ICSE 2024 EXAMINATION

CHEMISTRY

SAMPLE PAPER - 8

Time allowed: Two hours ***Max. Marks : 80***

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) A chloride which forms a precipitate that is soluble in excess of ammonium hydroxide, is:
(a) Calcium chloride (b) Ferrous chloride (c) Ferric chloride (d) Copper chloride

(ii) If the molecular formula of an organic compound is $C_{10}H_{18}$ it is:
(a) alkene (b) alkane (c) alkyne (d) Not a hydrocarbon

(iii) Which of the following is a common characteristic of a covalent compound?
(a) high melting point (b) consists of molecules
(c) always soluble in water (d) conducts electricity when it is in the molten state

(iv) To increase the pH value of a neutral solution, we should add :
(a) an acid (b) an acid salt (c) an alkali (d) a salt

(v) Anhydrous iron (III) chloride is prepared by:
(a) direct combination (b) simple displacement (c) decomposition (d) neutralization

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

(vii) The organic compound which undergoes ***substitution reaction*** is :
(a) C_2H_2 (b) C_2H_4 (c) $C_{10}H_{18}$ (d) C_2H_6

(viii) The electrolysis of acidified water is an example of :
(a) Reduction (b) Oxidation (c) Redox reaction (d) Synthesis

(ix) The IUPAC name of dimethyl ether is :
(a) Ethoxy methane (b) Methoxy methane (c) Methoxy ethane (d) Ethoxy ethane

(x) The catalyst used in the Contact Process is :
(a) Copper (b) Iron (c) Vanadium pentoxide (d) Manganese dioxide

(xi) An electrolyte which completely dissociates into ions is :
(a) Alcohol (b) Carbonic acid (c) Sucrose (d) Sodium hydroxide

(xii) The most electronegative element from the following elements is :

(a) Magnesium (b) Chlorine (c) Aluminium (d) Sulphur

(xiii) The reason for using Aluminium in the alloy duralumin is :

(a) Aluminium is brittle. (b) Aluminium gives strength.

(c) Aluminium brings lightness. (d) Aluminium lowers melting point.

(xiv) The drying agent used to dry HCl gas is :

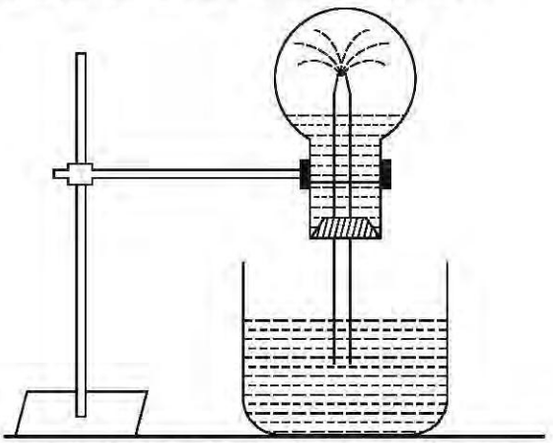
(a) Conc. H_2SO_4 (b) ZnO (c) Al_2O_3 (d) CaO

(xv) A hydrocarbon which is a greenhouse gas is :

(a) Acetylene (b) Ethylene (c) Ethane (d) Methane

Question 2

(i) The diagram shows a simple arrangement of the fountain experiment : [5]



(a) Name the two gases you have studied which can be used in this experiment.

(b) What is the common property demonstrated by this experiment?

(c) Name the drying agents which are used to dry the above mentioned gases during laboratory preparation.

(ii) Match the descriptions (a) to (e) below with appropriate term from list 1 to 6. [5]

1. Neutral oxide **2.** Cation **3.** Hydrocarbons

4. Hygroscopic **5.** Alkynes **6.** Malleability

(a) The property possessed by metals by which they can be beaten into sheets.

(b) The process by which a substance absorbs moisture from air, but does not change its state.

(c) The compounds of carbon and hydrogen.

(d) A homologous series with general formula C_nH_{2n-2}.

(e) An oxide which is neither acidic nor basic in nature.

