ICSE 2024 EXAMINATION

CHEMISTRY

SAMPLE PAPER - 4

Answers to this Paper must be written on the paper provided separately.
You will not be allowed to write during the 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) Among the period 2 elements, the element which has high electron affinity is

    (a) Lithium   (b) Carbon   (c) Chlorine   (d) Fluorine

(ii) Among the following compounds identify the compound that has all three bonds (ionic, covalent and coordinate bond).

    (a) Ammonia   (b) Ammonium chloride   (c) Sodium hydroxide   (d) Calcium chloride

(iii) Identify the statement that is incorrect about alkanes :

    (a) They are hydrocarbons.

    (b) There is single covalent bond between carbon and hydrogen

    (c) They can undergo both substitution as well as addition reactions

    (d) On complete combustion they produce carbon dioxide and water.

(iv) Which of these will act as non-electrolyte?

    (a) Liquid carbon tetrachloride   (b) Acetic acid

    (c) Sodium hydroxide aqueous solution   (d) Potassium chloride aqueous solution.

(v) Which one of the following will not produce an acid when made to react with water?

    (a) Carbon monoxide   (b) Carbon dioxide   (c) Nitrogen dioxide   (d) Sulphuric trioxide.

(vi) Identify the metallic oxide which is amphoteric in nature :

    (a) Calcium oxide   (b) Barium oxide   (c) Zinc oxide   (d) Copper(II) oxide

(vii) In the given equation identify the role played by concentrated sulphuric acid

$$S + 2H_2SO_4 \longrightarrow 3SO_2 + 2H_2O :$$

    (a) Non-volatile acid   (b) Oxidising agent   (c) Dehydrating agent   (d) None of these

(viii) Nitrogen gas can be obtained by heating:

    (a) Ammonium nitrate   (b) Ammonium nitrite   (c) Magnesium nitride   (d) Ammonium chloride.

(ix) Which of the following is not a typical property of an ionic compound?
- (a) High melting point
- (b) Conducts electricity in the molten and in the aqueous solution state
- (c) They are insoluble in water
- (d) They exist as oppositely charged ions even in the solid state.

(x) The metals zinc and tin are present in the alloy:
- (a) Solder
- (b) Brass
- (c) Bronze
- (d) Duralumin

(xi) An element in period-3 whose electron affinity is zero.
- (a) Neon
- (b) Sulphur
- (c) Sodium
- (d) Argon

(xii) An alkaline earth metal
- (a) Potassium
- (b) Calcium
- (c) Lead
- (d) Copper

(xiii) The vapour density of carbon dioxide [C = 12, O = 16]
- (a) 32
- (b) 16
- (c) 44
- (d) 22

(xiv) Identify the weak electrolyte from the following :
- (a) Sodium Chloride solution
- (b) Dilute Hydrochloric acid
- (c) Dilute Sulphuric acid
- (d) Aqueous acetic acid

(xv) Which of the following metallic oxides cannot be reduced by normal reducing agents?
- (a) Magnesium oxide
- (b) Copper(II) oxide
- (c) Zinc oxide
- (d) Iron(III) oxide

ANSWERS

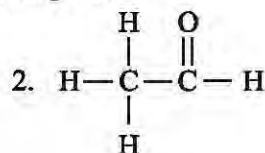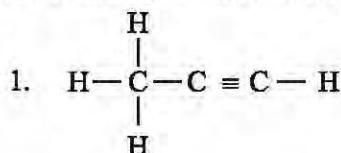| (i) (d)	(ii) (b)	(iii) (c)	(iv) (a)	(v) (a)	(vi) (c)	(vii) (b)	(viii) (b)
(ix) (c)	(x) (c)	(xi) (d)	(xii) (b)	(xiii) (d)	(xiv) (d)	(xv) (a)	

Question 2

(i) Answer the following questions pertaining to laboratory preparation of Hydrogen chloride: [5]
- (a) Write an equation for the laboratory preparation of Hydrogen Chloride.
- (b) Name the drying agent used.
- (c) Name the method of collecting Hydrogen Chloride gas.
- (d) Give a test to identify the gas.

