Solution for CHEMISTRY
(SCIENCE PAPER - 2)

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 (40 Marks)

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

Question 1

Choose the correct answers to the questions from the given options. [15]

(Do not copy the questions, write the correct answers only.)

(i) An element in period 3, whose electron affinity is zero:

(a) Neon

(b) Sulphur

(c) Sodium

(d) Argon

Answer: (d)

Argon belongs to period 3. It is an inert element and stable. It neither requires gain nor loss. It has its octet complete and hence it has the zero electron affinity.

(ii) An element with the largest atomic radius among the following is:

(a) Carbon

(b) Nitrogen

(c) Lithium

(d) Beryllium

Answer: (c)

For the elements belonging to one period, an increase in atomic number results in decrease in atomic radius. Therefore, the effective nuclear charge increases along a period and results in decreasing atomic radii.

So Li has the largest atomic radius.

(iii) The compound that is not an ore of aluminium:

(a) Cryolite

(b) Corundum

(c) Fluorspar

(d) Bauxite

Answer: (c)

Fluorspar is calcium fluoride having a chemical formula as CaF_2.

Bauxite - $Al_2O_3.2H_2O$

It is the main source of aluminium. It is composed of mainly aluminium-bearing minerals.

Corundum - Al_2O_3

It is an aluminium oxide. It occurs as a crystal in many colors. Along with aluminium, it contains traces of iron, titanium, vanadium and chromium.

Cryolite - Na_3AlF_6

It is a very rare aluminium halide mineral, which occurs as a colourless to white crystal.

(iv) The vapour density of CH_3OH is (At. Wt. C-12, H=1, 0=16)

(a) 32

(b) 18

(c) 16

(d) 34

Answer: (c)

Molecular mass of methyl alcohol = (1×12 + 3×1 + 16×1 + 1×1) = 32

Vapour density = $\frac{Molecular\ mass}{2}$ = $\frac{32}{2}$ = 16

(v) Which of the following reactions takes place at the anode during the electroplating of an article with silver?

(a) Ag-1e → Ag^{1+}

(b) Ag+1e → Ag^{1}-

(c) Ag-1e→ Ag

(d) None of the above

Answer: (a)

In electroplating with silver, oxidation reaction at anode takes place:

Ag - $1e^{-}$ → Ag^{1+}

(vi) The metallic hydroxide which forms a deep inky blue solution with excess ammonium hydroxide solution is:

(a) $Fe(OH)_2$

(b) $Cu(OH)_2$

(c) $Ca(OH)_2$

(d) $Fe(OH)_3$

Answer: (b)

Copper (II) hydroxide reacts with a solution of excess ammonia to form a deep blue solution of tetraamine copper complex ions. In the presence of oxygen it acts as a catalyst for oxidation of ammonia. It results in forming copper ammine nitrites.

The reaction can be given as,

$Cu(OH)_2 + 4NH_4OH \rightarrow [Cu(NH_3)_4](OH)_2 + 4H_2O \rightarrow Cu(NO_2)_2(NH_3)$

(vii) An example of a cyclic organic compound is:

(a) Propene

(b) Pentene

(c) Butene

(d) Benzene

Answer: (d)

From these four options, we can infer that a cyclic unsaturated carbon compound would have ring structure with at least one double or triple bond between the carbon atoms. One such compound is benzene. In benzene, six carbon atoms form a ring structure and there are three single and three double bonds between the carbon atoms. Hence, benzene can be taken as an example of a cyclic unsaturated carbon compound.

(viii) In the laboratory preparation, HCl gas is dried by passing through:

(a) dilute nitric acid

(b) concentrated sulphuric acid

(c) dilute sulphuric acid

(d) acidified water

Answer: (b)

The hydrogen chloride gas is passed through concentrated sulphuric acid to remove the moisture present in the gas. Due to its hygroscopic nature, concentrated sulphuric acid absorbs moisture from the air, dilutes, and acts as a drying agent. It has a high affinity for water, so it absorbs it quickly.

Thus, sulphuric acid acts as a dehydrating agent.

(ix) The nitrate which on thermal decomposition leaves behind a residue which is yellow when hot and white when cold:

(a) Lead nitrate

(b) Ammonium nitrate

(c) Copper nitrate.

