ICSE 2025 EXAMINATION

Sample Question Paper - 11

Chemistry

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

Maximum Marks: 80
Time allowed: Two hours
Answers to this paper must be written on the paper provided separately.
You will not be allowed to write during first 15 minutes.
This time is to be spent in reading the question paper.
The time given at the head of this paper is the time allowed for writing the answers.

***Section A** is compulsory. Attempt any four questions from **Section B**.*
The intended marks for questions or parts of questions are given in brackets [ ].

SECTION-A

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

Question 1

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

(i) Alkaline earth metals include:
  (a) Group 1 element
  (b) Group 2 elements
  (c) Group 18 elements
  (d) Group 17 elements

(ii) The valency of magnesium and chlorine in magnesium chloride:
  (a) Magnesium 2 and chlorine 2
  (b) Magnesium 1 and chlorine 2
  (c) Magnesium 2 and chlorine 1
  (d) Magnesium 1 and chlorine 1

(iii) Bases change the colour of methyl orange to:
  (a) Red
  (b) Blue
  (c) Colourless
  (d) Yellow

(iv) Which of the following solution of the compound gives a dirty green precipitate with sodium hydroxide?
  (a) Ferrous sulphate
  (b) Copper nitrate
  (c) Lead carbonate
  (d) Ammonium sulphate

(v) **Assertion (A)**: Hydrogen chloride is an ionic compound.
Reason (R): In a covalent bonding, both the bonding atoms share equal no. of electrons.
(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) The simplest formula of a compound containing 50% of element X (atomic mass = 10g/mol) and 50% of element Y (atomic mass 20g/mol) is:
(a) XY_3
(b) XY
(c) X_2Y
(d) X_2Y_3

(vii) Myra wanted to make a galvanic cell using a strong electrolyte. She had four labelled beakers containing below mentioned solutions. Select the one which she should have used.
(a) Carbonic acid
(b) Formic acid
(c) Acetic acid
(d) Sulphuric acid

(viii) Calamine has the chemical formula:
(a) $ZnCO_3$
(b) ZnS
(c) ZnO
(d) ZnC

(ix) Hydrogen chloride gas on dissolving in water produces:
(a) Weak dibasic acid
(b) Strong dibasic acid
(c) Weak monobasic acid
(d) Strong monobasic acid

(x) Most non-metallic among F, Cl, Br, and I is:
(a) I
(b) F
(c) Cl
(d) Br

(xi) **Assertion (A)**: Hydrocarbons are excellent fuels.
Reason (R): Hydrocarbons such as alkanes undergo addition reaction.

(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.

(xii) Which of the following will be the strongest base?
(a) KOH
(b) LiOH
(c) RbOH
(d) NaOH