(ii) Sodium hydroxide solution is added to the solutions containing the ions mentioned in List X. List Y gives the details of the precipitate. Match the ions with their coloured precipitates. [5]

List X	List Y
(a) Pb^{2+}	1. Reddish Brown
(b) Fe^{2+}	2. Dirty green
(c) Zn^{2+}	3. White soluble in excess
(d) Fe^{3+}	4. White soluble in excess
(e) Cu^{2+}	5. Blue

(iii) Complete the following by choosing the correct answers from the bracket : [5]
- (a) Conversion of ethanol to ethene by the action of concentrated sulphuric acid is an example of _____. (dehydration / dehydrogenation / dehydrohalogenation)
- (b) When sodium chloride is heated with concentrated sulphuric acid below 200°C, one of the products formed is _____. (sodium hydrogen sulphate / sodium sulphate / chlorine)
- (c) Ammonia reacts with excess chlorine to form _____. (nitrogen / nitrogen trichloride / ammonium chloride)

(d) A salt prepared by displacement reaction is _____ . (ferric chloride / ferrous chloride / silver chloride).

(e) In Period 3, the most metallic element is _____ . (sodium / magnesium / aluminium)

(iv) Identify the following :   [5]

(a) The formula that represents the simplest ratio of the various elements present in one molecule of the compound.

(b) The substance that releases hydronium ion as the only positive ion when dissolved in water.

(c) The tendency of an atom to attract electrons towards itself when combined in a covalent compound.

(d) The process by which certain ores, specially carbonates, are converted to oxides in the absence of air.

(e) The covalent bond in which the electrons are shared equally between the combining atoms.

(v) (a) Give the IUPAC name of the following organic compounds :   [5]

1.
$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-C \equiv C-H$$

2.
$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\overset{\overset{O}{\|}}{C}-H$$

(b) What is the special feature of the structure of ethyne?

(c) Name the saturated hydrocarbon containing two carbon atoms.

(d) Give the structural formula of Acetic acid.

Section B
(Attempt *any four* questions.)

Question 3

(i) Identify the anion present in each of the following compounds :   [2]

(a) A salt *M* on treatment with concentrated sulphuric acid produces a gas which fumes in moist air and gives dense fumes with ammonia.

(b) A salt *D* on treatment with dilute sulphuric acid produces a gas which turns limewater milky but has no effect on acidified potassium dichromate solution.

(ii) Write the products and balance the equation :   [2]

(a) $Mg + HNO_3$ (dil.) $\longrightarrow$ (b) $Cu + HNO_3$ (conc.) $\longrightarrow$

(iii) Arrange the following as per the instruction given in the brackets.   [3]

(a) O_2, N_2, Cl_2 [increasing order of number of covalent bonds]

(b) Zn^{2+}, Na^+, Cu^{+2} [order of preference of discharge at the cathode]

(c) Br, F, Cl [Decreasing order of atomic radius]

(iv) Complete the following by selecting the correct option from the choices given :   [3]

(a) The metal which does not react with water or dilute H_2SO_4 but reacts with concentrated H_2SO_4 is _____ . (Al/Cu/Zn/Fe)

(b) The metal whose oxide, which is amphoteric, is reduced to metal by carbon reduction _____ .
(Fe/Mg/Pb/Al)

(c) The divalent metal whose oxide is reduced to metal by electrolysis of its fused salt is _____ .
(Al/Na/Mg/K)

Question 4

(i) For each of the substances listed below, describe the role played in the extraction of aluminium. [2]

(a) Cryolite   (b) Sodium hydroxide

(ii) Which property of sulphuric acid is shown by the reaction of concentrated sulphuric acid with : [2]

(a) Ethanol?   (b) Carbon?

(iii) (a) With the help of equations, give an outline for the manufacture of sulphuric acid by the contact process. [3]

(b) What property of sulphuric acid is shown by the reaction of concentrated sulphuric acid when heated with

    1. Potassium nitrate   2. Copper

(iv) Explain the following :   [3]

(a) Ionic compounds have a high melting point.

(b) Inert gases do not form ions.

(c) Ionisation potential increases across a period, from left to right.

Question 5

(i) Name two soluble nitrates which can be converted into insoluble chlorides by the use of dilute HCl. Support your answer by chemical equations.   [2]

(ii) Fill in the blanks using the appropriate words given below :   [2]

(Sulphur dioxide, Nitrogen dioxide, Nitric oxide, sulphuric acid)

(a) Cold, dilute nitric acid reacts with copper to give _____.

(b) Hot, concentrated nitric acid reacts with sulphur to form _____.

(iii) Write a **balanced chemical equation** for each of the following :   [3]

(a) Burning of ethane in plentiful supply of air.

(b) Action of water on Calcium carbide.

(c) Heating of Ethanol at 170°C in the presence of conc. sulphuric acid.