(d) Zinc nitrate

Answer: (d)

Zinc nitrate is a colourless crystalline solid with the chemical formula $Zn(NO_3)_2$

When Zinc nitrate decomposes, it produces zinc oxide, a yellow-colored oxide of zinc when hot and white when cold.

$$Zn(NO_3)_2\ (s) \rightarrow ZnO\ (s) + 2NO_2\ (g) + O_2\ (g)$$

(x) The salt formed when concentrated sulphuric acid reacts with KNO_3 above 200°C:

(a) K_2SO_4

(b) K_2SO_3

(c) $KHSO_4$

(d) $KHSO_3$

Answer: (a)

When concentrated sulphuric acid reacts with KNO_3 above 200°C K_2SO_4 is formed.

$KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3$ (Below 200^0C)

$KNO_3 + H_2SO_4 \rightarrow K_2SO_4 + HNO_3$ (Above 200^0C)

(xi)

The property exhibited by concentrated sulphuric acid when it is used to prepare hydrogen chloride gas from potassium chloride:

(a) Dehydrating property

(b) Drying property

(c) Oxidizing property

(d) Non-volatile acid property

Answer: (d)

Concentrated sulphuric acid has a high boiling point (338 ^0C) and so, it is considered to be a non-volatile acid. It is therefore used for preparing volatile acids like hydrochloric acid, nitric acid and acetic acid from their salts by double decomposition.

(xii)

The hydrocarbon formed when sodium propanoate and soda lime are heated together:

(a) Methane

(b) Ethane

(c) Ethene

(d) Propane

Answer: (b)

When sodium propionate is heated with soda lime ethane is formed. This reaction is known as Decarboxylation reaction.

$CH_3CH_2COONa + Soda\ lime \rightarrow CH_3 - CH_3 + CO_2$

(xiii)

The acid which does not form acid salt by a basic radical:

(a) H_2CO_3

(b) H_3PO_4

(c) H_2SO_4

(d) CH_3COOH

Answer: (d)

Acetic acid is a weak acid which does not dissociate completely in water, so it does not form acid salt but forms a normal salt. While in comparison with acetic acid, the other three acids are strong.

(xiv) The general formula of hydrocarbons with single covalent bonds is:

(a) C_nH_{2n+2}

(b) C_nH_{2n}

(c) C_nH_{2n-2}

(d) C_nH_{2n-6}

Answer: (a)

The general formula of hydrocarbons with single covalent bonds is **C_nH_{2n+2}.**

(xv) The indicator which changes to pink colour in an alkaline solution is:

(a) Blue Litmus

(b) Methyl Orange

(c) Red Litmus

(d) Phenolphthalein

Answer: (d)

Phenolphthalein produces pink colour in an alkaline solution and colourless in an acidic solution.

Methyl orange changes its colour to yellow in an alkane solution.

Litmus paper turns from red to blue in alkaline solution.

Question 2

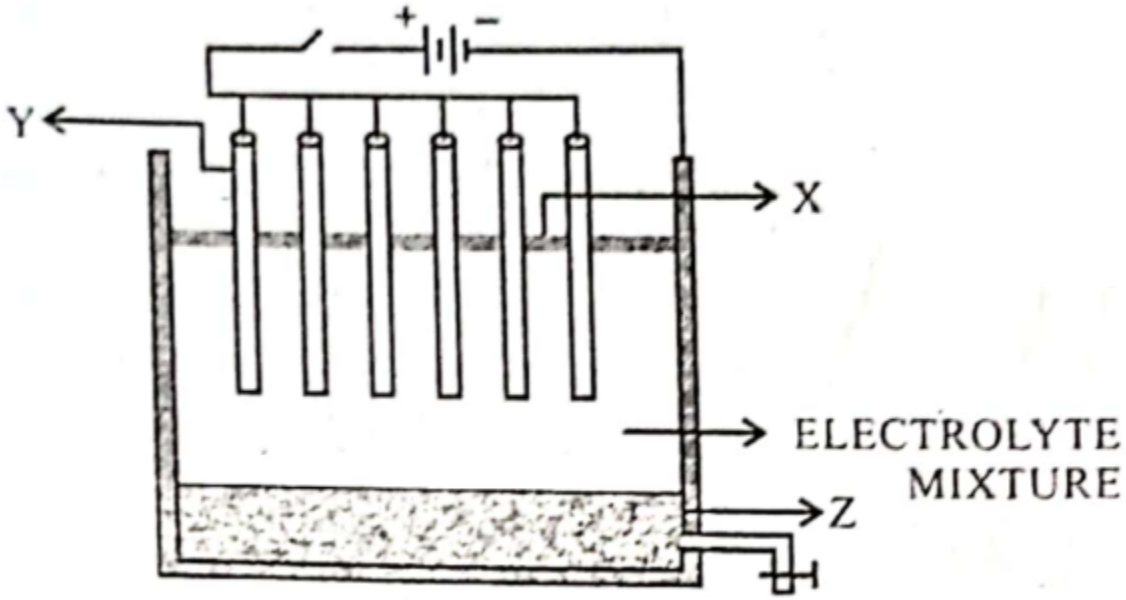
(i) Match the *Column A* with *Column B*:

