

Sample Question Paper - 3

Maximum Marks: 80

d) Manganese

- (g) If N_A is Avogadro's number, then the number of oxygen atom in one g-equivalent of oxygen is [1]

b) $\frac{N_A}{4}$

d) $\frac{N_A}{2}$

- (h) The perfect example of an ideal gas is: [1]

b) Hydrogen

d) Air

- (i) During electrolysis of a concentrated aqueous solution of NaCl, what is the product at the cathode? [1]

b) Sodium

d) Chlorine

- (j) The neutral oxide: **[1]**

b) N_2O

d) Fe_2O_3

- (k) A solid which bursts into flames on addition of concentrated nitric acid is _____. [1]

b) Turpentine oil

d) Saw dust

- (l) Nitric acid was also called as [1]

b) aqua nitrate

d) aqua-regia

- (m) An organic weak acid is _____ [1]

b) Sulphuric acid

d) Nitric acid

- (n) The organic compound obtained as the end product of the fermentation of sugar solution is: **[1]**

b) Ethane

d) Ethanol

- (o) The reaction of alcohol with acetic acid in the presence of concentrated sulphuric acid is known as [1]

b) distillation

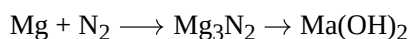
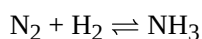
d) condensation

2. **Question 2** [25]

- (a) i. Why silver nitrate is dissolved in tap water? [5]

ii. A compound A when warmed with dilute sulphuric acid, gives a gas. Name that gas.

iii. Complete and balance the following reaction.



- (b) Match the salts given in Column I with their method of preparation given in Column II: [5]

Column I	Column II
(a) $\text{Pb}(\text{NO}_3)_2$ from PbO	(i) Simple displacement
(b) MgCl_2 from Mg	(ii) Titration
(c) FeCl_3 from Fe	(iii) Neutralisation
(d) NaNO_3 from NaOH	(iv) Combination

(c) **Complete the following by choosing the correct answers from the bracket:**

- As we move across the period metallic characters _____. (decreases/increases) [1]
- _____ indicators can differentiate between the acidic or basic solutions of different pH values. [1]
- The number of molecules present in 35.5 g of chlorine is _____ $\times 10^{23}$. (3.01/6.02) [1]
- Electrolysis of aqueous sodium chloride solution will form _____ at the cathode, (hydrogen gas/sodium metal) [1]
- Ammonia gas is collected by _____ (an upward displacement of air/a downward displacement of water/a downward displacement of air) [1]

(d) **Identify the following:**

- Series of compounds having similar structural formulae, same functional group and similar chemical properties. [1]
- The gas evolved in warming ammonium sulphate with sodium hydroxide solution. [1]
- The particle that move when electric current is passed through metal wire. [1]
- The process by which soluble salt like sodium sulphate can be prepared. [1]
- The most metallic element in its respective group is placed at the _____. (top/bottom) [1]

(e) i. A gaseous compound of nitrogen and hydrogen contains 12.5% hydrogen by mass. Find the molecular formula of the compound if its relative molecular mass is 37. [2]

(N = 14, H = 1)

ii. The following table shows the electronic configuration of the 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:

- What type of bond is formed between?
 - W and X
 - X and Y
- What is the formula of the compound formed between?
 - X and Z
 - W and X

Section B

Attempt any 4 questions

3. **Question 3** [10]

(a) i. Of the two gases, ammonia and hydrogen chloride, which is more dense? Name the method of [2]

collection of this gas.

ii. Give one example of a reaction between the above two gases which produces a solid compound.

(b) **Write the products and balance the equation.**

i. Sodium thiosulphate is reacted with dilute hydrochloric acid [1]

ii. Lead sulphate from lead carbonate. [1]

(c) **Arrange the following as per the instruction given in the brackets:**

i. He, Ar, Ne (Increasing order of the number of shells) [1]

ii. F, B, N, O (In the increasing order of electron affinity) [1]

iii. Cs, Na, Li, K, Rb (increasing order of metallic character) [1]

(d) **Fill in the blanks by selecting the appropriate word from the given choice:**

i. Two adjacent members of homologous series differ by CH_2 units and _____ amu. [1]

ii. A carbon atom linked with two carbon atoms is known as _____ carbon. [1]

iii. CH_2O is an _____ for the molecular formula, $\text{C}_6\text{H}_{12}\text{O}_6$. [1]

4. **Question 4** [10]

(a) What is lone pair effect? In what kind of compound does this effect occur? [2]

(b) Given: $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$ [2]

2000 cc of O_2 was burnt with 400 cc of ethane.

Calculate the volume of CO_2 formed and unused O_2 .