(iv) State **one** relevant observation for each of the following :   [3]

(a) Lead nitrate solution is mixed with dilute hydrochloric acid and heated.

(b) Anhydrous calcium chloride is exposed to air for some time.

(c) Barium chloride solution is slowly added to sodium sulphate solution.

Question 6

(i) If the empirical formula of a compound is CH and it has a vapour density of 13, find the molecular formula of the compound.   [2]

(ii) Propane burns in air according to the following equation :   [2]

$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O.$

What volume of propane is consumed on using 1000 cm³ of air, considering only 20% of air contains oxygen?

(iii) Calculate the percentage of :   [3]

(a) Fluorine   (b) Sodium and   (c) Aluminium

in sodium aluminium fluoride [Na_3AlF_6], to the nearest whole number

[Atomic Mass : Na = 23, Al = 27, F = 19]

(iv) Give one equation each to show the following properties of sulphuric acid :   [3]

(a) Dehydrating property   (b) Acidic nature   (c) As a non-volatile acid

Question 7

(i) A gaseous hydrocarbon contains 82.76% of carbon. Given that its vapour density is 29, find its **molecular formula**.

                                          [C=12, H=1]   [2]

(ii) Identify the term/substance in each of the following :   [2]

(a) The type of reactions alkenes undergo.

(b) The catalyst used in the conversion of ethyne to ethane.

(iii) Copper sulphate solution is electrolysed using copper electrodes.

Study the diagram given alongside and answer the questions that follow : [3]

(a) Which electrode to your left or right is known as the oxidising electrode and why?
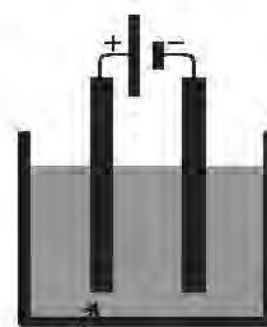
(b) Write the equation representing the reaction that occurs.

(c) State two appropriate observations for the above electrolysis reaction.

(iv) (a) Give two examples of weak acids. [3]

(b) Give two examples of bases which are not soluble in water.

(c) The pH of a solution is 5. To this solution is added a liquid when the pH decreases to 3. What is nature of liquid added to the solution?

Copper(II) Sulphate Solution

Question 8

(i) By drawing an electron dot diagram show the formation of **Ammonium Ion** [2]

[Atomic No.: N = 7 and H = 1]

(ii) Answer the following questions: [2]

(a) How will you distinguish between Ammonium hydroxide and Sodium hydroxide using copper sulphate solution?

(b) How will you distinguish between dilute hydrochloric acid and dilute sulphuric acid using lead nitrate solution?

(iii) Mr. Ramu wants to electroplate his key chain with nickel to prevent rusting. For this electroplating: [3]

(a) Name the electrolyte   (b) Name the cathode   (c) Name the anode

(iv) Study the table and answer the following questions: [3]

Atom	Atom No.
A	11
B	17

(a) Compare the positions of A and B in the Periodic Table.

(b) Which is more metallic?

(c) Write equations for the formation of ions of A and B.

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SOLUTION

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

Question 1 : Choose one correct answer to the questions from the given options :   **[15]**

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       (a) Lithium   (b) Carbon   (c) Chlorine   (d) Fluorine

 (ii) Among the following compounds identify the compound that has all three bonds (ionic, covalent and coordinate bond).

       (a) Ammonia   (b) Ammonium chloride   (c) Sodium hydroxide   (d) Calcium chloride

(iii) Identify the statement that is incorrect about alkanes :

       (a) They are hydrocarbons.

       (b) There is single covalent bond between carbon and hydrogen

       (c) They can undergo both substitution as well as addition reactions

       (d) On complete combustion they produce carbon dioxide and water.

 (iv) Which of these will act as non-electrolyte?

       (a) Liquid carbon tetrachloride   (b) Acetic acid

       (c) Sodium hydroxide aqueous solution   (d) Potassium chloride aqueous solution.

  (v) Which one of the following will not produce an acid when made to react with water?

       (a) Carbon monoxide   (b) Carbon dioxide   (c) Nitrogen dioxide   (d) Sulphuric trioxide.