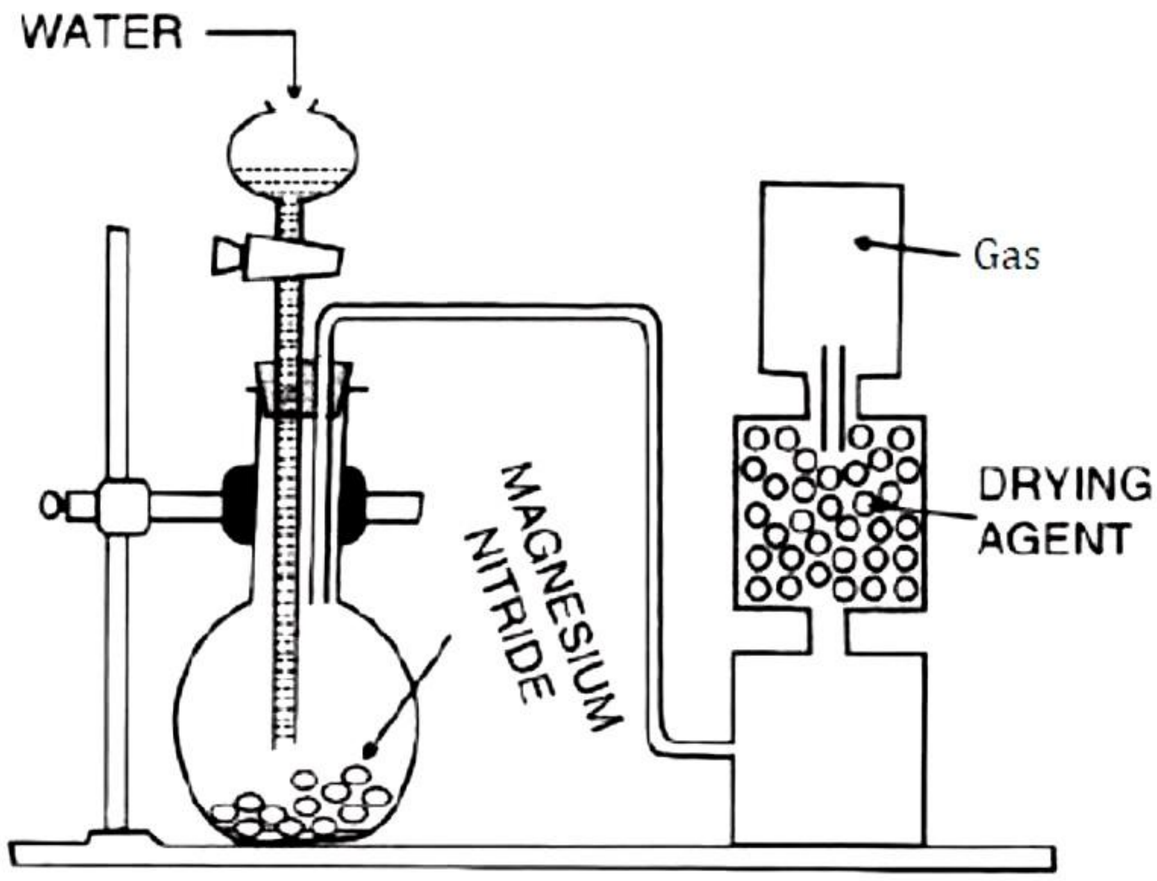
(xiii) If empirical formula of a compound is C_5H_4 and the value of n is 2, then molecular formula of the compound is:
(a) $C_{15}H_{12}$
(b) C_2H_4
(c) C_5H_4
(d) $C_{10}H_8$

(xiv) Conductivity of the solution depends upon:
(a) Nature of electrolyte
(b) Nature of solvent
(c) Temperature
(d) All of the above

(xv) When sulphuric acid is poured over zinc, which of the following gases is formed?
(a) Hydrogen
(b) Oxygen
(c) Nitrogen
(d) Zinc dioxide

Question 2

(i) The diagram shows an experiment set up for the laboratory preparation of a pungent choking gas. The gas is alkaline in nature [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) Write an experiment to identify presence of the gas in the gas jar.

(ii) Four atoms are labelled from A and D. [5]

Atoms	Mass No.	Atomic No.
A	19	9
B	7	3
C	16	8
D	14	7

Answer the following questions based on the above table.
(a) Which element has 3 shells?
(b) The compound formed when C combines with C.
(c) Compound formed between A and B.
(d) Which element contains 7 protons.
(e) Name the halogen.

(iii) Fill in the blanks: [5]

(a) Substances which conduct electricity in the solid state are generally _____(metals/non-metals).

(b) The electron-releasing tendency of zinc is ____ (more/less) than that of copper.

(c) Pure water consists entirely of …….. (ions/molecules).

(d) We can expect that pure water …….. (will/will not) normally conduct electricity.

(e) Electrolysis is the passage of…….. (electricity/electrons) through a liquid or a solution accompanied by a …….. (physical/chemical) change.

(iv) Name all the following: [5]

(a) A metal hydroxide which possesses a pale blue colour

(b) A salt of lead completely soluble in water

(c) An amphoteric hydroxide having gelatinous white ppt.

(d) A chloride which gives reddish brown ppt with caustic soda

(e) The salts which possess light green colour

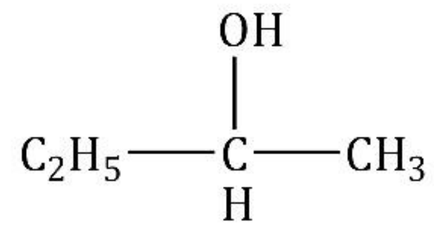
(v) [5]

(a) Draw the structural formula for the following:

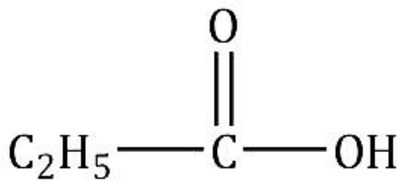
1. 2-methylbutane
2. Butanone
3. Pent-2-ene

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

1.



