ICSE 2025 EXAMINATION

Sample Question Paper - 6

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) Sadiya was asked to select the acid which gives sulphate salt from the given options. The acid would be:
  (a) Nitric acid
  (b) Sulphuric acid
  (c) Sulphurous acid
  (d) Sulphonic acid

(ii) Ammonia can be obtained by adding water to:
  (a) Ammonium chloride
  (b) Ammonium nitrate
  (c) Magnesium nitride
  (d) Magnesium Nitrate

(iii) The observation when lead nitrate solution is added to sodium hydroxide, is :
  (a) Pale yellow precipitate is formed
  (b) White precipitate is formed
  (c) Dirty green precipitate is formed
  (d) No precipitate is formed

(iv) The one which will not conduct electricity is:
  (a) Molten NaCl
  (b) NaCl dissolved in water
  (c) Solid NaCl
  (d) Both molten and solid NaCl

(v) **Assertion (A)**: Brisk effervescence is seen when sulphuric acid is added to sodium carbonate.

Reason (R): It liberates sulphur dioxide 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) The drying agent used in the process of preparation of ammonia is :
(a) CaO
(b) P_2O_5
(c) Cl_2
(d) HCl

(vii) The compound responsible for brown ring during the brown ring test for nitrate ion is:
(a) Iron (III) chloride
(b) Nitrosoiron (II) sulphate
(c) Chromium sulphate
(d) Sodium chloride

(viii) The salt solution which does not react with ammonium hydroxide is:
(a) Calcium nitrate
(b) Zinc nitrate
(c) Lead nitrate
(d) Copper nitrate

(ix) The anhydride of sulphuric acid is:
(a) Sulphur trioxide
(b) Acidic oxide
(c) Amphoteric oxide
(d) Neutral oxide

(x) The drying agent used for purifying hydrogen chloride gas is:
(a) Conc. Sulphuric acid
(b) Conc. Nitric acid
(c) Conc. Hydrochloric acid
(d) Conc. Sodium hydroxide

(xi) **Assertion (A)**: Hydrogen is kept in the metal activity series.
Reason (R): Hydrogen can form cation.
(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) All metals exist as solid at room temperature except for the metal 'X'. The metal 'X' is:
(a) Gold
(b) Tungsten
(c) Mercury
(d) Potassium

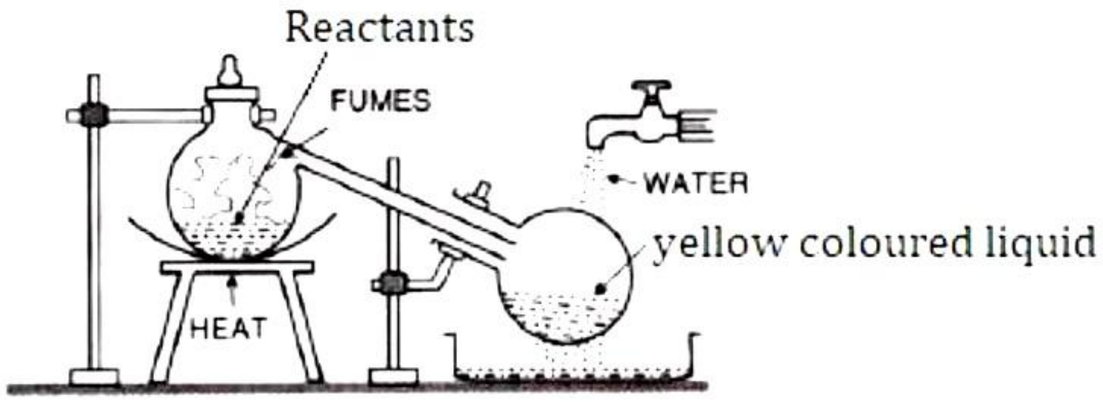
(xiii) The solution of the compound gives a dirty green precipitate with sodium hydroxide and which is insoluble in excess of ammonium hydroxide, is:
(a) Ammonium sulphate
(b) Ferrous sulphate
(c) Copper nitrate
(d) Lead carbonate

(xiv) An organic compound undergoes addition reactions with I_2 and hydrogenation reaction with H_2 in the presence of Ni to produce ethene. Therefore, the organic compound is:
(a) Ethanal
(b) Ethane
(c) Ethyne
(d) Ethanol

(xv) The pH of Ferric chloride solution is:
(a) More than 7
(b) Less than 7
(c) Equal to 7
(d) None of these

Question 2

(i) The diagram shows an experiment set up for the laboratory preparation of a yellow-coloured liquid which is sour. [5]



(a) Name of the liquid collected in the round bottom flask.
(b) Write a balanced chemical equation for the above preparation.
(c) What is the colour of the fumes?
(d) Why the collected liquid is yellow?
(e) How the yellow liquid is made colourless?