 (vi) Identify the metallic oxide which is amphoteric in nature :

       (a) Calcium oxide   (b) Barium oxide   (c) Zinc oxide   (d) Copper(II) oxide

(vii) In the given equation identify the role played by concentrated sulphuric acid

$$S + 2H_2SO_4 \longrightarrow 3SO_2 + 2H_2O :$$

       (a) Non-volatile acid   (b) Oxidising agent   (c) Dehydrating agent   (d) None of these

(viii) Nitrogen gas can be obtained by heating:

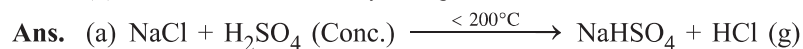   (a) Ammonium nitrate   (b) Ammonium nitrite   (c) Magnesium nitride   (d) Ammonium chloride.

(ix) Which of the following is not a typical property of an ionic compound?
  (a) High melting point
  (b) Conducts electricity in the molten and in the aqueous solution state
  (c) They are insoluble in water
  (d) They exist as oppositely charged ions even in the solid state.
 (x) The metals zinc and tin are present in the alloy:
  (a) Solder   (b) Brass   (c) Bronze   (d) Duralumin
 (xi) An element in period-3 whose electron affinity is zero.
  (a) Neon   (b) Sulphur   (c) Sodium   (d) Argon
(xii) An alkaline earth metal
  (a) Potassium   (b) Calcium   (c) Lead   (d) Copper
(xiii) The vapour density of carbon dioxide [C = 12, O = 16]
  (a) 32   (b) 16   (c) 44   (d) 22
(xiv) Identify the weak electrolyte from the following :
  (a) Sodium Chloride solution   (b) Dilute Hydrochloric acid
  (c) Dilute Sulphuric acid   (d) Aqueous acetic acid
(xv) Which of the following metallic oxides cannot be reduced by normal reducing agents?
  (a) Magnesium oxide   (b) Copper(II) oxide   (c) Zinc oxide   (d) Iron(III) oxide

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ANSWERS

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

Question 2

 (i) Answer the following questions pertaining to laboratory preparation of Hydrogen chloride: [5]
  (a) Write an equation for the laboratory preparation of Hydrogen Chloride.
  (b) Name the drying agent used.
  (c) Name the method of collecting Hydrogen Chloride gas.
  (d) Give a test to identify the gas.

Ans. (a) $NaCl + H_2SO_4$ (Conc.) $\xrightarrow{< 200°C}$ $NaHSO_4 + HCl$ (g)

  (b) Conc. H_2SO_4

  (c) Upward displacement of air

  (d) Bring a glass rod dipped in ammonia solution near the mouth of the gas jar. Formation of dense white fumes around the glass rod confirms that gas jar is completely filled with the HCl gas.

$$NH_3 + HCl \rightarrow NH_4Cl$$

 (ii) Sodium hydroxide solution is added to the solutions containing the ions mentioned in List X. List Y gives the details of the precipitate. Match the ions with their coloured precipitates. [5]

List X	List Y
(a) Pb^{2+}	1. Reddish Brown
(b) Fe^{2+}	2. Dirty green
(c) Zn^{2+}	3. White soluble in excess
(d) Fe^{3+}	4. White soluble in excess
(e) Cu^{2+}	5. Blue

Ans. (a) Pb^{2+} — 3.   (b) Fe^{2+} — 2.   (c) Zn^{2+} — 4.   (d) Fe^{3+} — 1.   (e) Cu^{2+} — 5.
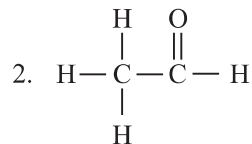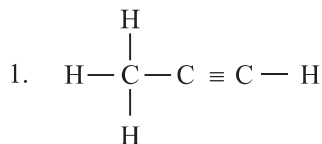
(iii) Complete the following by choosing the correct answers from the bracket : [5]

(a) Conversion of ethanol to ethene by the action of concentrated sulphuric acid is an example of _____. (dehydration / dehydrogenation / dehydrohalogenation)

(b) When sodium chloride is heated with concentrated sulphuric acid below 200°C, one of the products formed is _____. (sodium hydrogen sulphate / sodium sulphate / chlorine)

(c) Ammonia reacts with excess chlorine to form _____. (nitrogen / nitrogen trichloride / ammonium chloride)

(d) A salt prepared by displacement reaction is _____. (ferric chloride / ferrous chloride / silver chloride).

(e) In Period 3, the most metallic element is _____. (sodium / magnesium / aluminium)

Ans. (a) dehydration   (b) sodium hydrogen sulphate   (c) nitrogen trichloride   (d) ferrous chloride (e) sodium

(iv) Identify the following : [5]

(a) The formula that represents the simplest ratio of the various elements present in one molecule of the compound.

(b) The substance that releases hydronium ion as the only positive ion when dissolved in water.