(c) The following questions related to the extraction of aluminium by electrolysis: [3]

i. Give the equation for the reaction that takes place at cathode.

ii. Explain why it is necessary to renew anode from time to time.

iii. What is the role of graphite?

(d) **Explain the following:**

i. Cast iron is used to make castings. [1]

ii. An aqueous solution of the salt ammonium chloride is acidic in nature while an aqueous solution of sodium chloride is neutral. [1]

iii. Although copper is a good conductor of electricity, it is a non-electrolyte. [1]

5. **Question 5** [10]

(a) i. Which will give red precipitate with ammoniacal cuprous chloride solution? Identify the substance. [1]

ii. How is methanol converted to methanal? [1]

(b) State the type of bonding in the following molecules: [2]

i. Water

ii. Calcium oxide

(c) **Give balanced chemical equation for the following:**

i. Ammonia is oxidised by a metal oxide [1]

ii. Lead nitrate is heated in a dry test tube [1]

iii. Ammonium chloride is warmed with concentrated sulphuric acid [1]

(d) **State one relevant observation for each of the following reactions:**

i. Dilute hydrochloric acid is added to sodium thiosulphate. [1]

ii. Sodium hydroxide solution is added to ferric chloride solution at first a little and then in excess. [1]

iii. Electricity is passed through molten lead bromide. [1]

6. **Question 6** [10]

(a) i. What is meant by a group in the periodic table? [2]

ii. Within a group where would you expect to find the element with:

a. the greatest metallic character?

b. the largest atomic size?

(b) i. If 150 cc of gas A contains X molecules, how many molecules of gas B will be present in 75 cc of B? The gases A and B are under the same conditions of temperature and pressure. [2]

ii. Name the law on which the above problems is based.

(c) List three characteristics of isomers. [3]

(d) 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).

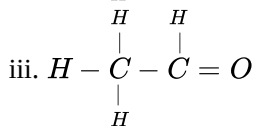
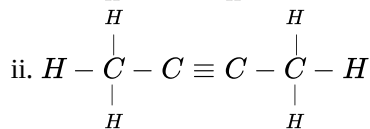
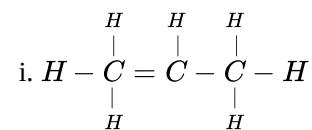
7. **Question 7** [10]

(a) NaCl has a high melting point and boiling point as compared to carbon tetrachloride. Why? [2]

(b) Calculate the mass percent of each element of water. [2]

(c) Differentiate between electrical conductivity of copper sulphate solution and copper metal. [3]

(d) Write the IUPAC names of each of the following. [3]



8. **Question 8** [10]

(a) An element L consists of molecules: [2]

i. What type of bonding is present in the particle that make up L?

ii. When L is heated with iron metal, it forms a compound FeL. What chemical term would you use to describe the change undergone by L?

(b) What are the applications of Avogadro's law? [2]

(c) The pH values of three solutions A, B and C are given in the table. [3]

Answer the following questions:

Solution	pH value
A	12
B	2

- 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?
- (d)
- i. Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. [3]
 - ii. State why concentrated sulphuric acid is not used for drying ammonia gas.
 - iii. Why is ammonia gas not collected over water?

Solution

Section A

1. Question 1 Choose one correct answer to the questions from the given options:

- (i) **(d)** $\text{Be} > \text{Mg} > \text{Ca}$

Explanation: {

$\text{Be} > \text{Mg} > \text{Ca}$

- (ii) **(b)** 7

Explanation: {

7

- (iii) **(b)** Solid NaCl

Explanation: {

As, attractive force between ions in solid state are very strong and ions are not free to move, therefore they do not conduct electricity in solid state.

NaCl (solid) is an ionic solid hence, do not conduct electricity.

- (iv) **(d)** conc. H_2SO_4

Explanation: {

conc. H_2SO_4

- (v) **(a)** Hydrochloric acid

Explanation: {

Hydrochloric acid

- (vi) **(c)** Zinc

Explanation: {

Zinc

- (vii) **(b)** $\frac{N_A}{4}$

Explanation: {

Each oxygen atom in $\text{O}_2(\text{g})$ bear two electrons.