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

(a) In covalent compounds, the bond is formed due to the _____(sharing/transfer) of electrons.

(b) Electrovalent compounds have a _____ (low/high) boiling point.

(c) A molecule of _____contains a triple bond. (hydrogen, ammonia, nitrogen).

(d) Across a period the ionization potential _____ (increases, decreases, remains same).

(e) Down the group, electron affinity _____ (increases, decreases, remains same).

(iv) Identify the following : [5]

(a) Process by which ethane is obtained from ethene.

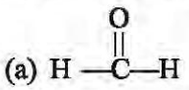
(b) A hydrocarbon which contributes towards the **greenhouse** effect.

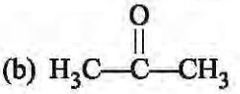
(c) An organic compound whose functional group is carboxyl.

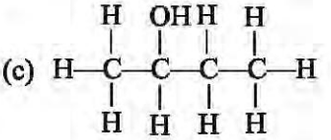
(d) An ore of zinc containing its sulphide.

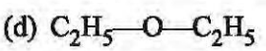
(e) Reaction when an alkyl halide is treated with alcoholic potassium hydroxide.

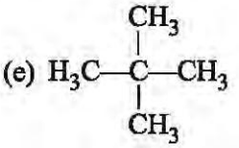
(v) Write the I.U.P.A.C. names of the following compounds : [5]

(a) 

(b) 

(c) 

(d) 

(e) 

Section B

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

Question 3

(i) Identifying the cations in each of the following case : [2]

(a) NH_4OH solution when added to the solution (A) gives white precipitate which does not dissolve in excess.

(b) NaOH solution when added to the solution (B) gives white precipitate which is insoluble in excess.

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

(a) $CuO + NH_3 \xrightarrow{heat}$

(b) $NH_4Cl + Ca(OH)_2 \xrightarrow{CaO}$

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

(a) Na, Li, K (increasing Ionisation Energy)

(b) F, Cl, Br (Increasing electronegativity)

(c) Na, K, Li (increasing atomic size)

(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) Choose the major metals to make the following alloys : [2]

(a) Stainless steel (b) Brass

(ii) Name the gas evolved when the following mixtures are heated : [2]

(a) Calcium hydroxide and ammonium chloride

(b) Sodium nitrite and ammonium chloride

(iii) (a) Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. [3]

(b) State why concentrated sulphuric acid is not used for drying ammonia gas.

(c) Why is ammonia gas not collected over water?

(iv) Explain the following : [3]

(a) Sodium Chloride will conduct electricity only in fused or aqueous solution state.

(b) In the electroplating of an article with silver, the electrolyte sodium argento-cyanide solution is preferred over silver nitrate solution.

(c) Although copper is a good conductor of electricity, it is a non-electrolyte.

Question 5

(i) During the electrolysis of copper (II) sulphate solution using platinum as cathode and carbon as anode : [2]

(a) What do you observe at the cathode and at the anode?

(b) What change is noticed in the electrolyte?

(ii) Identify the salts P and Q from the observations given below : [2]

(a) On performing the flame test salt P produces a lilac coloured flame and its solution gives a white precipitate with silver nitrate solution, which is soluble in Ammonium hydroxide solution.

(b) When dilute HCl is added to a salt Q, a brisk effervescence is produced and the gas turns limewater milky. When NH_4OH solution is added to the above mixture (after adding dilute HCl), it produces a white precipitate which is soluble in excess NH_4OH solution

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

(a) Monochloro ethane is hydrolysed with aqueous KOH.

(b) A mixture of sodalime and sodium acetate is heated.

(c) Ethanol under high pressure and low temperature is treated with acidified potassium dichromate.

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

(a) Barium chloride solution is added to sodium sulphate solution.

(b) Neutral litmus solution is added to solution of carbon dioxide in water.

(c) Small piece of copper is placed in silver nitrate solution.