(c) The tendency of an atom to attract electrons towards itself when combined in a covalent compound.

(d) The process by which certain ores, specially carbonates, are converted to oxides in the absence of air.

(e) The covalent bond in which the electrons are shared equally between the combining atoms.

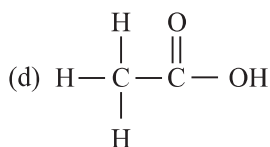**Ans.** (a) Empirical formula (b) Acid   (c) Electronegativity (d) Calcination   (e) Non-polar covalent compound

(v) (a) Give the IUPAC name of the following organic compounds : [5]

$$
\begin{array}{ll}
\text{1.} \quad
\begin{array}{c}
\quad\ \text{H} \\
\quad\ | \\
\text{H}-\text{C}-\text{C}\equiv\text{C}-\text{H} \\
\quad\ | \\
\quad\ \text{H}
\end{array}
&
\text{2.} \quad
\begin{array}{c}
\quad\ \text{H}\quad\ \text{O} \\
\quad\ |\quad\ \ || \\
\text{H}-\text{C}-\text{C}-\text{H} \\
\quad\ | \\
\quad\ \text{H}
\end{array}
\end{array}
$$

(b) What is the special feature of the structure of ethyne?

(c) Name the saturated hydrocarbon containing two carbon atoms.

(d) Give the structural formula of Acetic acid.

Ans. (a) 1. Propyne   2. Ethanal

(b) Ethyne is the first member of alkyne series. It is characterised by the presence of a triple covalent bond ($-\text{C}\equiv\text{C}-$) between two carbon atoms.

(c) Ethane (C_2H_6)

(d)
$$
\begin{array}{c}
\text{H}\quad\ \text{O} \\
|\quad\ \ || \\
\text{H}-\text{C}-\text{C}-\text{OH} \\
|\\
\text{H}
\end{array}
$$

Section B
*(Attempt **any four** questions.)*
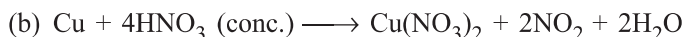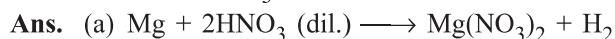

Question 3

(i) Identify the anion present in each of the following compounds : [2]

(a) A salt **M** on treatment with concentrated sulphuric acid produces a gas which fumes in moist air and gives dense fumes with ammonia.

(b) A salt **D** on treatment with dilute sulphuric acid produces a gas which turns limewater milky but has no effect on acidified potassium dichromate solution.

Ans. (a) M has chloride (Cl^-) anion.

(b) D has carbonate $\left(CO_3^{2-}\right)$ or bicarbonate $\left(HCO_3^{-1}\right)$ anion.

(ii) Write the products and balance the equation : [2]

(a) $Mg + HNO_3$ (dil.) $\longrightarrow$ (b) $Cu + HNO_3$ (conc.) $\longrightarrow$

Ans. (a) $Mg + 2HNO_3$ (dil.) $\longrightarrow Mg(NO_3)_2 + H_2$
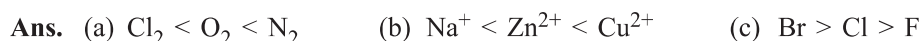
(b) $Cu + 4HNO_3$ (conc.) $\longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

(iii) Arrange the following as per the instruction given in the brackets. [3]

(a) O_2, N_2, Cl_2 [increasing order of number of covalent bonds]

(b) Zn^{2+}, Na^+, Cu^{+2} [order of preference of discharge at the cathode]

(c) Br, F, Cl [Decreasing order of atomic radius]

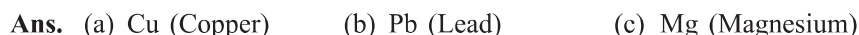**Ans.** (a) $Cl_2 < O_2 < N_2$ (b) $Na^+ < Zn^{2+} < Cu^{2+}$ (c) $Br > Cl > F$

(iv) Complete the following by selecting the correct option from the choices given : [3]

(a) The metal which does not react with water or dilute H_2SO_4 but reacts with concentrated H_2SO_4 is _____. (Al/Cu/Zn/Fe)

(b) The metal whose oxide, which is amphoteric, is reduced to metal by carbon reduction _____.
(Fe/Mg/Pb/Al)

(c) The divalent metal whose oxide is reduced to metal by electrolysis of its fused salt is _____.
(Al/Na/Mg/K)

Ans. (a) Cu (Copper)   (b) Pb (Lead)   (c) Mg (Magnesium)

Question 4

(i) For each of the substances listed below, describe the role played in the extraction of aluminium. [2]

(a) Cryolite   (b) Sodium hydroxide

Ans. (a) Cryolite lowers the melting point of alumina from 2050°C to 950°C. This in turn increases the conductivity of electrolyte and saves electricity, which is the main source of energy in the reduction of alumina.