Column A	**Column B**
(a) Sodium Chloride	1. Has two shared pair electrons
(b) Methane	2. Has high melting and boiling point
(c) Hydrogen chloride gas	3. A greenhouse gas
(d) Oxidation reaction	4. Has low melting and boiling point
(e) Water	5. $Zn - 2e^{-1} \rightarrow Zn^{2+}$
	6. $S + 2e^{-1} \rightarrow S^{2-}$

Answer:

Column A	**Column B**
(c) Sodium Chloride	2. Has high melting and boiling point
(d) Methane	3. A greenhouse gas
(c) Hydrogen chloride gas	4. Has low melting and boiling point
(d) Oxidation reaction	5. $Zn - 2e^{-} \rightarrow Zn^{2+}$
(e) Water	1. Has two shared pair electrons

(ii) The following sketch illustrates the process of conversion of **Alumina** to Aluminium: Study the diagram and answer the following:



(a) Name the constituent of the electrolyte mixture which has a divalent metal in it.

(b) Name the powdered substance 'X' sprinkled on the surface of the electrolyte mixture.

(c) What is the name of the process?

(d) Write the reactions taking place at the electrodes 'Y' (anode) and 'Z' (cathode) respectively.

Answer:

(a) The shown figure are the Hall-Heroult's process, the electrolyte taken in this diagram are - mixture of molten alumina 20%, cryolite 60%, and fluorspar 20%

(b) Powdered coke is sprinkled on the surface of the electrolyte

(c) It is Hall-Heroult's process

(d) The reaction taking place at anode and cathode are–

At cathode -

$4Al^{3+}$ (melt) + $12e^{-} \rightarrow 4Al(l)$

At anode-

$6O^{2-} - 12e^{-} \rightarrow 6[O]$

$3O + 3O \rightarrow 3O_2$

Anode is oxidised to carbon monoxide, which further forms carbon dioxide.

$2C + O_2 \rightarrow 2CO$

$2CO + O_2 \rightarrow 2CO_2$

(iii) Fill in the blanks with the choices given in the brackets:

(a) Metals are good _____ [oxidizing agents/reducing agents]

(b) Non-polar covalent compounds are _____ [good/bad] conductors of heat and electricity.

(c) Higher the pH value of a solution, the more is _____ [acidic / alkaline] it is.

(d) _____ [Silver chloride / Lead chloride] is a white precipitate that is soluble in excess of Ammonium hydroxide solution.

(e) Conversion of ethene to ethane is an example of_____ hydrogenation] [hydration/

Answer:

(a) Metals are good reducing agents

metals have low ionization energies and are relatively electropositive, and so they lose electrons easily. Therefore, metals are good reducing agents.

(b) Non-polar covalent compounds are bad conductors of heat and electricity.

Covalent compounds are generally poor conductors of electricity: During the formation of a covalent bond, when the electrons get shared within the bonds, hence, there are no electrons or ions available to conduct electricity.

(c) Higher the pH value of a solution, the more is alkaline it is

The more acidic is a solution, lesser will be its pH . The more alkaline is a solution, the higher will be its pH value.

(d) Silver chloride is a white precipitate that is soluble in excess of Ammonium hydroxide solution.