Question 6

(i) Define the following terms : [2]

(a) Ionization potential (b) Electron affinity

(ii) Calculate : [2]

The amount of each reactant required to produce 750 ml of carbon dioxide, when two volumes of carbon monoxide combine with one volume of oxygen to produce two volumes of carbon dioxide.

$$2CO + O_2 \rightarrow 2CO_2$$

(iii) Copy and complete the following table which refers to the **industrial method for the preparation** of ammonia and sulphuric acid: [3]

Name of the compound	Name of the process	Catalytic equation (with the catalyst)
Ammonia	(a) _____	(b) _____
Sulphuric acid	(c) _____	(d) _____

(iv) What property of sulphuric acid is shown by the reaction of concentrated sulphuric acid when heated with [3]

(a) Potassium nitrate (b) Carbon (c) Sugar

Question 7

(i) A compound gave a following data: [2]

C = 57.82%, O = 38.58% and the rest hydrogen. Its relative molecular mass is 166.

Find its empirical formula and molecular formula.

[C = 12, O = 16, H = 1]

(ii) Compare the properties of covalent and electrovalent compounds on the following points : [2]

(a) Solubility (b) Structure.

(iii) Calculate : [3]

(a) The number of moles in 12 g of oxygen gas. [O = 16]

(a) The weight of 10^{22} atoms of carbon.

[C = 12, Avogadro's No. = 6×10^{23}]

(iv) Identify **the acid** which matches the following description (a) to (c) : [3]

(a) The acid which is used in the preparation of a non-volatile acid.

(b) The acid which produces sugar charcoal from sugar.

(c) The acid which is prepared by catalytic oxidation of ammonia.

Question 8

(i) Draw an electron dot diagram to show the structure of hydronium ion. State the type of bonding present in it. [2]

(ii) How will you distinguish between following pairs of compounds using NH_4OH. [2]

(a) Zinc nitrate and lead nitrate.

(b) Iron(II) sulphate and iron(III) sulphate.

(iii) Name the particles (ions / molecules or both) present in : [3]

(a) Ammonium hydroxide solution (b) Dilute hydrochloric acid (c) Carbon tetrachloride

(iv) An element has an atomic number 16. State : [3]

(a) the period to which it belongs.

(b) the number of valence electrons.

(c) whether it is a metal or non-metal.

SOLUTION

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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) A chloride which forms a precipitate that is soluble in excess of ammonium hydroxide, is:
(a) Calcium chloride (b) Ferrous chloride (c) Ferric chloride (d) Copper chloride

(ii) If the molecular formula of an organic compound is $C_{10}H_{18}$ it is:
(a) alkene (b) alkane (c) alkyne (d) Not a hydrocarbon

(iii) Which of the following is a common characteristic of a covalent compound?
(a) high melting point (b) consists of molecules
(c) always soluble in water (d) conducts electricity when it is in the molten state

(iv) To increase the **pH** value of a neutral solution, we should add :
(a) an acid (b) an acid salt (c) an alkali (d) a salt

(v) Anhydrous iron (III) chloride is prepared by:
(a) direct combination (b) simple displacement (c) decomposition (d) neutralization

(vi) The salt solution which does not react with ammonium hydroxide is :
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(vii) The organic compound which undergoes ***substitution reaction*** is :
(a) C_2H_2 (b) C_2H_4 (c) $C_{10}H_{18}$ (d) C_2H_6

(viii) The electrolysis of acidified water is an example of :
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(ix) The IUPAC name of dimethyl ether is :
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(x) The catalyst used in the Contact Process is :
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(xi) An electrolyte which completely dissociates into ions is :
(a) Alcohol (b) Carbonic acid (c) Sucrose (d) Sodium hydroxide

(xii) The most electronegative element from the following elements is :

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(xiii) The reason for using Aluminium in the alloy duralumin is :

(a) Aluminium is brittle. (b) Aluminium gives strength.

(c) Aluminium brings lightness. (d) Aluminium lowers melting point.

