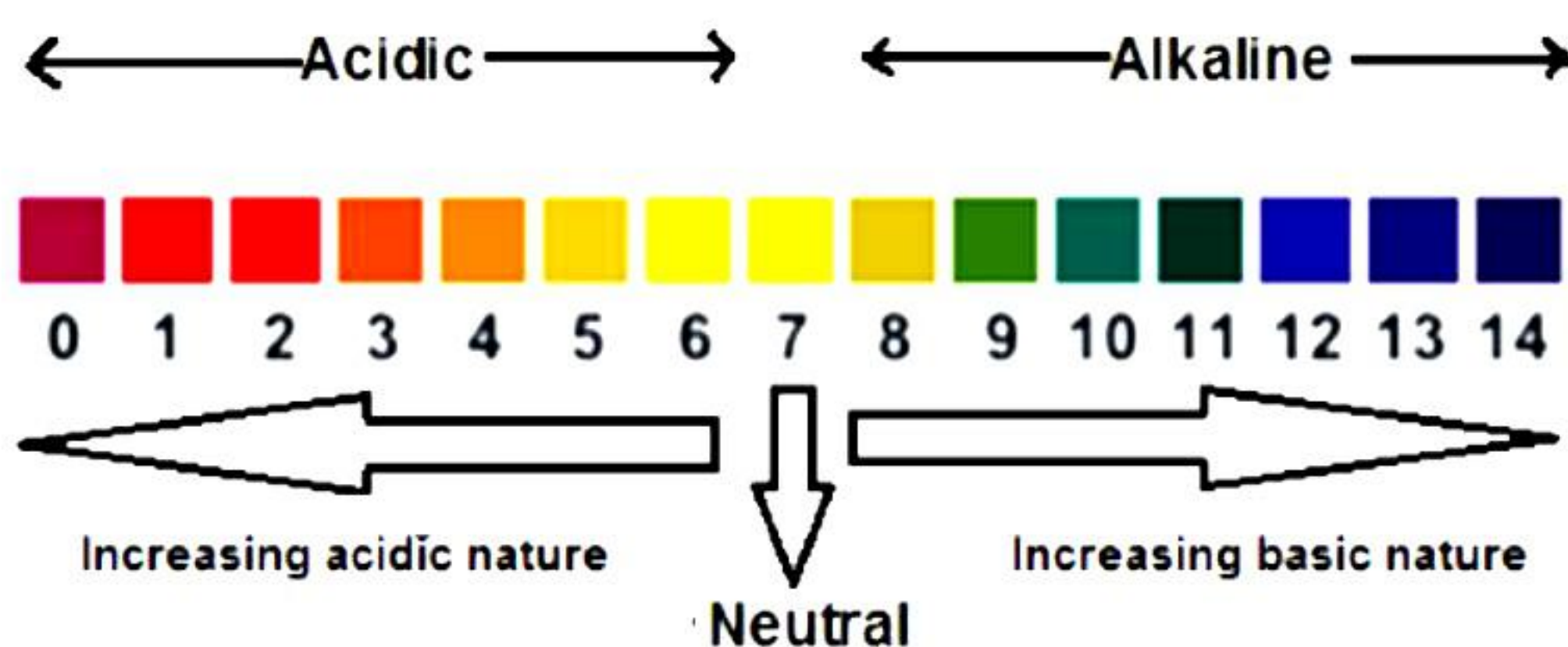
$$=5.9g$$

Solution 8

(i) Water

Ammonia

(ii) The strength of an acid or base is measured on a scale of numbers called the pH scale. The pH scale has values from 0 to 14.

Acids have a pH of less than 7, lower the pH more acidic is the solution.
Bases have a pH of more than 7, higher the pH more basic is the solution. Neutral substances have a pH of exactly 7.

(iii)
   (a) Concentrated nitric acid
   (b) Steel
   (c) Electromagnetic separation

(iv)
   (a) The element with atomic number 9 is Fluorine.
       Period = 2
       Group = 17
   (b) It is non-metal.
   (c) BeF_2