(b) Sodium hydroxide dissolves the alumina (Al_2O_3), but not the impurities to form sodium aluminate. The impurities are filtered out and the sodium aluminate is treated with carbon dioxide to form pure aluminium hydroxide. Alumina is recovered from sodium hydroxide by strong heating.
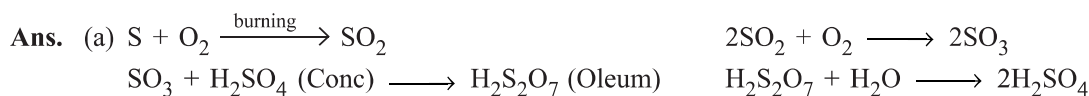
(ii) Which property of sulphuric acid is shown by the reaction of concentrated sulphuric acid with : [2]

(a) Ethanol?   (b) Carbon?

Ans. (a) Dehydrating property.   (b) Oxidising property.

(iii) (a) With the help of equations, give an outline for the manufacture of sulphuric acid by the contact process. [3]

(b) What property of sulphuric acid is shown by the reaction of concentrated sulphuric acid when heated with

1. Potassium nitrate   2. Copper

Ans. (a) $S + O_2 \xrightarrow{\text{burning}} SO_2$ $2SO_2 + O_2 \longrightarrow 2SO_3$

$SO_3 + H_2SO_4$ (Conc) $\longrightarrow H_2S_2O_7$ (Oleum) $H_2S_2O_7 + H_2O \longrightarrow 2H_2SO_4$

(b) 1. In case of KNO_3, the property shown is least volatile acid

2. In case of Copper, the oxidising property is shown.

(iv) Explain the following : [3]

(a) Ionic compounds have a high melting point.

(b) Inert gases do not form ions.

(c) Ionisation potential increases across a period, from left to right.

Ans. (a) Because the cations and anions in an ionic compound are held very strongly due to strong electrostatic forces. Thus, a large amount of heat energy is required to snap the electrostatic bonds, before the ions could actually start interchanging their positions.

(b) Because helium has a duplet structure in its valence shell, whereas all other inert gases have octet structure in their valence shells. A duplet or an octet configuration of electrons in the valence shell is most stable and will be in the minimum state of energy. So they are inactive.

(c) Across a period from left to right, the nuclear charge continues to increase. So, the nuclear attraction on the electrons in the valence shell increases. Thus, more energy is required to pull out the electrons from the valence shell and hence, ionisation potential increases.
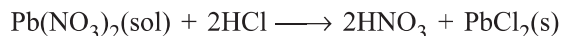
Question 5

(i) Name two soluble nitrates which can be converted into insoluble chlorides by the use of dilute HCl. Support your answer by chemical equations. [2]

Ans. (a) Silver nitrate solution on treating with dilute HCl, forms insoluble silver chloride.

$$AgNO_3(sol) + HCl \longrightarrow HNO_3 + AgCl(s)$$
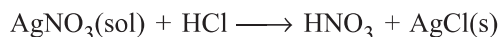
(b) Lead nitrate solution on treating with dilute HCl, forms insoluble lead chloride.

$$Pb(NO_3)_2(sol) + 2HCl \longrightarrow 2HNO_3 + PbCl_2(s)$$

(ii) Fill in the blanks using the appropriate words given below : [2]

(Sulphur dioxide, Nitrogen dioxide, Nitric oxide, sulphuric acid)

(a) Cold, dilute nitric acid reacts with copper to give _____.

(b) Hot, concentrated nitric acid reacts with sulphur to form _____.

Ans. (a) Nitric oxide   (b) Sulphuric acid

(iii) Write a **balanced chemical equation** for each of the following : [3]

(a) Burning of ethane in plentiful supply of air.

(b) Action of water on Calcium carbide.

(c) Heating of Ethanol at 170°C in the presence of conc. sulphuric acid.

Ans. (a) $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O.$

(b) $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

(c) $C_2H_5OH + H_2SO_4(conc) \xrightarrow{170°C} C_2H_4(g) + H_2SO_4.H_2O$

(iv) State **one** relevant observation for each of the following : [3]

(a) Lead nitrate solution is mixed with dilute hydrochloric acid and heated.