2.



SECTION-B

(Attempt any four questions)

Question 3

(i) Answer the following question based on the extraction of aluminium from alumina by Hall-Heroult's process: [2]

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

(b) Why is powdered Coke sprinkled on top of the electrolyte?

(ii) Fill in the blanks selecting the appropriate word from the given choice: [2]

(a) Cations are formed by _____ (loss/gain) of electrons.

(b) Helium has _____ (2/4) electrons in its valence shell.

(iii) Copy and complete the following table which refers to the conversion of ions to neutral particles:

Conversion	**Ionic Equation**	**Oxidation / Reduction**
(a) Chloride ion to chlorine molecule	.....	.....
(b) Lead (II) ion to lead	.....	.....
(c) Calcium to Calcium ion	.....	.....

(iv) From the list of the following salts, choose the salt that most appropriately fits the description in the following: [3]

[AgCl, $MgCl_2$, $NaHSO_4$, $PbCO_3$, $ZnCO_3$, KNO_3, $Ca(NO_3)_2$]

(a) A deliquescent salt

(b) On heating, this salt gives a yellow residue when hot and a white residue when cold.

(c) On heating this salt, a brown-coloured gas is evolved.

Question 4

(i) Explain why: [2]

(a) In the electrolysis of alumina using the Hall–Héroult process, the electrolyte is covered with powdered coke.

(b) Iron sheets are coated with zinc during galvanisation.

(ii) [2]

(a) Give balanced chemical equations for the action of sulphuric acid on each of the following:

A. Potassium hydrogen carbonate

B. Sulphur

(b) Write balanced chemical equations to show how SO_3 is converted to sulphuric acid in the contact process.

(iii) Write balanced chemical equations for the following: [3]

(a) The laboratory preparation of methane from sodium acetate.

(b) The preparation of ethyne from 1, 2-dibromoethane.

(c) Ehtyne in an inert solvent of carbon tetrachloride.

(iv)

(a) The following table shows the electronic configuration of elements W, X, Y, Z: [3]

Element	W	X	Y	Z
Electronic configuration	2, 8, 1	2, 8, 7	2, 5	1

Answer the following questions based on the table above:

Write formula and what type of bond is formed between

A. W and X

B. Y and Z

(b) Name the following:

A. Elements having eight electrons in the outermost shell.

B. Gaseous polar covalent compound

Question 5

(i) [2]

(a) Define mineral.

(b) Which two chemical compounds are added to pure bauxite at the time of electrolytic reduction?

(ii) Give equations for the reactions occurring at the cathode and anode during the electrolysis of: [2]

(a) Acidified copper sulphate solution with copper electrode.

(b) Acidified nickel sulphate solution with nickel electrode.

(iii) Name the following: [3]

(a) Second member of alkene series

(b) First member of alkane series

(c) Third member of alkyne series

(iv) Give equations for the following conversions from A to D: [3]

$$ZnSO_4 \xrightarrow{A} ZnCO_3 \xrightarrow{B} Zn(NO_3)_2 \xrightarrow{C} Zn(OH)_2$$

Question 6

(i) For the preparation of hydrochloric acid in the laboratory: [2]

(a) Why is direct absorption of hydrogen chloride gas in water not feasible?

(b) What arrangement is made to dissolve hydrogen chloride gas in water?

(ii) [2]

(a) During the electroplating of silver over the copper spoon, the electrolyte used must contain (A) _____ ions. The (B) _____ is used as a cathode.

(b) Give the equation taking place at the cathode and at the anode during the electroplating of silver over the copper spoon.

(iii) Give a chemical test with balanced chemical equations to distinguish between the following pairs of chemicals: [3]

(a) Lead nitrate solution and Zinc nitrate solution

(b) Fe(II) salt solution and Fe(III) salt solution.

(iv) [3]

(a) The percentage composition of a gas is:
Nitrogen 82.35% Hydrogen 17.64%
Find the empirical formula of the gas.[N = 14, H = 1]

(b) Find the total percentage of oxygen in magnesium nitrate [$Mg(NO_3)_2.6H_2O$] crystals. (H=1, N=14, O=16, Mg=24)

Question 7

(i) Find the empirical formula and the molecular formula of an organic compound from the data given below: [3]

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]

(ii) Write balanced chemical equations for the following reactions: [3]

(a) Action of caustic soda on calcium nitrate salt solution.