Observation when Ammonium hydroxide (NH_4OH) is added to Lead salts

1. When Ammonium hydroxide **(NH_4OH)** is added to Lead salts, a white precipitate is formed which is insoluble in excess of **NH_4OH**
2. So, the Lead salts are insoluble in excess of **NH_4OH**

Observation when Ammonium hydroxide **(NH_4OH)** is added to Silver salts

1. When Ammonium hydroxide **(NH_4OH)** is added to Silver salts, a white precipitate is formed which is soluble in excess of **NH_4OH**

   $AgCl(aq) \ 2NH_4OH(l) \rightarrow 2H_2O(l) + [Ag(NH_3)_2]Cl(aq)$

   So, Silver salts are soluble in excess of **NH_4OH**.

(e) Conversion of ethene to ethane is an example of **hydrogenation**

Conversion of Ethene (C_2H_4) to ethane (CH_3CH_3) is an example of Addition of hydrogen or hydrogenation.

When Hydrogen is added to Ethene , in the presence of Nickel or Platinum or Palladium as catalyst at 200^0C - 300^0C, Ethane is formed.

$$CH_2 = CH_2(g) + H_2(g) \rightarrow CH_3 - CH_3(g)$$

(iv) **State the terms/process for the following:**

(a) The energy released when an atom in the gaseous state accepts an electron to form an anion.
(b) Tendency of an element to form chains of identical atoms.
(c) The name of the process by which Ammonia is manufactured on a large scale.
(d) A type of salt formed by partial replacement of hydroxyl radicals with an acid radical.
(e) The ratio of the mass of a certain volume of gas to the same volume of hydrogen measured under the same conditions of temperature and pressure.

Answer:

(a) The energy released when an atom in the gaseous state accepts an electron to form an anion called **electron affinity or electron gain enthalpy.**

(b) Tendency of an element to form chains of identical atoms are called **catenation**.

(c) The name of the process by which Ammonia is manufactured on a large scale called Haber's process.

(d) A type of salt formed by partial replacement of hydroxyl radicals with an acid radical is **Basic salt.**

(e) The ratio of the mass of a certain volume of gas to the same volume of hydrogen measured under the same conditions of temperature and pressure is called **Vapour Density**.

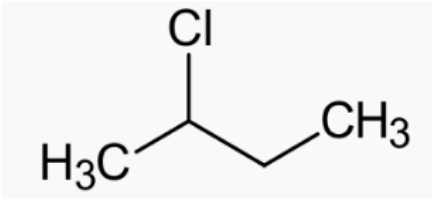
(v)

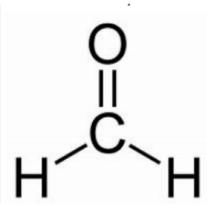
(a) Give the structural formula of the following organic compounds:

1. 2-chlorobutane
2. Methanal
3. But-2-yne

Answer:

1.

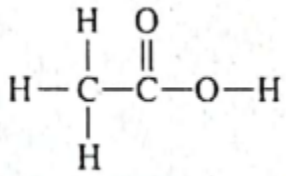


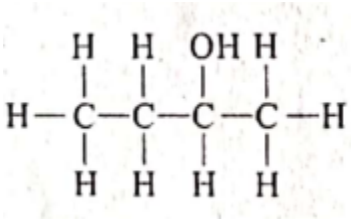
2. 

3. $H_3C—C\equiv C—CH_3$

(b) Give the IUPAC name of the following organic compounds:

1. 2.





Answer:

1. Ethanoic acid
2. Butan-2-ol Or 2-butanol.

SECTION - B (40 MARKS)

(Attempt any four questions from this Section.)

Question 3

(i) Identify the **cation** in each of the following cases:

(a) Ammonium hydroxide solution when added to Solution B gives a white precipitate which does not dissolve in excess of ammonium hydroxide solution.

(b) Sodium hydroxide solution when added to Solution C gives a white precipitate which is insoluble in excess of sodium hydroxide solution.

Answer:

When Lead nitrate (Solution B) reacts with ammonium hydroxide(NH_4OH), a white gelatinous precipitate is formed which is insoluble in excess of ammonium hydroxide.

$$Pb(NO_3)_2\ (aq) + 2NH_4OH\ (aq) \rightarrow Pb(OH)_2 \downarrow + 2NH_4NO_3\ (aq)$$

The white gelatinous precipitate is Lead hydroxide which is insoluble in excess of Ammonium hydroxide.

