CHEMISTRY

(Science Paper II)

ICSE Board Class X Exam

(2024)

Answers

SECTION-A (40 Marks)

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

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

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

   (i) Unsaturated hydrocarbons undergo:

       (a) Addition reaction   (b) Substitution reaction

       (c) Oxidation reaction   (d) Redox reaction

   Ans. (a) [1]

   Hint & Sol.: Unsaturated hydrocarbons undergo addition reaction to form saturated hydrocarbons.

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

       (a) It has unstable electronic configuration.   (b) It easily accepts electrons.

       (c) It easily loses electrons.   (d) The outer most shell is completely filled.

   Ans. (d) [1]

   Hint & Sol.: Neon has completely filled/stable electronic configuration.

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

       (a) Duralumin   (b) Brass

       (c) Bronze   (d) Solder

   Ans. (c) [1]

   Hint & Sol.: Cu, Sn and Zn are alloyed to form bronze.

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

       (a) Calcium hydroxide   (b) Magnesium hydroxide

       (c) Aluminium hydroxide   (d) Ferric hydroxide

   Ans. (c) [1]

   Hint & Sol.: Aluminium hydroxide is amphoteric in nature.

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

       (a) Halogenation   (b) Esterification

       (c) Hydrogenation   (d) Dehydrohalogenation

   Ans. (b) [1]

   Hint & Sol.: An alcohol reacts with carboxylic acid in the presence of conc. H_2SO_4 to give sweet smelling ester.

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

       (a) Dehydration   (b) Dehydrogenation

       (c) Dehydrohalogenation   (d) Hydrolysis

   Ans. (a) [1]

   Hint & Sol.: In the presence of conc. H_2SO_4 ethanol gives ethene and water.

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

    (a)   Sulphur   (b)   Sulphuric acid

    (c)   Sulphur dioxide   (d)   Water

Ans. (b) [1]

Hint & Sol.: Sulphuric acid oxidises sulphur to sulphur dioxide (SO_2).

(viii) Electron Affinity is maximum in :

    (a)   Mg   (b)   Ar

    (c)   Li   (d)   Br

Ans. (d) [1]

Hint & Sol.: Bromine has high electron affinity due to its non-metallic nature.

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

    (a) Al_2O_3 (b) $NaAlO_2$

    (c) Na_3AlF_6 (d) CaF_2

Ans. (b) [1]

Hint & Sol.: In Hall-Heroult's process, electrolyte is a mixture of alumina, cryolite and fluorspar.

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

    (a)   Basic property   (b)   Oxidising property

    (c)   Reducing property   (d)   Acidic property

Ans. (c) [1]

Hint & Sol.: Ammonia reduces heated metallic oxide to give metal, water vapour and nitrogen gas.

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

    (a)   HCl gas   (b) H_2S gas

    (c) Cl_2 gas   (d) SO_2 gas

Ans. (b) [1]

Hint & Sol: H_2S gas has rotten egg smell.

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

    (a)   very slightly soluble in water.   (b)   heavier than air.

    (c)   lighter than air.   (d)   insoluble in water

Ans. (c) [1]

Hint & Sol: Ammonia being lighter than air collected by downward displacement of air.

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

    1.   32 g of oxygen gas

    2.   2 moles of hydrogen gas

    3. 6.022×10^{23} molecules of ammonia

    (a)   1 & 2   (b)   1 & 3

    (c)   2 & 3   (d)   1, 2 & 3

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

Ans. (b) [1]

Hint & Sol: 1 mole of oxygen gas = 32 g = 22.4 L (at STP)

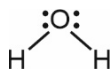1 mole of NH_3 = 6.022×10^{23} molecules of NH_3 = 22.4 L (at STP)

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

(a)   One shared pair of electrons.

(b)   Three shared pairs of electrons.

(c)   Two lone pairs of electrons.

(d)   One lone pair of electrons.