(b) Action of excess of ammonium hydroxide on zinc sulphate solution.

(c) Action of boiling caustic soda solution with aluminium.

(iii) If, an organic compound with vapour density 94 contains C = 12.67 %, H = 2.13 %, and Br = 85.11 %, then: [4]

(a) Find the molecular formula.

[Atomic mass: C = 12, H = 1, Br = 80]

(b) Calculate the mass of:

1. 10^{22} atoms of Sulphur.
2. 0.1 mole of carbon dioxide.

[Atomic mass: S = 32, C = 12 and O = 16 and Avogadro's number = 6×10^{23}]

Question 8

(i) Draw the electron dot structure for the formation of magnesium chloride. [2]

(ii) What are the terms defined in the following? [2]

(a) A chemical used to adjust pH of the stomach.

(b) A substance absorbs moisture from the atmosphere without dissolving in it.

(iii) 200 cm^3 of ethylene [C_2H_4] is burnt in just sufficient air (containing 20% oxygen) to form carbon dioxide gas and steam. If all measurements are made at constant pressure and 100°C, find the composition of the resulting mixture. [3]

(iv) An element X has atomic number 8. 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 X and alkali metal.

Solution

SECTION A

Solution 1

(i) (b)

(ii) (c)

(iii) (d)

(iv) (a)

(v) (d)

(vi) (c)

(vii) (d)

(viii) (a)

(ix) (d)

(x) (b)

(xi) (c)

(xii) (c)

(xiii) (d)

(xiv) (d)

(xv) (a)

Solution 2

(i)

(a) Ammonia (NH_3)

(b) $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3 \uparrow$

(c) The ammonia gas collected by holding the jar with its mouth downwards over delivery tube i.e. downward displacement of air.

(d) Quicklime.

(e) Fountain experiment.
Being basic, ammonia gas changes red litmus solution blue.

(ii)

(a) None
(b) C_2
(c) BA
(d) D
(e) A

(iii)

(a) Substances which conduct electricity in the solid state are generally metals.
(b) The electron-releasing tendency of zinc is more than that of copper.
(c) Pure water consists entirely of molecules.
(d) We can expect that pure water will not normally conduct electricity.
(e) Electrolysis is the passage of electricity thro=ugh a liquid or solution accompanied by a chemical change.

(iv)

(a) Copper hydroxide

(b) Lead nitrate

(c) Zinc hydroxide

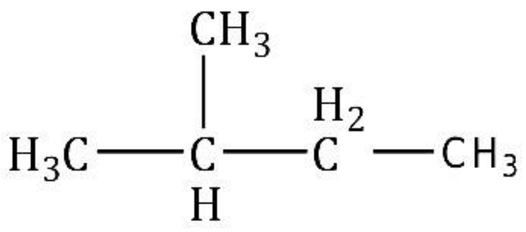
(d) Ferric chloride

(e) Chromium salts

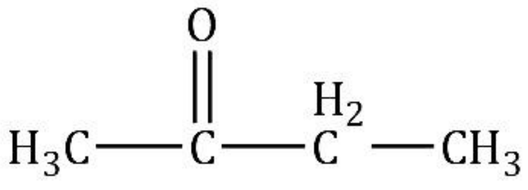
(v)

(a)

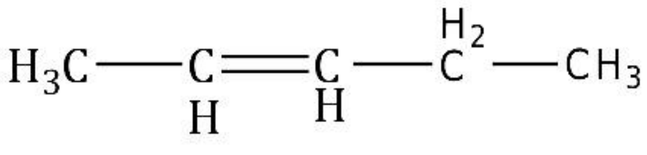
1. 2-methylbutane



2. Butanone

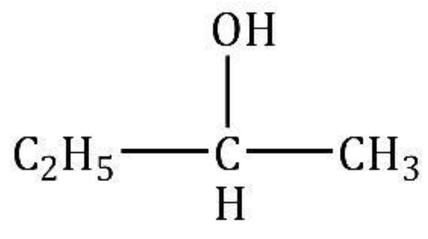


3. Pent-2-ene

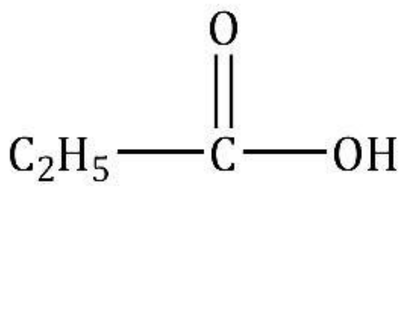


(b)