(xiv) The drying agent used to dry HCl gas is :

(a) Conc. H_2SO_4 (b) ZnO (c) Al_2O_3 (d) CaO

(xv) A hydrocarbon which is a greenhouse gas is :

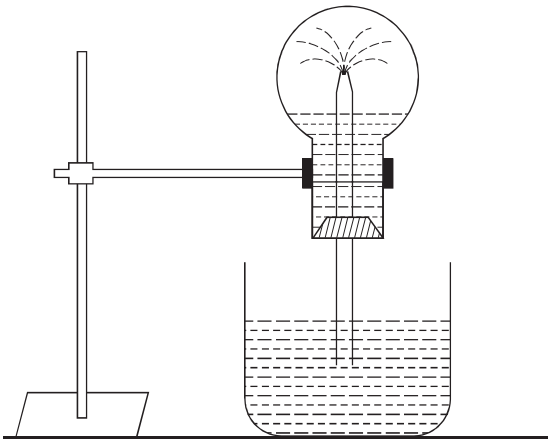
(a) Acetylene (b) Ethylene (c) Ethane (d) Methane

ANSWERS

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

Question 2

(i) The diagram shows a simple arrangement of the fountain experiment : [5]



(a) Name the two gases you have studied which can be used in this experiment.

(b) What is the common property demonstrated by this experiment?

(c) Name the drying agents which are used to dry the above mentioned gases during laboratory preparation.

Ans. (a) HCl gas and ammonia gas

(b) HCl and ammonia gases are extremely soluble in water.

(c) In case of HCl, conc. H_2SO_4 is used as drying agent while in case of NH_3, CaO is used as drying agent.

(ii) Match the descriptions (a) to (e) below with appropriate term from list 1 to 6. [5]

1. Neutral oxide **2.** Cation **3.** Hydrocarbons

4. Hygroscopic **5.** Alkynes **6.** Malleability

(a) The property possessed by metals by which they can be beaten into sheets.

(b) The process by which a substance absorbs moisture from air, but does not change its state.

(c) The compounds of carbon and hydrogen.

(d) A homologous series with general formula C_nH_{2n-2}.

(e) An oxide which is neither acidic nor basic in nature.

Ans. (a) **6.** [Malleability] (b) **4.** [Hygroscopic] (c) **3.** [Hydrocarbons]

(d) **5.** [Alkynes] (e) **1.** [Neutral oxide]

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

(a) In covalent compounds, the bond is formed due to the _____(sharing/transfer) of electrons.

(b) Electrovalent compounds have a _____ (low/high) boiling point.

(c) A molecule of _____contains a triple bond. (hydrogen, ammonia, nitrogen).

(d) Across a period the ionization potential _____ (increases, decreases, remains same).

(e) Down the group, electron affinity _____ (increases, decreases, remains same).

Ans. (a) sharing (b) high (c) nitrogen (d) increases (e) decreases

(iv) Identify the following : [5]

(a) Process by which ethane is obtained from ethene.

(b) A hydrocarbon which contributes towards the **greenhouse** effect.

(c) An organic compound whose functional group is carboxyl.

(d) An ore of zinc containing its sulphide.

(e) Reaction when an alkyl halide is treated with alcoholic potassium hydroxide.

Ans. (a) Ethane is obtained from ethene by the process of **addition** of two hydrogen atoms in the molecule of ethene.

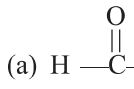
(b) **Methane** gas contributes towards the greenhouse effect.

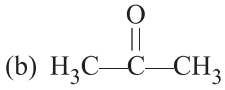
(c) Acetic acid.

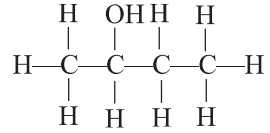
(d) Zinc blend (ZnS).

(e) The reaction is called **hydrolysis** of alkyl halide.

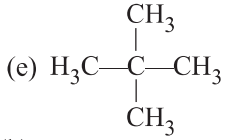
(v) Write the I.U.P.A.C. names of the following compounds : [5]

(a) 

(b) 

(c) 

(d)

(e) 

Ans. (a) Methanal (b) Propanone (c) Butan-2-ol

(d) Ethoxy Ethane (e) 2-2-dimethyl Propane

Section B

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

Question 3

(i) Identifying the cations in each of the following case : [2]

(a) NH_4OH solution when added to the solution (A) gives white precipitate which does not dissolve in excess.