The cation present is Pb^{2+}.

(b) When Sodium hydroxide (NaOH) reacts with Calcium nitrate (Solution C), then a double displacement reaction takes place. Sodium nitrate($NaNO_3$) and Calcium

hydroxide($Ca(OH)_2$) is formed, out of which Calcium hydroxide precipitates as white precipitate which is insoluble in excess of Sodium hydroxide solution.

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

The cation present is Ca^{2+} ion.

(ii) Fill in the blanks by choosing the correct answer from the brackets:

(a) During electrolysis, the compound _____ in its molten state liberates reddish brown fumes at the anode. [NaCl/$PbBr_2$]

(b) The ion which could be discharged most readily during electrolysis is [Fe^{2+} /Cu^{2+}]

Answer:

(ii)

(a) During electrolysis, the compound **$PbBr_2$** in its molten state liberates reddish brown fumes at the anode.

(b) The ion which could be discharged most readily during electrolysis is **Cu^{2+}.**

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

(a) Al, K, Mg, Ca (decreasing order of its reactivity)

(b) N, Be, O, C (increasing order of non-metallic character)

(c) P. Si, F, Be (decreasing order of valence electrons)

Answer:

(a) K > Ca > Mg > Al

(b) Be < C < N < O

(c) F > P > Si > Be

(iv) Complete and balance the following equations:

(a) $NH_4Cl + Ca(OH)_2 \rightarrow$

(b) $CuSO_4 + NH_4OH \rightarrow$

(c) Cu + Conc. $HNO_3 \rightarrow$

Answer:

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

(b) $CuSO_4 + 2NH_4OH \rightarrow (NH_4)_2SO_4 + Cu(OH)_2$

(c) $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

Question 4

(i) State a relevant reason for the following:

(a) Hydrogen chloride gas cannot be dried over quick lime.

(b) Ammonia gas is not collected over water.

Answer:

(i)

(a) We know that Hydrogen chloride is acidic in nature whereas quick lime i.e. Calcium oxide is basic in nature.

If we use Calcium oxide for drying, then both will react to form a salt.

Therefore, quick lime is not used for drying Hydrogen chloride gas.

(b) In the laboratory preparation of ammonia, ammonia is collected by downward displacement of air. Ammonia gas can not be collected over water because this gas is highly soluble in water and due to its high solubility. We are unable to collect it over water.

Ammonia on reaction with water gives hydronium ions and ammonium ions.

Therefore, ammonia is collected over mercury.

(ii) Identify the alloy in each case from the given composition:

(a) aluminium, magnesium, manganese, copper

(b) iron, nickel, chromium, carbon

Answer:

(ii)

(a) Duralumin

(b) Stainless steel

(iii) Solve the following numerical problem.

Ethane burns in oxygen according to the chemical equation:

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

If 80 ml of ethane is burnt in 300 ml of oxygen, find the composition of the resultant gaseous mixture when measured at room temperature.

Answer:

According to the equation, at room temperature,

- 2 moles of ethane reacts with 7 moles of oxygen to produce 4 moles of carbon dioxide and 6 moles of water.

  Therefore,
- 2 mL of ethane reacts with 7 mL of oxygen to produce 4 mL of carbon dioxide and 6 mL of water.

  Then,
- 80 mL of ethane reacts with 280 mL of oxygen to produce 160 mL of carbon dioxide and 240 mL of water.

Here, ethane is the limiting reagent and 20 mL of oxygen will be left unreacted.
the composition of the resultant gaseous mixture when measured at room temperature will be:

20 mL of oxygen gas; 160 mL of carbon dioxide and 240 mL of water.

(iv) The following questions are pertaining to the laboratory preparation of Ammonia gas from Magnesium nitride:

(a) Write a balanced chemical equation for its preparation.

(b) Why is this method seldom used?

(c) How do you identify the gas formed?

Answer:

(iv)

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

(b) This method is not used as it is expensive.

(c) Litmus test: Ammonia gas is basic in nature.

It is soluble in water. Its aqueous solution can turn the red litmus paper to blue and no change will be observed if a blue litmus paper is used.