1. Butan-2-ol



2. Propanoic acid



SECTION-B

(Attempt any four questions)

Solution 3

(i)

(a) Cryolite lowers the fusion temperature from 2050°C to 950°C and enhances conductivity. [1]

(b) Powdered coke is sprinkled on top of the electrolyte. It reduces heat loss by radiation. It also prevents the burning of the anode. [1]

(ii)

(a) Loss [1]

(b) 2 [1]

(iii) [3]

Conversion	**Ionic Equation**	**Oxidation / Reduction**
(a) Chloride ion to chlorine molecule	$Cl^- - e^- \rightarrow Cl$ $Cl + Cl \rightarrow Cl_2$	Oxidation
(b) Lead (II) ion to lead	$Pb^{2+} + 2e^- \rightarrow Pb$	Reduction
(c) Calcium to Calcium ion	$Ca \rightarrow Ca^{2+} + 2e^-$	Oxidation

(iv)

(a) A deliquescent salt = $MgCl_2$ [1]

(b) On heating, this salt gives a yellow residue when hot and a white residue when cold = $ZnCO_3$ [1]

(c) On heating this salt, a brown-coloured gas is evolved = $Ca(NO_3)_2$ [1]

Solution 4

(i)

(a) In the electrolysis of alumina using the Hall–Héroult process, the electrolyte is covered with powdered coke as it

- reduces heat loss by radiation
- prevents the burning of the anode [1]

(b) Iron sheets are coated with zinc during galvanisation to prevent them from rusting. [1]

(ii)

(a)

A. Action of sulphuric acid on potassium hydrogen carbonate

$2KHCO_3 + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O + 2CO_2\uparrow$ [1]

B. Action of sulphuric acid on sulphur

$S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$ [1]

C. In the contact process for the manufacture of sulphuric acid, the equations for the conversion of sulphur trioxide to sulphuric acid are

$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ (oleum or pyro sulphuric acid) [1/2]

$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$ [1/2]

(iii)

(a)

$$CH_3COONa + NaOH \xrightarrow[300^\circ C]{CaO} CH_4 + Na_2CO_3$$ [1]

(b) [1]

$$CH_2Br - CH_2Br + 2KOH_{(alco)} \xrightarrow[\text{boiling}]{200^\circ C} CH \equiv CH + 2KBr + 2H_2O$$

(c) $CH \equiv CH \xrightarrow{Cl_2} ClCH=CHCl \xrightarrow{Cl_2} Cl_2CH\text{-}CHCl_2$ [1]

(iv)

(a)

A. Ionic bond: [1]

Ionic bond is formed by the electrostatic attraction between cations and anions.

Electronic configuration of W – 2, 8, 1

By the removal of one electron from W it becomes W^+ = 2, 8

Electronic configuration of X – 2, 8, 7

By the addition of one electron from W it becomes X = 2, 8, 8.

The compound formed is WX.

B. Covalent bond: [1]

Covalent bond is formed due to the mutual sharing of electrons between the atoms.

Electronic configuration of Y – 2, 5

Electronic configuration of Z – 1
Y needs three more electrons to attain stability. Z needs one more electron to attain duplet configuration. So Y shares its 3 electrons with three Z atoms and form triple bond.
The compound formed is YZ_3.

(b)

A. Inert gases or noble gases [1/2]
B. Hydrogen chloride (HCl) [1/2]

Solution 5

(i)

(a) The naturally occuring compounds of metals which are generally mixed with other matter such as soil, sand, limestone and rocks are known as minerals. [1]
(b) Cryolite and Fluorspar [1]

(ii)

(a) Reaction at the cathode: $Cu^{2+} + 2e^- \longrightarrow Cu$ [1]
Cu being lower in the electrochemical series
Reaction at the anode: $Cu - 2e^- \longrightarrow Cu^{2+}$
SO_4^{2-} and OH^- are not discharged.