(b) Anhydrous calcium chloride is exposed to air for some time.

(c) Barium chloride solution is slowly added to sodium sulphate solution.

Ans. (a) A thick white precipitate of lead chloride is formed. The precipitate dissolves on heating.

(b) Anhydrous calcium chloride absorbs moisture from the air then dissolves in the absorbed moisture to change into liquid state.

(c) A thick white precipitate of barium sulphate is formed, which rapidly settles down.

Question 6

(i) If the empirical formula of a compound is CH and it has a vapour density of 13, find the molecular formula of the compound. [2]
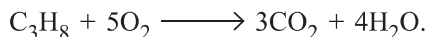
Ans. Empirical formula weight of CH = 12 + 1 = 13

Vapour density of the compound of CH = 13

∴ Molecular weight of the compound = 2 × 13 = 26

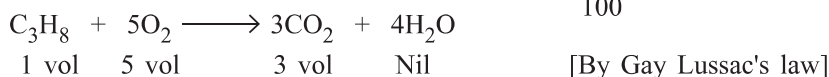∴ $n = \dfrac{\text{Molecular weight}}{\text{Empirical formula weight}} = \dfrac{26}{13} = 2$

Thus, Molecular formula of the compound = n × (Empirical formula weight)

= 2 × (CH) = C_2H_2

(ii) Propane burns in air according to the following equation : [2]

$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$.

What volume of propane is consumed on using 1000 cm^3 of air, considering only 20% of air contains oxygen?

Ans. Amount of oxygen in 1000 cm^3 of air = $1000 \times \dfrac{20}{100}$ = 200 cm^3

$$C_3H_8 \ + \ 5O_2 \longrightarrow 3CO_2 \ + \ 4H_2O$$

1 vol   5 vol   3 vol   Nil   [By Gay Lussac's law]

For 5 volumes of oxygen, the propane consumption = 1 Vol

∴ 200 cm^3 of oxygen, the propane consumption = $\dfrac{200}{5}$ = **40 cm^3**.

(iii) Calculate the percentage of : [3]

(a) Fluorine   (b) Sodium and   (c) Aluminium

in sodium aluminium fluoride [Na_3AlF_6], to the nearest whole number

[Atomic Mass : Na = 23, Al = 27, F = 19]

Ans. Molecular weight of sodium aluminium fluoride [Na_3AlF_6]

= $3 \times 23 + 27 + 6 \times 19$ = 69 + 27 + 114 = 210 amu

(a) Mass of fluorine in sodium aluminium fluoride (Na_3AlF_6) = 114 amu

Thus, percentage of fluorine = $\dfrac{114 \text{ amu}}{210 \text{ amu}} \times 100 = \dfrac{380}{7}$ = 54.29%

(b) Percentage of sodium = $\dfrac{69 \text{ amu}}{210 \text{ amu}} \times 100 = \dfrac{230}{7}$ = 32.86%

(c) Percentage of aluminium = $\dfrac{27 \text{ amu}}{210 \text{ amu}} \times 100 = \dfrac{90}{7}$ = 12.86%

(iv) Give one equation each to show the following properties of sulphuric acid : [3]

(a) Dehydrating property   (b) Acidic nature   (c) As a non-volatile acid

Ans. (a) $C_6H_{12}O_6 + 6H_2SO_4$ (conc.) $\longrightarrow$ $6C + 6H_2SO_4 \cdot H_2O$.

        Glucose

(b) $2NaOH + H_2SO_4$ (dil.) $\longrightarrow$ $Na_2SO_4 + 2H_2O$.

(c) $2NaNO_3 + H_2SO_4$ (conc.) $\xrightarrow{>200°C}$ $Na_2SO_4 + 2HNO_3$.

Question 7

(i) A gaseous hydrocarbon contains 82.76% of carbon. Given that its vapour density is 29, find its **molecular formula**.

[C=12, H=1] [2]

Ans.

Element	Percentage At. Weight	Atomic weight	Relative number of moles	Simple ratio of atoms
C	82.7	12	82.7 ÷ 12 = 6.9	6.9 ÷ 6.9 = 1 or 2
H	17.3	1	17.3 ÷ 1 = 17.3	17.3 ÷ 6.9 = 2.5 or 5

∴ Empirical formula of compound = C_2H_5.

∴ Empirical formula weight of compound = $2 \times 12 + 5 \times 1$ = 29

Vapour of density of compound = 29

∴ Molecular weight of compound = $2 \times$ V.D. = 2×29 = 58.