Other tests:

Ammonia gas when brought near Hydrochloric acid, reacts to form dense white fumes of Ammonium chloride.

Question 5

(i) Write one use of the following alloys:

(a) Bronze

(b) Fuse metal

Answer:

(a) Bronze is used in making statues.

(b) Fuse metal is used for Soldering purposes.

(ii) Draw the electron dot structure for the following:

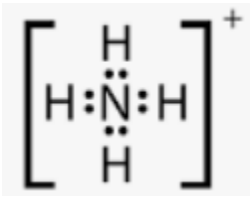
(a) Ammonium ion

(b) A molecule of nitrogen

[At. No.: N=7, H=1]

Answer:

(a)



(b)

(iii) Give a balanced chemical equation for the following conversions with conditions:

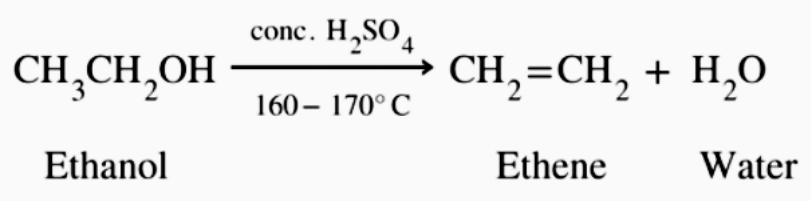
(a) Ethene from ethanol

(b) Ethyne from calcium carbide

(c) Monochloromethane from methane

Answer:

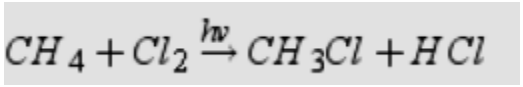
(a) When concentrated sulphuric acid is added to ethyl alcohol and the mixture is heated upto 170^0C, it causes dehydration of ethyl alcohol to give ethene.



(b) Calcium carbide reacts with water to produce colourless gas (Ethyne gas, C_2H_2) with sweet smelling (ether like odour). This reaction is exothermic.

$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2 \uparrow$

(c) Methane reacts with chlorine in diffused sunlight, or when heated to 600 K, to give monochloromethane



(iv) Study the following observations and name the anions present in each of the reactions.

(a) When a crystalline solid 'P' is warmed with concentrated H_2SO_4 and copper turnings a reddish brown gas is released.

(b) When few drops of dilute sulphuric acid is added to Salt 'R' and heated, a colourless gas is released which turns moist lead acetate paper silvery black.

(c) When few drops of barium nitrate solution is added to the salt solution 'Q', a white precipitate is formed which is insoluble in HCl.

Answer:

(a) Copper nitrate, when warmed with concentrated H_2SO_4 and copper turnings, releases reddish brown gas.

$Cu(NO_3)_2 + H_2SO_4 + Cu \rightarrow 2CuSO_4 + 2NO_2 + 2H_2O$

(b) When a few drops of dilute sulphuric acid are added to Sodium sulphide salt (Na_2S) and heated, Hydrogen sulphide (HCl), a colourless gas is released which turns moist lead acetate paper silvery black.

$Na_2S + H_2SO_4 \rightarrow Na_2SO_4 + H_2S\uparrow$

$(CH_3COO)_2Pb + H_2S \rightarrow PbS$ (Black in Colour) + CH_3COOH

(c) When few drops of barium nitrate solution are added to the Sodium sulphate solution', a white precipitate of Barium Sulphate is formed which is insoluble in HCl. The anion present in salt solution 'Q' is Sulphate ion (SO_4^{2-} ion)

Question 6

(i) Define / State:

(a) Electronegativity

(b) Gay-Lussac's Law of combining volumes

Answer:

(i)

(a) The tendency of an atom in a molecule to attract the shared pair of electrons towards itself is known as electronegativity.

(b) The law of combining volumes states that when gases react together to form other gases, and when all volumes are measured at the same temperature and pressure. The ratio between the volumes of the reactant gases and the gaseous products can be expressed in simple whole numbers.

(ii)

The Empirical formula of an organic compound is $CHCl_2$.

If its relative molecular mass is 168, what is its molecular formula?