Ans. (c) [1]

Hint & Sol:

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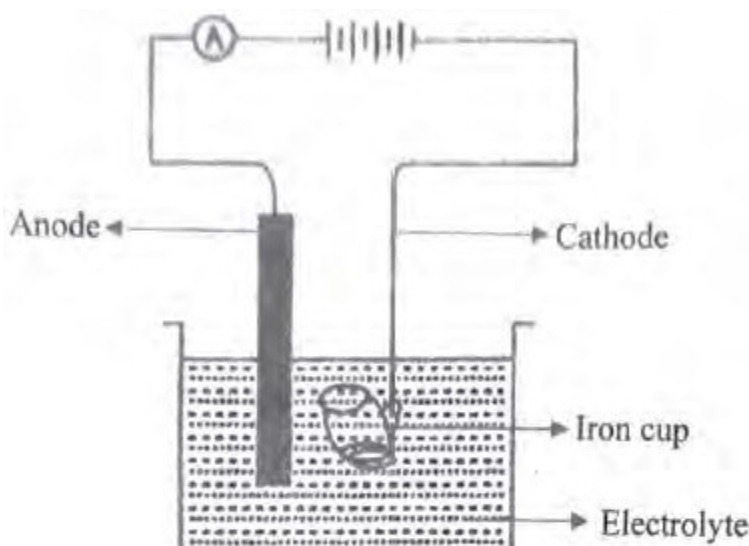
(a)   Matrix

(b)   Ore

(c)   Flux

(d)   Alloy

Ans. (b) [1]

Hint & Sol: An ore is a mineral from which the metal can be extracted economically and conveniently.

2. (i)   The following sketch represents the electroplating of an Iron cup with Nickel metal. Study the diagram and answer the following questions: **[5]**

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

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

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

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

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

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

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

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

(a) The salt that can be prepared by Direct Combination is_____ *[FeCl₃/FeCl₂]*

(b) The metallic oxide which can be reduced by using common reducing agents is _____ *[Fe₂O₃/Al₂O₃]*

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

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

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

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

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

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

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

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

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

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

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

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

Sol. 2 (i) (a) Iron cup is placed at cathode because during electrolytic reaction, the metal is always deposited at the cathode by gain of electrons. **[1]**

(b) Ni^{2+} ions **[1]**

(c) A low current for a longer time should be used to ensure a smooth, firm and even deposit. **[1]**

(d) $Ni^{2+} + 2e^- \rightarrow Ni$ **[1]**

(e) The nickel anode (metal strip) will decrease in size as it continuously dissolves in solution by producing Ni^{2+} ions. **[1]**

(ii) (a)-3, (b)-1, (c)-2, (d)-5, (e)-4 **[5 × 1]**

(iii) (a) $FeCl_3$ **[1]**

(b) Fe_2O_3 **[1]**

(c) Copper nitrate   **[1]**

(d) Copper   **[1]**

(e) Calcination   **[1]**

(iv) (a) Alkyl group   **[1]**

(b) Electrodes   **[1]**

(c) Mole   **[1]**

(b) Electronegativity   **[1]**

(c) Empirical formula   **[1]**

(v) (a) 1. 2, 3-Dichloropentane   **[1]**

2. Propanoic acid   **[1]**

(b) 1.

3-Methylpentane   **[1]**

2.

Propyne   **[1]**

3.

Methanal   **[1]**
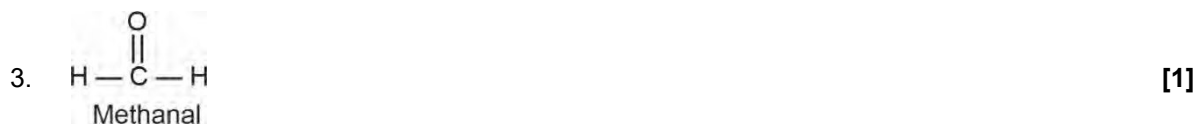
SECTION-B (40 Marks)

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

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

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

(i) Sulphuric acid acts as a dehydrating agent.

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

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

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

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

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

Which of the above solutions **P**, **Q** or **R**.

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

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

(c) will contain molecules as well as ions?

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

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

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

Sol. (i) (a) **Concentrated** sulphuric acid acts as a dehydrating agent. **[1]**

(b) **Excess** ammonia reacts with chlorine to give ammonium chloride and nitrogen. **[1]**
[1]