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

Statement	Atomic number
(1) A solid non-metal belonging to the third period	10
(2) A metal of valency 1.	20
(3) A gaseous element with valency 2.	3
(4) An element belonging to Group 2.	16
(5) A rare gas.	8

(iii) Complete the following by choosing the correct answers from the bracket: [5]

(a) If X is a metal, then litmus will turn _____.
(b) If X is a non-metal, then litmus will turn _____.
(c) If X is a reactive metal, then _____ will be evolved when X reacts with dilute sulphuric acid.
(d) If X is a metal, then it will form _____ oxide which will form _____ solution with water.
(e) If X is a non-metal, then it will not conduct electricity unless it is carbon in the form of _____.

(iv) Name the following: [5]

(a) Compound with triple covalent bonds
(b) Charged particles which attract one another to form electrovalent compounds
(c) Ion having a coordinate bond
(d) Elements having eight electrons in the outermost shell.
(e) Gaseous polar covalent compound

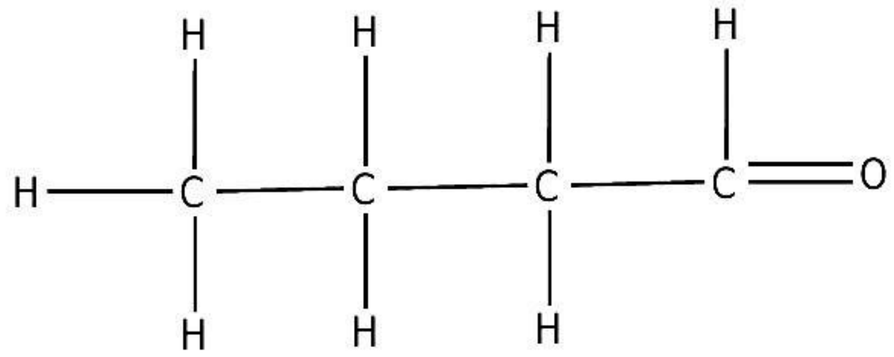
(v) [5]

(a) Draw the structural formula for the following:

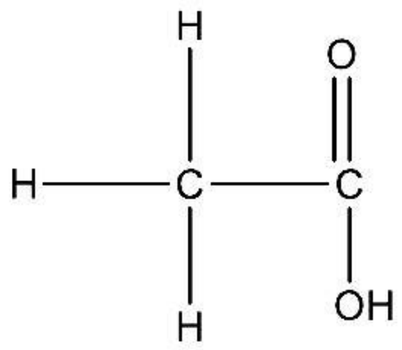
1. Isobutane
2. Butanone
3. Pent-2-yne

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

1.



2.



SECTION-B

(Attempt any four questions)

Question 3

(i) Explain coordinate bond formation in hydronium ion: [2]

(ii) Write a balanced equation for the preparation of each of the following salts: [2]
(a) Copper sulphate from copper carbonate
(b) Zinc carbonate from zinc sulphate

(iii) Give balanced chemical equations for each of the following: [3]
(i) Laboratory preparation of ammonia using an ammonium salt
(ii) Reaction of ammonia with excess chlorine
(iii) Reaction of ammonia with sulphuric acid

(iv) Which element from the following has the highest ionisation energy? [3]
(a) P, Na, Cl
(b) F, O, Ne
(c) Ne, He, Ar
Explain your choice

Question 4

(i) Calculate the percentage of the following: [2]
(a) Magnesium in magnesium chloride ($MgCl_2$)
(b) Sodium in Sodium peroxide (Na_2O_2)

(ii) Give reasons for the following: [2]
(a) The size of a Cl^- ion is greater than the size of a Cl atom.
(b) Ionisation potential of the element increases across a period.