Thus, 1 g equivalent of $\text{O}_2 = \frac{N_A}{2}$

Hence, 1 g equivalent of oxygen atom = $\frac{N_A}{4}$

- (viii) **(a)** None of these

Explanation: {

None of these

- (ix) **(a)** Hydrogen

Explanation: {

Hydrogen

- (x) **(b)** N_2O

Explanation: {

N_2O

- (xi) **(d)** Saw dust

Explanation: {

Saw dust

- (xii) **(c)** aqua fortis

Explanation: {

aqua fortis

(xiii) (c) Formic acid

Explanation: {
Formic acid

(xiv) (d) Ethanol

Explanation: {
Ethanol

(xv) (c) esterification

Explanation: {
esterification

2. Question 2

(i) i. Silver nitrate is dissolved in tap water because tap water contains sodium chloride thus, silver nitrate reacts with it to form a curdy white precipitate.

ii. Sulphite, SO_3^{2-}

iii. $4\text{NH}_3 + 3\text{O}_2 \longrightarrow 2\text{N}_2 + 6\text{H}_2\text{O}$

$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 + \text{Heat}$

Catalyst - Iron

Promoter - Molybdenum

Temp. - $450-500^\circ\text{C}$

Pressure (atm) - 200-1000 atm

$3\text{Mg} + \text{N}_2 \longrightarrow \text{Mg}_3\text{N}_2 \xrightarrow{6\text{H}_2\text{O}} 3\text{Mg}(\text{OH})_2 + 2\text{NH}_3 \uparrow$

(ii) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

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

i. 1. decreases

ii. 1. Universal

iii. 1. 3.01

iv. 1. Hydrogen gas

v. 1. Downward displacement of air

(iv) Identify the following:

i. 1. Homologous series

ii. 1. Ammonia

iii. 1. Electron

iv. 1. Titration

v. 1. bottom

(v)

i.	Element	Percentage	Atomic mass	No. of atoms	Simplest ratio
	N	87.5	14	$\frac{87.5}{14} = 6.25$	$\frac{6.25}{6.25} = 1$
	H	12.5	1	$\frac{12.5}{1} = 12.5$	$\frac{12.5}{6.25} = 2$

Empirical formula of compound = NH_2

Empirical formula weight = $14 + 2 = 16$

Molecular weight = 37 n = $\frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{37}{16} = 2.3 = 2$

Molecular formula = $(\text{NH}_2)_2 = \text{N}_2\text{H}_4$.

ii. i. a. Electrovalent bond or ionic bond

b. Covalent bond

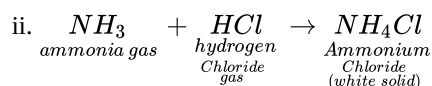
ii. a. ZX

b. WX

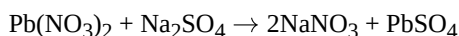
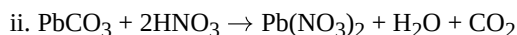
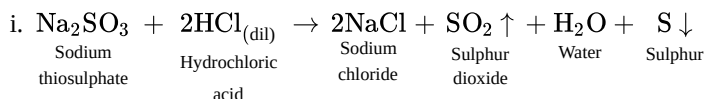
Section B

3. Question 3

(i) i. Hydrogen chloride is denser than ammonia. It is collected by upward displacement of air.



(ii) Write the products and balance the equation.



(iii) Arrange the following as per the instruction given in the brackets:

i. He < Ne < Ar

ii. B, N, O, F

iii. Li < Na < K < Rb < Cs (increasing order)

(iv) Fill in the blanks by selecting the appropriate word from the given choice:

i. 1. 14

ii. 1. Catenation

iii. 1. empirical formula

4. Question 4

(i) When the unshared pair of electrons around an atom in the middle of a molecule is completely shared by another atom or an ion, it is called lone pair effect. Lone pair effect is shown by polar covalent compounds such as HCl and NH₃.

(ii) $2\text{C}_2\text{H}_6 + 7\text{O}_2 \longrightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$ [By Gay Lussac's law]
 $\begin{matrix} 2 \text{ vol} & : & 7 \text{ vol} & :: & 4 \text{ vol} & : & 6 \text{ vol} \end{matrix}$

2 volumes of C₂H₆ give 4 volumes of CO₂

400 cc of C₂H₆ gives $\frac{4}{2} \times 400$ cc of CO₂

400 cc of C₂H₆ gives 800 cc of CO₂

So, CO₂ produced = 800 cc

2 Volume of C₂H₆ uses 7 volumes of O₂

400 cc of C₂H₆ uses $\frac{7}{2} \times 400$ volumes of O₂

400 cc of C₂H₆ uses 1400 volumes of O₂

Unused O₂ = 2000 - 1400 = 600 cc

(iii) i. $\text{Al}^{3+} + 3\text{e}^- \longrightarrow \text{Al}$

ii. Anode is renewed from time to time because they get oxidized.

iii. Graphite acts as anode.

(iv) Explain the following:

i. This is due to fact that cast iron expands on solidification. It takes the shape of the mould and is used to make castings.

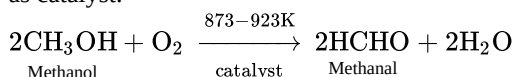
ii. Ammonium chloride is a salt of weak base and strong acid. It undergoes salt hydrolysis to produce an acidic solution whereas sodium chloride is a salt of strong acid and strong bases, it does not undergo salt hydrolysis. Hence, its solution remains neutral.

iii. An electrolyte must have free ions which act as charge carriers whereas in copper the free electrons act as charge carriers.