Now, Molecular weight = $n \times$ empirical weight

$58 = n \times 29$

∴ $n = 2$

∴ Molecular formula of compound $= n \times$ Empirical formula

$= 2 \times C_2H_5 = \mathbf{C_4H_{10}}$.

(ii) Identify the term/substance in each of the following : [2]

    (a) The type of reactions alkenes undergo.

    (b) The catalyst used in the conversion of ethyne to ethane.

**Ans.** (a) Addition reaction   (b) Nickel

(iii) Copper sulphate solution is electrolysed using copper electrodes.

Study the diagram given alongside and answer the questions that follow : [3]

    (a) Which electrode to your left or right is known as the oxidising electrode and why?

    (b) Write the equation representing the reaction that occurs.

    (c) State two appropriate observations for the above electrolysis reaction.

Copper(II) Sulphate Solution

Ans. (a) The electrode on the right hand side donates electrons and hence is oxidising electrode.

    (b) $Cu^{2+} + 2e^- \rightarrow Cu$
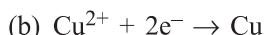
    (c) The size of anode gradually decreases and that of cathode gradually increases. However, there is no change in the colour of copper sulphate solution.
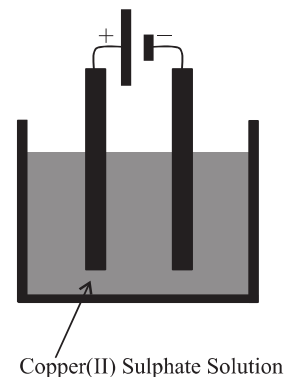
(iv) (a) Give two examples of weak acids. [3]

    (b) Give two examples of bases which are not soluble in water.

    (c) The pH of a solution is 5. To this solution is added a liquid when the pH decreases to 3. What is nature of liquid added to the solution?

Ans. (a) (1) Carbonic acid (H_2CO_3)   (2) Sulphurous acid (H_2SO_3).

    (b) (1) Copper hydroxide [$Cu(OH)_2$]   (2) Iron (II) hydroxide [$Fe(OH)_2$]

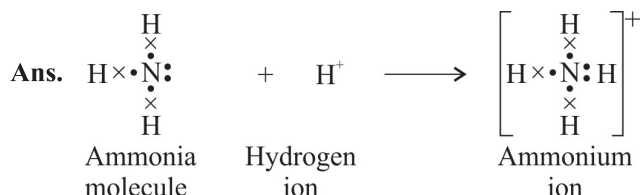   (c) Liquid is acidic in nature and has pH less than 3.

Question 8

(i) By drawing an electron dot diagram show the formation of **Ammonium Ion** [2]

[Atomic No.: N = 7 and H = 1]

(ii) Answer the following questions: [2]

    (a) How will you distinguish between Ammonium hydroxide and Sodium hydroxide using copper sulphate solution?

    (b) How will you distinguish between dilute hydrochloric acid and dilute sulphuric acid using lead nitrate solution?

Ans. (a) Sodium hydroxide forms a pale blue precipitate which is insoluble in excess of sodium hydroxide.

Ammonium hydroxide forms a pale blue precipitate which dissolves in excess of ammonium hydroxide to form deep blue coloration.

    (b) Hydrochloric acid forms a white precipitate with lead nitrate solution. This precipitate dissolves on warming the reaction mixture so as to form clear solution. Sulphuric acid forms a white precipitate with lead nitrate solution. This precipitate does not dissolve on warming the reaction mixture.

(iii) Mr. Ramu wants to electroplate his key chain with nickel to prevent rusting. For this electroplating: [3]

    (a) Name the electrolyte   (b) Name the cathode   (c) Name the anode

Ans. (a) Nickel sulphate solution acidified with sulphuric acid.   (b) Key chain   (c) Pure nickel plate/rod.

(iv) Study the table and answer the following questions: [3]

Atom	Atom No.
A	11
B	17

(a) Compare the positions of A and B in the Periodic Table.

(b) Which is more metallic?

(c) Write equations for the formation of ions of A and B.

Ans. Electronic configuration of A = 2, 8, 1
Electronic configuration of B = 2, 8, 7

   (a) Position of A in the Periodic Table

      Group 1(IA) and Period 3

      Position of B in the Periodic Table

      Group 17 (VIIA) and Period 3

   (b) A is more metallic

   (c) $A - e^- = A^+$ and $B + e^- = B^-$

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