(iii) [3]
(a) Molecular weight of an organic compound if its vapour density is 45.
(b) Calculate the percentage of nitrogen and oxygen in ammonium nitrate (Relative molecular mass of ammonium nitrate is 80, H = 1, N = 14, O = 16).

(iv) Which of the following is true/false? If the answer is false, explain the correct answer:[3]
(a) Ionic compounds are soluble in non-polar organic solvents.
(b) Solid sodium chloride is a strong electrolyte.
(c) Covalent compounds are conductors of electricity in the solid, molten or aqueous state.

Question 5

(i) Explain action of sodium hydroxide on zinc, aluminium and lead with balanced reactions. [2]

(ii) Sanjana was asked to perform silver plating of an iron nail in the practical examination. The following questions were asked related to the electroplating of the iron nail with silver: [2]

(a) Name the electrode formed by the iron nail to be plated.

(b) Which ion is discharged at the iron nail to be plated?

(iii) A compound made up of two elements X and Y has an empirical formula X_2Y. If the atomic weight of X is 10 and that of Y is 5 and the compound ha a vapour density 25, find its molecular formula. [3]

(iv) Define: [3]

(a) Universal indicator

(b) Acid-Base indicator

(c) Ionic definition of salt

Question 6

(i) State the observations at the anode and cathode during the electrolysis of fused lead bromide using graphite electrodes. [2]

(ii) Write balanced chemical equations for each of the following: [2]

(i) Excess of ammonia is treated with chlorine.

(ii) Equation to illustrate the reducing nature of ammonia.

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

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

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

(iv) Answer the following questions: [3]

(d) Write the composition of Brass and Bronze.

(e) If a hydride of nitrogen contains 87.5 per cent by mass of nitrogen then what would be the empirical formula of this compound?

Question 7

(i) 80 cm^3 of methane is mixed with 200 cm^3 of pure oxygen at room temperature and pressure. The mixture is then ignited when it burns as illustrated by the equation: [2]

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

Calculate the composition of the resulting mixture if it is cooled to initial room temperature and pressure.

(ii) 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.

(iii) The gases hydrogen, carbon dioxide, sulphur dioxide and chlorine are arranged in order of their increasing relative molecular masses. If 8 g of each gas at S.T.P., are taken then which gas will contain the least number of molecules and which gas the most? [4]

Question 8

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

(ii) 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 done to dissolve hydrogen chloride gas in water?

(iii) Identify the ***term*** or ***substance*** based on the descriptions given below: [3]

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

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

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

(iv) An element Y has atomic number 3. 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 halogen.

Solution

SECTION A

Solution 1

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

Solution 2

(i)

(a) Nitric acid

(b) $KNO_3 + H_2SO_4 \xrightarrow{<200^\circ C} KHSO_4 + HNO_3$

(c) Brown fumes of nitric acid vapour.

(d) The collected liquid is yellow in colour due to the dissolution of reddish brown nitrogen dioxide gas in the acid. This gas is produced due to thermal decomposition of a portion of nitric acid.

$4HNO_3 \rightarrow 2H_2O + 4NO_2 + O_2$

(e) Dry air or CO_2 is bubbled through the acid. The acid turns colourless because dry air or CO_2 drives out NO_2 from warm acid which is further oxidized to nitric acid.

(ii)

Statement	Atomic number
(1) A solid non-metal belonging to the third period	16
(2)A metal of valency 1	3
(3)A gaseous element with valency 2	8
(4)An element belonging to Group 2	20
(5)A rare gas	10

(iii)

(a) If X is a metal, then litmus will turn <u>blue</u>.

(b) If X is a non-metal, then litmus will turn <u>red</u>.

(c) If X is a reactive metal, then <u>hydrogen</u> will be evolved when X reacts with dilute sulphuric acid.

(d) If X is a metal, then it will form <u>basic</u> oxide which will form <u>alkaline</u> solution with water.