(b) NaOH solution when added to the solution (B) gives white precipitate which is insoluble in excess.

Ans. (a) Plumbous (Pb^{2+}) ion

(b) Calcium (Ca^{2+}) ion

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

(a) $CuO + NH_3 \xrightarrow{heat}$

(b) $NH_4Cl + Ca(OH)_2 \xrightarrow{CaO}$

Ans. (a) $3CuO + 2NH_3 \xrightarrow{heat} 3Cu + 3H_2O + N_2(g)$

(b) $2NH_4Cl + Ca(OH)_2 \xrightarrow{CaO} CaCl_2 + 2H_2O + 2NH_3$

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

(a) Na, Li, K (increasing Ionisation Energy)

(b) F, Cl, Br (Increasing electronegativity)

(c) Na, K, Li (increasing atomic size)

Ans. (a) K, Na, Li (increasing ionisation energy)

(b) Br, Cl, F (increasing electronegativity)

(c) Li, Na, K (increasing atomic size)

(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) Choose the major metals to make the following alloys : [2]

(a) Stainless steel (b) Brass

Ans. (a) Iron and Chromium (b) Copper and Zinc

(ii) Name the gas evolved when the following mixtures are heated : [2]

(a) Calcium hydroxide and ammonium chloride

(b) Sodium nitrite and ammonium chloride

Ans. (a) Ammonia gas

(b) Nitrogen gas

(iii) (a) Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. [3]

(b) State why concentrated sulphuric acid is not used for drying ammonia gas.

(c) Why is ammonia gas not collected over water?

Ans. (a) $2NH_4Cl + Ca(OH)_2 \xrightarrow{\text{warm}} CaCl_2 + 2H_2O + 2NH_3(g)$

(b) Because ammonia gas reacts chemically with conc. sulphuric acid to form ammonium sulphate.
$2NH_3 + H_2SO_4(\text{conc.}) \rightarrow (NH_4)_2SO_4$

(c) Because ammonia gas is extremely soluble in water. However solubility of ammonia gas in hot water vapour is low.

(iv) Explain the following : [3]

(a) Sodium Chloride will conduct electricity only in fused or aqueous solution state.

(b) In the electroplating of an article with silver, the electrolyte sodium argento-cyanide solution is preferred over silver nitrate solution.

(c) Although copper is a good conductor of electricity, it is a non-electrolyte.

Ans. (a) It is because the ions can migrate towards opposite electrodes only, they are free to move, i.e., they are either in fused state or solution form.

(b) It is because silver nitrate has a tendency to hydrolyse, but not the silver argentocyanide. Furthermore silver nitrate solution is corrosive to metals like copper used for electroplating.

(c) In an electrolyte the conduction of electricity takes place due to migration of cations and anions. As no cations or anions are present in copper metal therefore it is not an electrolyte.

Question 5

(i) During the electrolysis of copper (II) sulphate solution using platinum as cathode and carbon as anode : [2]

(a) What do you observe at the cathode and at the anode?

(b) What change is noticed in the electrolyte?

Ans. (a) (1) On the cathode a thin layer of reddish copper metal is deposited.
(2) On the anode a colourless gas is evolved.
(b) The colour of electrolyte (blue) gradually fades.

(ii) Identify the salts P and Q from the observations given below : [2]
(a) On performing the flame test salt P produces a lilac coloured flame and its solution gives a white precipitate with silver nitrate solution, which is soluble in Ammonium hydroxide solution.
(b) When dilute HCl is added to a salt Q, a brisk effervescence is produced and the gas turns limewater milky. When NH_4OH solution is added to the above mixture (after adding dilute HCl), it produces a white precipitate which is soluble in excess NH_4OH solution

Ans. (a) The salt P is potassium chloride.
Reason: K^+ ions give lilac colour to flame and Cl^- ions react with silver nitrate to form silver chloride precipitate which is soluble in excess of ammonium hydroxide.
(b) The salt Q is Zinc carbonate.
Reason: CO_3^{-2} ions are responsible for the liberation of carbon dioxide with HCl. The salt formed is zinc chloride which forms white precipitate with ammonium hydroxide. This precipitate is soluble in excess of ammonium hydroxide.