(ii) (a) Carbonate ion $\left(CO_3^{2-}\right)$

(b) Nitrate ion $\left(NO_3^{-}\right)$ **[1]**

(iii) (a) R **[1]**

(b) P **[1]**

(c) Q **[1]**

(iv) (a) Contact process **[1]**

(b) V_2O_5 **[1]**

(c) H_2SO_4 **[1]**

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

(a) Molar volume

(b) Normal salt

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

(a) Methane molecule

(b) Nitrogen molecule

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

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

(a) $Al_2O_3 + NaOH \rightarrow$

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

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

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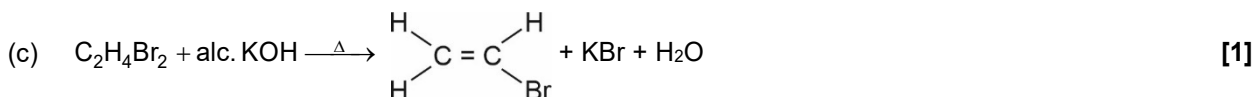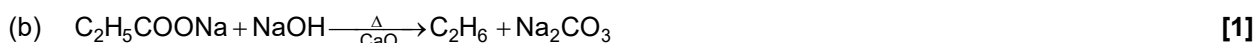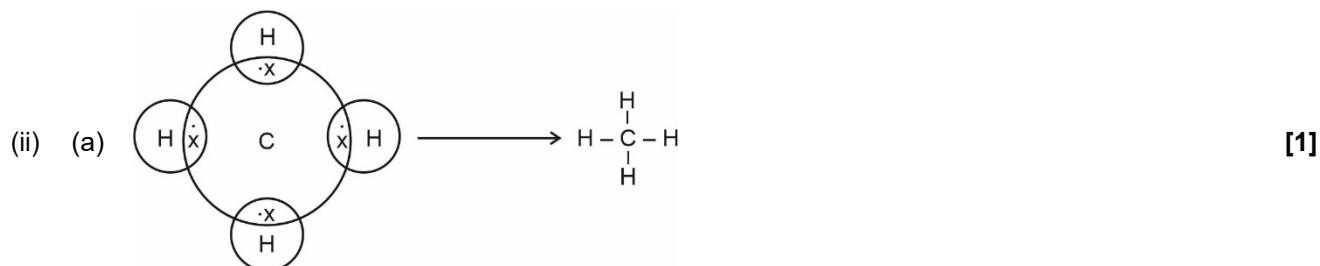
Ethene   Ethanoic acid   Ethanol   Methanal

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

(b) The compound which in its pure form turns into an ice like solid on cooling.
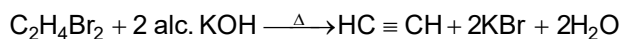
(c) The compound which is used for artificial ripening of fruits.

Sol. (i) (a) One mole of any gaseous substance occupies a volume of 22.4 dm³ (litre) or 22400 cm³ (mL) at S.T.P. This volume is known as molar volume. **[1]**

(b) Normal salts are the salts formed by the complete replacement of the ionisable hydrogen atoms of an acid by a metallic ion or an ammonium ion. Normal salts have no ionisable hydrogen atoms. **[1]**

(ii) (a) **[1]**

(b) **[1]**

(iii) (a) $Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$ **[1]**

(b) $C_2H_5COONa + NaOH \xrightarrow[CaO]{\Delta} C_2H_6 + Na_2CO_3$ **[1]**

(c) **[1]**

OR

$C_2H_4Br_2 + 2 \text{ alc. KOH} \xrightarrow{\Delta} HC \equiv CH + 2KBr + 2H_2O$

(iv) (a) Ethanol **[1]**

(b) Ethanoic acid **[1]**

(c) Ethene **[1]**

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

(a) Duralumin

(b) Stainless steel

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

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

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

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

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

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

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

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

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

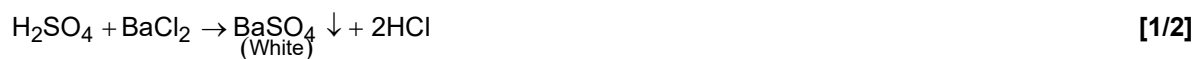   (a) Methane undergoes complete combustion.

    (b) Copper carbonate is heated.

    (c) MnO_2 reacts with concentrated HCl.

Sol. (i) (a) Aluminium (95%) **[1]**

    (b) Iron (73%) **[1]**

(ii) (a) Sulphuric acid forms white precipitate with barium chloride solution whereas nitric acid does not.

$$H_2SO_4 + BaCl_2 \rightarrow \underset{(White)}{BaSO_4} \downarrow + 2HCl$$ **[1/2]**

$$2HNO_3 + BaCl_2 \rightarrow \underset{(Soluble)}{Ba(NO_3)_2} + 2HCl$$ **[1/2]**

    (b) Saturated hydrocarbons – All the carbon atoms are connected by a single bond. **[1/2]**

    Unsaturated hydrocarbons – At least two carbon atoms are either connected by a double bond or a triple bond. **[1/2]**

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

    (a) Relative molecular mass of calcium carbonate = 100

    Molar mass of $CaCO_3$ = 100 g/mol

    Mass of 5 moles of calcium carbonate = (5 × 100) g = 500 g **[1]**

    (b) 1 mole of calcium carbonate reacts with 2 moles of HCl

    $\therefore$ 5 moles of calcium carbonate will react with 2 × 5 = 10 moles of HCl. **[1]**

    (c) Five moles of carbon dioxide gas is produced in the given reaction.