(e) If X is a non-metal, then it will not conduct electricity unless it is carbon in the form of <u>graphite.</u>

(iv)

(a) Nitrogen (N_2)

(b) Cations and anions

(c) Ammonium ion (NH_4^+)

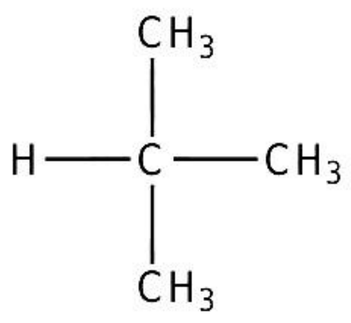
(d) Inert gases or noble gases

(e) Hydrogen chloride (HCl)

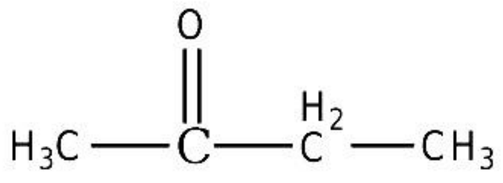
(v)

(a)

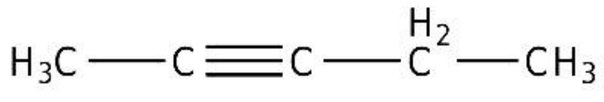
1. Isobutane



2. Butanone



3. Pent-2-yne



(b)

1. Butanal
2. Ethanoic acid or Acetic acid

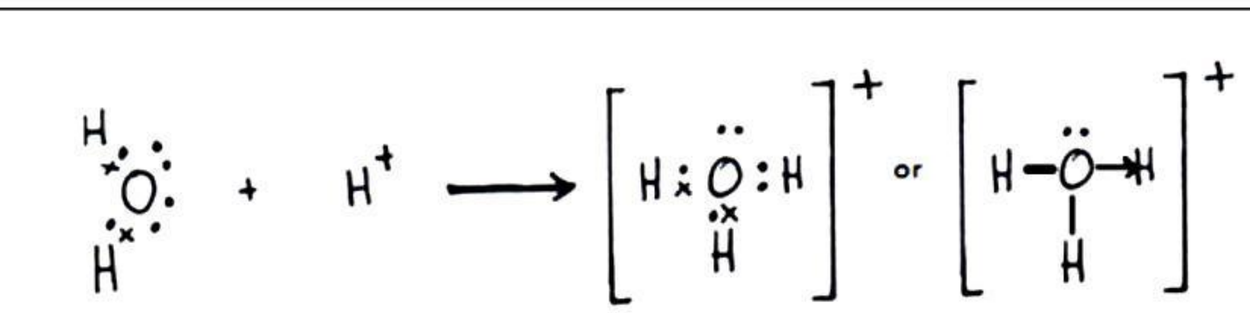
SECTION-B

(Attempt any four questions)

Solution 3

(i) The bond formed between two atoms by sharing a pair of electrons provided entirely by one of the combining atoms but shared by both is called a coordinate bond or dative bond.

Formation of hydronium ion [H_3O^+]



Water Hydrogen ion Hydronium ion

H_2O + H^+ → H_3O^+ (Hydronium ion)

- In water, the O atom contains two lone pairs of electrons after completing its octet.
- The hydrogen ion accepts one lone pair of electrons of the oxygen atom of water molecule leading to the formation of a coordinate bond.

(ii)

(a) Copper sulphate from copper carbonate

$$CuCO_3 + H_2SO_4 \longrightarrow CuSO_4 + H_2O + CO_2 \uparrow$$

(b) Zinc carbonate from zinc sulphate

$$ZnSO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + ZnCO_3 \downarrow$$

(iii)

(a) Ammonia is prepared in the laboratory by using ammonium chloride.

$$2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O + 2NH_3$$

Ammonium chloride — Calcium chloride — Ammonia gas

(b) When ammonia reacts with excess of chlorine, it forms nitrogen trichloride and HCl.

$$NH_3 + 3Cl_2 \longrightarrow NCl_3 + 3HCl$$

(Nitrogen trichloride)

(c) Ammonia reacts with sulphuric acid to form ammonium sulphate.

$$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$$

Ammonium sulphate

(iv)

(a) Cl

Metals have low ionisation energy and non-metals have high ionisation energy. Also, across the period, ionisation energy tends to increase. The elements P, Na and Cl belong to the third period. Na - Group 1, P - Group 15 and Cl - Group 17.