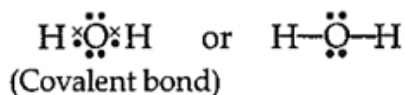
5. Question 5

(i) i. Ethyne

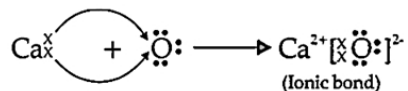
ii. Methanal is prepared by the controlled oxidation of methanol (CH₃OH) at 873-923 K and using silver or iron oxide as catalyst.



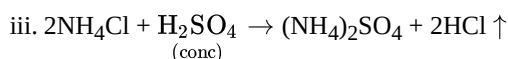
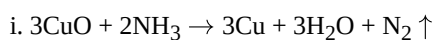
- (ii) i. Electron dot Structure of water (H₂O)



- ii. Electron dot structure of calcium oxide (CaO)



- (iii) Give balanced chemical equation for the following:



- (iv) State one relevant observation for each of the following reactions:

i. Gas (SO₃) evolved which turns potassium dichromate paper from orange to green and yellow particles of sulphur.

ii. A reddish brown ppt. of ferric hydroxide is formed which remains insoluble in excess of sodium hydroxide.

iii. A silvery white metal of Pb (lead) is deposited at cathode.

6. Question 6

- (i) i. The vertical column in the periodic table is called a group.

ii. a. Bottom of the group

b. Bottom of the group

- (ii) i. 150 cc of gas A = X mole

150 cc of gas B = X mole

1 cc of gas B = $\frac{X}{150}$ mole

75 cc of gas B = $\frac{X}{150} \times 75$

= $\frac{75 \times X}{150} = \frac{X}{2}$ molecules

ii. Avogadro's law

- (iii) i. They have same molecular formula.

ii. They have different physical and chemical properties.

iii. They have same molecular mass.

- (iv) 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 H₂SO₄.

7. Question 7

- (i) Sodium chloride has high melting point and boiling point because it has strong electrostatic force of attraction between its ions hence, more energy is required whereas carbon tetrachloride has weak van der Waals forces of attraction and hence, energy required is less.

- (ii) Molar mass of H₂O = 2 × atomic mass of H + 1 × atomic mass of O

$$= 2 \times 1.01 + 1 \times 16.00 = 18.02 \text{ g}$$

$$\text{Mass \% of hydrogen} = \frac{2 \times 1.008}{18.02} \times 100 = 11.18\%$$

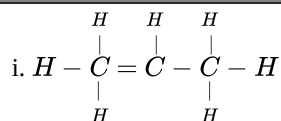
$$\text{Mass \% of oxygen} = \frac{16.00}{18.02} \times 100 = 88.79\%$$

- (iii)

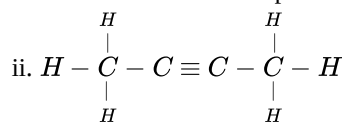
Copper metal	Electrolyte- CuSO ₄ Solution
The flow of electricity takes place by flow of electrons which have negligible mass.	The flow of electricity takes place by flow of ions which are dense particles as compared to electrons.
There is no decomposition of the parent metal and thus the chemical properties of the metal are intact.	Decomposition of the electrolytic solution takes place and thus the chemical properties of the electrolyte are altered.

Metals are good conductors of electricity in the solid state and in the molten state.	Electrolytes are good conductors of electricity in aqueous solution or molten state but do not conduct in the solid state.
During metallic conduction, there is no transfer of matter. The flow of electricity only produces heat energy and no new products are formed.	Electrolytic conduction involves transfer of ions. The electrolyte is decomposed and new products are formed.

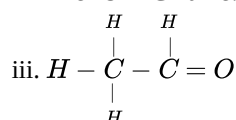
(iv)



The IUPAC name: Prop-1-ene



The IUPAC name: But-2-yne



The IUPAC name: Ethanal

8. Question 8

- (i) i. Covalent bonding since L consists of molecules.
ii. L is getting reduced.
- (ii) i. It determines the molecular formula of a gas.
ii. It determines atomicity of gases.
iii. It explains Gay-Lussac's law of combining volumes.
iv. It establishes the relation between molecular weight and vapour density of a gas.
- (iii) i. C/pH 7
ii. B/pH 2
iii. A/pH 12
- (iv) i. $2\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \xrightarrow{\Delta} \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{NH}_3 \uparrow$
ii. Concentrated sulphuric acid reacts with ammonia/form ammonium sulphate or NH_3 being basic combines with concentrated H_2SO_4 /as follow in chemical equation.
$$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$$

salt
iii. NH_3 is highly soluble in water or dissolves in water.