(b) Reaction at the cathode: $Ni^{2+} + 2e^- \longrightarrow Ni$ [1]
Reaction at the anode: $Ni - 2e^- \longrightarrow Ni^{2+}$
SO_4^{2-} and OH^- are not discharged.

(iii) [3]
(a) Ethene
(b) Methane
(c) Propyne

(iv) [3]

(a)	$ZnSO_4 + Na_2CO_3 \longrightarrow ZnCO_3 + Na_2SO_4$ A
(b)	$ZnCO_3 + 2HNO_3 \longrightarrow Zn(NO_3)_2 + H_2O + CO_2$ B
(c)	$Zn(NO_3)_2 + 2NaOH \longrightarrow Zn(OH)_2 + 2NaNO_3$ C

Solution 6

(i) For the preparation of hydrochloric acid in the laboratory:

(a) Direct absorption of hydrogen chloride gas in water is not feasible because it is highly soluble in water. [1]

(b) Hydrochloric acid is prepared by dissolving hydrogen chloride gas in water using a special funnel arrangement because direct absorption of HCl gas in water using a delivery tube causes back suction. [1]

(ii)

(a) A. Silver, B. Copper, [1]

(b) Cathode: $Ag+ + e \rightarrow AG$ [1/2]

Anode: $Ag - e^- \rightarrow Ag^+$ [1/2]

(iii)

(a) Lead nitrate solution can be distinguished from zinc nitrate solution with the help of a base, i.e. NaOH. Lead nitrate gives a white precipitate of lead hydroxide on treatment with a base which dissolves in excess of sodium hydroxide. Lead hydroxide in excess of sodium hydroxide form colourless solution of sodium plumbite.

Reaction of a base with lead nitrate solution:

$Pb(NO_3)_2 + 2NaOH \rightarrow Pb(OH)_2\downarrow + 2NaNO_3$

Reaction of a base with lead hydroxide solution:

$Pb(OH)_2 + 2NaOH \rightarrow Na_2PbO_2 + 2H_2O$ [1.5]

(b) To distinguish between Fe(II) salts and Fe(III) salts, the salt solutions are treated with a base like ammonium hydroxide or sodium hydroxide solution. Fe (II) salt solution give insoluble dirty green ppt. while Fe(III) salt solution give insoluble reddish brown ppt.

Reaction of base with Fe(II) salt solution:

$FeSO_4 + 2NH_4OH \rightarrow Fe(OH)_2\downarrow + (NH_4)_2SO_4$

Green dirty green ppt.

Reaction of base with Fe(III) salt solution:

$FeCl_3 + 3NH_4OH \rightarrow Fe(OH)_3\downarrow + 3NH_4Cl$

Yellow solution reddish brown ppt. [1.5]

(iv)

(a) Given:

N = 82.35%

H =17.64 %

Element	% composition	Atomic mass	Atomic ratio	Simplest ratio
H	17.64	1	17.64	3
N	82.35	14	5.8	1

So, the empirical formula is NH_3. [1.5]

(b)

Molecular weight of $Mg(NO_3)_2.6H_2O$

$= 24+2\times(14+48)+6\times 18$

$= 24+2\times 62+108$

$=24+124+108=256$ g

Weight of oxygen $= 12\times16=192$ g

% of oxygen $=\frac{192}{256}\times100$

=75% of Oxygen [1.5]

Solution 7

(i)

(a)

Element	% composition	Atomic mass	Atomic ratio	Simplest ratio
C	75.92	12	$\frac{75.92}{12}=6.32$	$\frac{6.32}{1.26}\approx5$
H	6.32	1	$\frac{6.32}{1}=6.32$	$\frac{6.32}{1.26}\approx5$
N	17.76	14	$\frac{17.76}{14}=1.26$	$\frac{1.26}{1.26}=1$

The empirical formula of the compound is C_5H_5N. [1.5]

Empirical formula weight = 79

We know,

Molecular weight = 2 × vapour density

$= 2\times39.5$

$= 79$

Molecular weight = n(empirical formula weight)

$n=\frac{79}{79}$

$n=1$

Therefore, the molecular formula is C_5H_5N. [1.5]

(ii)

(a)

$Ca(NO_3)_2 + 2NaOH \longrightarrow Ca(OH)_2\downarrow +2NaNO_3$ [1]

(b)

$ZnSO_4 + 2NH_4OH \longrightarrow Zn(OH)_2\downarrow +(NH_4)_2SO_4$ [1/2]

With excess of NH_4OH, gelatinous white ppt. dissolves.