(b) Ne

Inert gases have zero electron affinity because of their stable electronic configuration.

(c) He

Ionisation energy decreases with an increase in the atomic size, i.e. it decreases as one moves down a group. Ne, He and Ar are inert gases. He - Period 1, Ne - Period 2 and Ar - Period 3.

Solution 4

(i)

(a) Magnesium in magnesium chloride (MgCl2)

Relative molecular mass = 24+71 = 95 a.m.u.

$$\% \text{ Magnesium} = \frac{24}{95} \times 100 = 25.26\%$$

(b) Sodium in Sodium peroxide (Na2O2)

Relative molecular mass = 46+32 =78 a.m.u.

$$\% \text{ Sodium} = \frac{46}{78} \times 100 = 58.97\%$$

(ii)

(a) An anion is formed by the gain of electrons. In the chloride ion, the number of electrons is more than the number of protons. The effective positive charge in the nucleus is less, so less inward pull is experienced. Hence, the size expands.

(b) Ionisation potential of the element increases across a period because the atomic size decreases with an increase in the nuclear charge, and thus, more energy is required to remove the electron(s).

(iii)

(a) Molecular weight of organic compound $= 2 \times VD$
$= 2 \times 45$
$= 90$ g

(b) Molecular formula of ammonium nitrate is NH_4NO_3.

$$\% \text{ of N in } NH_4NO_3 = \frac{28}{80} X 100 = 35\%$$

$$\% \text{ of O in } NH_4NO_3 = \frac{48}{80} X 100 = 60\%$$

(iv)

(a) False.
Ionic compounds are insoluble in non-polar organic solvents.

(b) False.
Molten sodium chloride or its solution is a strong electrolyte.

(c) False.
Covalent compounds are non-conductors of electricity in solid, molten or aqueous state due to the absence of free ions.

Solution 5

(i)

Metal + **Alkali** → **Salt** + **Hydrogen**
Zinc $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$ Sodium zincate (colourless)
Aluminium $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + H_2$ Sodium meta aluminate (colourless)
Lead $Pb + 2NaOH \rightarrow Na_2PbO_2 + H_2$ Sodium plumbate (colourless)

(ii)

(a) Cathode

(b) Silver ions/Ag^+

$Ag+ + e^- \rightarrow Ag$

(iii)

$$\text{Empirical formula} = X_2Y$$

$$\text{Atomic Weight (X)} = 10$$

$$\text{Atomic Weight (Y)} = 5$$

$$\text{Empirical formula Weight} = 2 \times 10 + 5 = 25$$

$$\text{So.n} = \frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{2 \times \text{V.D.}}{\text{Empirical formula weight}}$$

$$n = \frac{2 \times 25}{25} = 2$$

$$\text{So molecular formula} = X_2Y \times 2 = X_4Y_4$$

(iv)

(a) A universal indicator is a mixture of organic dyes that gives definite colour change over a wide range of pH.

(b) Acid–Base Indicators

Common acid–base indicators such as litmus, methyl orange and phenolphthalein can distinguish between acid and basic solutions, but they cannot determine the strength of the solution.

(c) Ionic Definition of Salt:

A salt is an ionic compound which 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) Observations:

Anode: Dark reddish brown fumes of bromine evolve at the anode.

Cathode: Greyish white metal lead is formed on the cathode.

(ii)

(a) $8NH_3 + 3Cl_2 \rightarrow N_2 + 6NH_4Cl$

(b) $3PbO + 2NH_3 \rightarrow 3Pb + 3H_2O + N_2$

(iii)

(a) Components of electrolyte: Cryolite and fluorspar
Role played by each electrolyte is given below:

- Cryolite lowers the fusion temperature from 2050°C to 950°C and enhances conductivity.
- Fluorspar and cryolite act as a solvent for the electrolytic mixture and increases conductivity.