    $\therefore$ According to Avagadro's Law

    Volume of 1 mole of CO_2 at STP = 22.4 L

    $\therefore$ Volume of 5 moles of carbon dioxide gas at STP = 5 × 22.4 = 112 L **[1]**

(iv) (a) Carbon dioxide **[1]**

    (b) Carbon dioxide **[1]**

    (c) Chlorine **[1]**

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

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

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

    (a) electrolytic dissociation

    (b) ionization

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

    (a) Inert gases do not form ions.

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

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

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

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

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

(iv) Identify the following: **[3]**

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

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

   (c)   The most electronegative element of period 3.

Sol. **(i)**   (a)   Y   **[1]**

   (b)   X   **[1]**

(ii)   (a)   Inert gases have complete octet which is stable. Hence, they do not form ions.   **[1]**

   (b)   Covalent compounds have low melting and boiling point due to weak forces of attraction.   **[1]**

(iii)   (a)   Beryllium> Carbon > Fluorine   **[1]**

   (b)   Acetic acid < Sulphuric acid < Phosphoric acid   **[1]**

   (c)   Potassium < Sodium < Lithium   **[1]**

(iv)   (a)   Hydrogen   **[1]**
   (b)   Sulphur   **[1]**
   (c)   Chlorine   **[1]**

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

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

   •   To the second part of the salt solution, she added a few drops of silver nitrate solution and obtained a white precipitate.

   Name:

   (a)   The cation present and

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

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

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

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

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

$$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$$
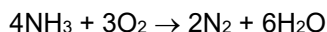
If 240 cc of ammonia is burnt in 300 cc of oxygen, find out the composition of the resultant gaseous mixture at room temperature.

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

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

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

    1.   A and B

    2.   D and C

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

Sol. (i) (a) Ferric ion (Fe^{3+}) **[1]**

     (b) Chloride ion (Cl^-) **[1]**

   (ii) (a) Non-polar **[1]**

     (b) Oxygen **[1]**

   (iii) $4NH_3 + 3O_2 \longrightarrow 2N_2 + 6H_2O$
         240 cc 300 cc

    4 Volume of NH_3 reacts with 3 volume of O_2

    $\therefore$ 240 cc of NH_3 will react with 180 cc of O_2

    NH_3 is a limiting reagent

    Now, 4 volume NH_3 produces = 2 volume N_2

    $\therefore$ 240 cc of NH_3 produces 120 cc of N_2

    and 240 cc of NH_3 produces 360 cc of H_2O

    $\therefore$ Amount of O_2 remains unreacted = 120 cc

    So, the resultant gaseous mixture contains

       N_2 = 120 cc **[1]**

       H_2O = 360 cc **[1]**

       O_2 = 120 cc **[1]**

   (iv) (a) 1. AB **[1]**
           2. DC_4 **[1]**

     (b) D **[1]**

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

    | Zinc blende, C_2H_2, Calamine, CH, Haematite |

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

    (b) Empirical formula of Ethyne.

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

    (a) Copper reacts with concentrated Nitric acid.

    (b) Aluminium nitride is treated with warm water.

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

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

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

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

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

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

Sol. (i) (a) Haematite can be concentrated by magnetic separation. **[1]**

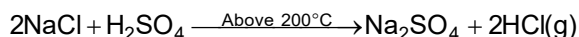   (b) Empirical formula of ethyne is CH. **[1]**

(ii) (a) $Cu + 4HNO_3 \xrightarrow{\Delta} Cu(NO_3)_2 + 2H_2O + 2NO_2$ **[1]**

   (b) $AlN + 3H_2O \xrightarrow{\text{Warm}} Al(OH)_3 + NH_3\uparrow$ **[1]**

(iii)

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

(iv) (a) $NaCl + H_2SO_4 \xrightarrow{<200°C} NaHSO_4 + HCl(g)$ **[1]**

OR

$2NaCl + H_2SO_4 \xrightarrow{\text{Above 200°C}} Na_2SO_4 + 2HCl(g)$

   (b) HCl gas is collected by the upward displacement of air as it is heavier than air (1.28 times). It cannot be collected over water as it is highly soluble in water **[1]**

   (c) Sulphuric acid is a suitable reagent for the laboratory preparation of hydrogen chloride gas because it is non-volatile in nature. **[1]**