$Zn(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH \rightarrow [Zn(NH_3)_4]SO_4 + 4H_2O$ [1/2]

OR

$Zn(OH)_2 + 4NH_4OH \rightarrow [Zn(NH_3)_4](OH)2+4H_2O$

(c)

$$2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2$$

Sodium meta aluminate

(colourless) [1]

(iii)

Element	Relative Atomic Mass	% Compound	Atomic Ratio	Simplest ratio
H	1	2.13	2.13/1 = 2.13	2
C	12	12.67	12.67 /12 = 1.055	1
Br	80	85.11	85.11 / 80 = 1	1

(a) Empirical formula = CH_2Br

n(Empirical formula mass of CH_2Br) = Molecular mass (2× VD)

n(12 + 2 + 80) = 94 × 2

n = 2

Molecular formula= n × Empirical formula [2]

= $(CH_2Br) \times 2$

= $C_2H_4Br_2$

(b)

1. 10^{22} atoms of sulphur

6.022×10^{23} atoms of sulphur will have mass = 32 g

10^{22} atoms of Sulphur will have mass

$$= \frac{32 \times 10^{22}}{6.022 \times 10^{23}}$$

$$= 0.533 g$$ [1]

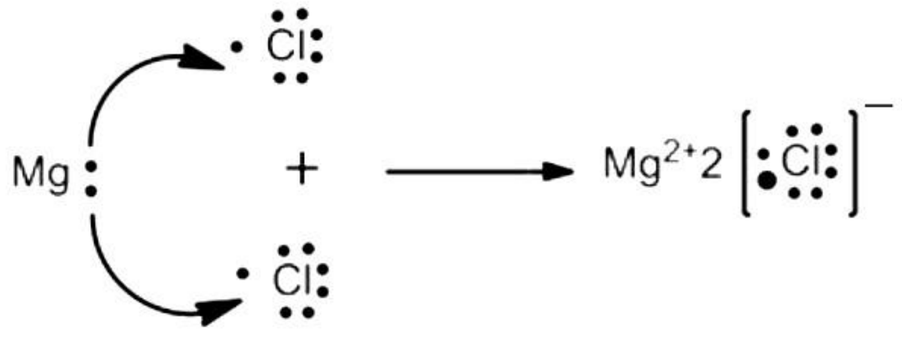
2. 0.1 mole of carbon dioxide

1 mole of carbon dioxide will have mass = 44 g

0.1 mole of carbon dioxide will have mass = 4.4 g [1]

Solution 8

(i) Formation of Magnesium chloride ($MgCl_2$): [2]



(ii)

(a) An antacid [1]

(b) Hygroscopic substance [1]

(iii) The reaction involved is given by:

$$C_2H_4(g) + 3O_2(g) \xrightarrow{100^\circ C} 2CO_2(g) + 2H_2O(g)$$

1 vol 3 vols 2 vols 2 vols

By Gay-Lussac's law:

1 vol. of ethylene requires 3 vols of oxygen

∴200 cm3 of ethylene will require

=3×200 = 600 cm^3 of oxygen

1 vol. of ethylene produces carbon dioxide = 2vols

∴200 cm3 of ethylene will produce carbon dioxide = 2×200 = 400 cm^3 [1]

1 vol. of ethylene produces steam = 2vols

∴200 cm3 of ethylene will produce steam = 2×200 =400 cm^3 [1]

When oxygen is 20%, unreacted air is = 80%

When oxygen is 600 cm^3, then unreacted air is =

$$\frac{80 \times 600}{20} = 2400\,cm^3$$ [1]

Hence, the composition of the mixture after the reaction:

(a)Carbon dioxide = 400 cm^3

(b)Steam = 400 cm^3

(c)Unreacted air = 2400 cm^3

(iv)

(a) The element with atomic number 8 is Oxygen.

Period = 2 [1/2]

Group = 16 [1/2]

(b) It is non-metal. [1]

(c) K_2O or Na_2O. [1]