(b) Powdered coke is sprinkled over the surface of the electrolytic mixture for the following reasons:

- Reduces heat loss by radiation
- Prevents burning of the anode

(iv)

(a)

Name	Composition	Uses
Brass	Cu = 60–80% Zn = 40–20%	For making utensils, cartridges
Bronze	Zn = 2%, Cu = 80% Sn = 18%	For making utensils, statues and coins

(b) Atomic ratio of N = 87.5 / 14 = 6.25
Atomic ratio of H = 12.5 / 1 = 12.5
This gives us simplest ratio as 1:2.
So, the molecular formula is NH_2.

Solution 7

(i) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$
1 vol 2 vols 1 vol nil
By Gay-Lussac's law,
1 vol of methane requires 2 vols of oxygen.
∴ 80 cm3 of methane requires = 2×80 = 160 cm^3 oxygen
1 vol of methane produces 1 vol of carbon dioxide,
∴ 80 cm^3 of methane produces 80 cm^3 of carbon dioxide.
Hence, composition of gaseous mixture after reaction is:
Methane = 80 – 80 = 0
Carbon dioxide = 80 cm^3
Oxygen = (200−160) = 40 cm^3
Water = Negligible

(ii)

(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

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

(iii)

(a) False.
Ionic compounds are insoluble in non-polar organic solvents.

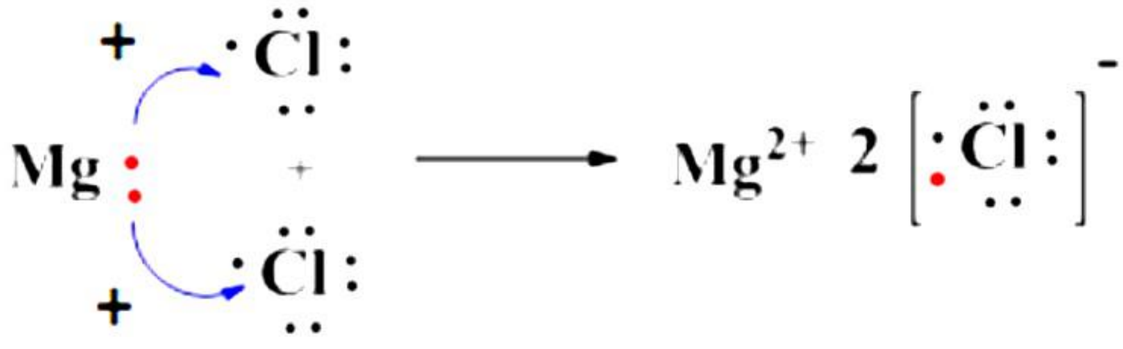
(b) False.
Molten sodium chloride or its solution is a strong electrolyte.

(c) False.
Covalent compounds are non-conductors of electricity in solid, molten or aqueous state due to the absence of free ions.

(iv) According to Avogadros law:
Equal volumes of all gases, under similar conditions of temperature and pressure, contain equal number of molecules.
So, 1 mole of each gas contains $= 6.02 \times 10^{23}$ molecules
Mol. Mass of H_2 (2), CO_2 (44), SO_2 (64), Cl_2 (71)
(1) Now 2 g of hydrogen contains molecules $= 6.02 \times 10^{23}$
So, 8g of hydrogen contains molecules $= 8/2 \times 6.02 \times 10^{23}$
$= 4 \times 6.02 \times 10^{23} = 4M$ molecules
(2) 44 g of carbon dioxide contains molecules $= 8/44 \times 6.02 \times 10^{23} = 2M/11$
(3) 64 g of sulphur dioxide contains molecules $= 6.02 \times 10^{23}$
So, 8 g of sulphur dioxide molecules $= 8/64 \times 6.02 \times 10^{23} = M/8$
(4) 71 g of chlorine contains molecules $= 6.02 \times 10^{23}$
So, 8 g of chlorine molecules $= 8/72 \times 6.02 \times 10^{23} = 8M/71$
Since, $8M/71 < M/8 < 2M/11 < M/4 < 4M$
Thus $Cl_2 < SO_2 < CO_2 < H_2$
(i)Least number of molecules in Cl_2
(ii)Most number of molecules in H_2

Solution 8

(i) $MgCl_2$



(ii) 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.

(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.

(a) Acetylene

(b) Isomerism

(c) Ketones

(iii)

(a) The element with atomic number 3 is Lithium.
Period = 2
Group = 1

(b) It is Metal.

(c) LiCl