(iii) Write balanced chemical equations for the following: [3]
(a) Monochloro ethane is hydrolysed with aqueous KOH.
(b) A mixture of sodalime and sodium acetate is heated.
(c) Ethanol under high pressure and low temperature is treated with acidified potassium dichromate.

Ans. (a) $C_2H_5Cl + KOH \longrightarrow C_2H_5OH + KCl$
(b) $CH_3COONa + NaOH \xrightarrow{CaO} Na_2CO_3 + CH_4$
(c) $C_2H_5OH + 2\,[O] \xrightarrow[K_2Cr_2O_7]{\text{Acidified}} CH_3COOH + H_2O$

(iv) State one relevant observation for each of the following reactions : [3]
(a) Barium chloride solution is added to sodium sulphate solution.
(b) Neutral litmus solution is added to solution of carbon dioxide in water.
(c) Small piece of copper is placed in silver nitrate solution.

Ans. (a) A thick white precipitate of barium sulphate is formed, which rapidly settles down to the base of test tube.
(b) The litmus solution changes to red colour.
(c) A silvery deposit is formed on copper and the solution gradually changes to blue colour.

Question 6

(i) Define the following terms : [2]
(a) Ionization potential (b) Electron affinity

Ans. (a) The energy required to remove an electron from an isolated gas atom, thereby, converting it into positively charged ion is called ionisation potential.
(b) The amount of energy released by an isolated gaseous atom of an element in its lowest state of energy by accepting an electron to form an ion is called **electron affinity**.

(ii) Calculate : [2]
The amount of each reactant required to produce 750 ml of carbon dioxide, when two volumes of carbon monoxide combine with one volume of oxygen to produce two volumes of carbon dioxide.

$$2CO + O_2 \rightarrow 2CO_2$$

Ans. $2CO + O_2 \longrightarrow 2CO_2$
2 vol. 1 vol. 2 vol. (By Gay Lussac's law)

750 ml $\frac{750\text{ ml}}{2}$ 750 ml

Thus, volume of carbon monoxide = 750 ml

Volume of oxygen gas = $\frac{750 \text{ ml}}{2}$ = 375 ml.

(iii) Copy and complete the following table which refers to the **industrial method for the preparation** of ammonia and sulphuric acid: [3]

Name of the compound	Name of the process	Catalytic equation (with the catalyst)
Ammonia	(a) _____	(b) _____
Sulphuric acid	(c) _____	(d) _____

Ans. (a) Haber's process

(b) $N_2 + 3H_2 \underset{200\,Atms-500\,Atms}{\overset{(Fe+Mo)\text{ at }450°C-500°C}{\rightleftharpoons}} 2NH_3 + 22{,}400$ cals

Catalyst – Finely divided iron (Fe)

Promoter – Molybdenum (Mo)

(c) Contact process

$2SO_2 + O_2 \underset{or\ V_2O_5-450°C}{\overset{\text{Platinised asbestos}}{\rightleftharpoons}} 2SO_3$

$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$

$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

(d) Catalyst – Platinised asbestos or vanadium pentoxide (V_2O_5)

(iv) What property of sulphuric acid is shown by the reaction of concentrated sulphuric acid when heated with [3]

(a) Potassium nitrate (b) Carbon (c) Sugar

Ans. (a) In case of KNO_3, the property shown is least volatile acid.

(b) In case of carbon, the oxidising property is shown.

(c) In case of sugar, the dehydrating property is shown.

Question 7

(i) A compound gave a following data: [2]

C = 57.82%, O = 38.58% and the rest hydrogen. Its relative molecular mass is 166.

Find its empirical formula and molecular formula.

[C = 12, O = 16, H = l]

Ans.

Element	Percentage weight	Atomic weight	Relative number of moles	Simple ratio of atoms
C	57.82	12	57.82 ÷ 12 = 4.82	4.82 ÷ 2.41 = 2 or, 2 × 2 = 4
O	38.58	16	38.58 ÷ 16 = 2.41	2.41 ÷ 2.41 = 1 or, 2 × 1 = 2
H	100 – (57.82 + 38.58) = 100 – 96.40 = 3.60	1	3.60 ÷ 1 = 3.60	3.60 ÷ 2.41 ≈ 1.5 or, 2 × 1.5 = 3

Thus, empirical formula of compound = $C_4H_3O_2$

So, empirical formula weight of $C_4H_3O_2$ = 4 × 12 + 3 × 1 + 2 × 16 = 48 + 3 + 32 = 83

Now, $n = \frac{\text{Molecular mass}}{\text{Empirical formula mass}} = \frac{166}{83} = 2$

Thus, Molecular formula = 2 × Empirical formula = 2 ($C_4H_3O_2$) = $C_8H_6O_4$.

(ii) Compare the properties of covalent and electrovalent compounds on the following points : [2]

(a) Solubility (b) Structure.

Ans. (a) Covalent compounds are generally insoluble in water, whereas the electrovalent compounds are generally soluble in water.

(b) Covalent compounds are generally gases, liquids or soft solids. However, electrovalent compounds are crystalline in nature.

(iii) Calculate : [3]

(a) The number of moles in 12 g of oxygen gas. [O = 16]

(a) The weight of 10^{22} atoms of carbon.

[C = 12, Avogadro's No. = 6×10^{23}]

Ans. (a) 32 g of oxygen gas = 1 mole

$\therefore$ 12 g of oxygen gas = $\frac{1}{32\,g} \times 12g$ mole = $\frac{3}{8}$ mole = 0.375 mole

(b) The weight of 6×10^{23} atoms of carbon = 12 g

$\therefore$ The weight of 10^{22} atoms of carbon = $\frac{12\,g}{6 \times 10^{23}} \times 10^{22} = \frac{2}{10}g$ = 0.2 g.

(iv) Identify **the acid** which matches the following description (a) to (c) : [3]

(a) The acid which is used in the preparation of a non-volatile acid.

(b) The acid which produces sugar charcoal from sugar.

(c) The acid which is prepared by catalytic oxidation of ammonia.

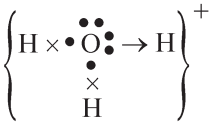
Ans. (a) Concentrated nitric acid. [When sulphur is heated with concentrated nitric acid, it produces non-volatile sulphuric acid.]

(b) Concentrated sulphuric acid.

(c) Nitric acid

Question 8

(i) Draw an electron dot diagram to show the structure of hydronium ion. State the type of bonding present in it. [2]

Ans.  Hydronium ion

Covalent and co-ordinate bonding are present in hydronium ion.

(ii) How will you distinguish between following pairs of compounds using NH_4OH. [2]

(a) Zinc nitrate and lead nitrate. (b) Iron(II) sulphate and iron(III) sulphate.

Ans. (a) Zinc nitrate will form a white gelatin like precipitate of zinc hydroxide which dissolves in excess of ammonia solution to form colourless solutions. Lead nitrate will form a white chalky precipitate of lead hydroxide, which is insoluble in excess of ammonium hydroxide.

(b) Iron (II) sulphate forms a dirty green precipitate, whereas Iron (III) sulphate forms a reddish brown precipitate with ammonium hydroxide.

(iii) Name the particles (ions / molecules or both) present in : [3]

(a) Ammonium hydroxide solution (b) Dilute hydrochloric acid (c) Carbon tetrachloride

Ans. (a) Ions and molecules both (b) Only ions (c) Only molecules

(iv) An element has an atomic number 16. State : [3]

(a) the period to which it belongs. (b) the number of valence electrons.

(c) whether it is a metal or non-metal.

Ans. The electron configuration of element is (2, 8, 6)

(a) The element belongs to third period. (b) The element has 6 valence electrons

(c) The element is a non-metal.

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