(At. Wt. C=12, H = 1, CI = 35.5]

Answer

(ii)

Empirical formula mass of $CHCl_2$ = 12 + 1 + 35.5 × 2 = 84 amu

Multiplication factor (n) = $\frac{Molecular\ mass}{Empirical\ formula\ mass} = \frac{168}{84} = 2$

Molecular formula = $(Empirical\ Formula)_n = (CHCl_2)_2 = C_2H_2Cl_4$

(iii)

Choose the substances given in the box below to answer the following questions:

Iron	Magnesium sulphite	Zinc	Sodium sulphide
Lead	Ferric chloride	Copper	Ferrous sulphate

(a) The metal that will not produce hydrogen gas when reacted with dilute acids.

(b) The compound that will produce sulphur dioxide gas when reacted with dilute HCl.

(c) The solution of this compound produces dirty green precipitate with NaOH.

Answer:

(iii)

(a) Copper

(b) Sodium Sulphite

(c) Ferrous Sulphate

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

(a) To the copper nitrate solution, initially few drops of sodium hydroxide solution is added and then added in excess.

(b) Burning of ammonia in excess of oxygen.

(c) Dry ammonia gas is passed over heated PbO.

Answer:

(iv)

(a) When a few drops of sodium hydroxide solution are added to the copper nitrate solution, $Cu(OH)_2$ light blue colour ppt. is obtained. This is insoluble with excess NaOH

(b) Ammonia is a combustible gas used in the generation of thermal power. When ammonia reacts with oxygen, it produces nitrogen gas and water.

$$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$$

(c) Nitrogen gas is produced when dry ammonia gas is passed over heated PbO.

$$PbO + NH_3 \rightarrow Pb + N_2 + H_2O$$

Question 7

(i) Name the following:

(a) Organic compounds with same molecular formula but different structural formula.

(b) Group of organic compounds where the successive members follow a regular structural pattern, successive compounds differ by a 'CH_2' group.

Answer:

(a) Organic compounds with same molecular formula but different structural formula are called **Isomers.**

(b) Group of organic compounds where the successive members follow a regular structural pattern, successive compounds differ by a 'CH_2' group are known as **Homologous series.**

(ii) Give reason for the following:

(a) Ionisation potential decreases down a group.

(b) Ionic compounds do not conduct electricity in solid state.

Answer:

(ii)

(a) Atomic size increases and the attraction between the valence electron/s and nucleus decreases down the group. This decrease in the attraction between the valence electron/s and nucleus causes the drop in ionization potential down the group.

(b) Ionic compounds cannot conduct electricity when solid, as their ions are held in fixed positions and cannot move. Ionic compounds are conductors of electricity when molten or in solution, and insulators when solid. But ionic compounds do not conduct electricity in solid state.

(iii)

Calculate:

(a) The percentage of phosphorus in the fertilizer super phosphate $Ca(H_2PO_4)_2$ correct to 1 decimal point. [At. Wt. H=1, P=31, O=16, Ca=40]

(b) Write the empirical formula of C_8H_{18}.

Answer:

(a) Molecular mass of $Ca(H_2PO_4)_2$ = 40 + (1×2 + 31 + 16×4)×2 = 234 amu

Percentage of Phosphorus = $\frac{Mass\ of\ phosphorus\ in\ one\ molecule}{Molecular\ mass\ of\ compound}$

$= \frac{62}{234} \times 100 = 26.49\%$ or 26.5%

(b) Empirical formula for C_8H_{18} is C_4H_9.

(iv)

Answer the following questions with reference to electrorefining of copper:

(a) What is the anode made of?

(b) What do you observe at the cathode?

(c) Write the reaction taking place at the cathode.

Answer:

(iv)

(a) The anode is made of **impure copper**.

(b) The cathode becomes thicker with time when electrorefining is done. This happens due to the deposition of pure copper over the cathode.

(c) At the cathode, Copper ions are getting deposited over cathode.

$$Cu^{2+}\ (aq) + 2e^{-1} \rightarrow Cu\ (s)$$

Question 8

(i) Arrange the following according to the instructions given in brackets:

(a) C_2H_2, C_3H_6, CH_4, C_2H_4 (*In the increasing order of the molecular weight*)

(b) Cu^{2+}, Na^+, Zn^{2+}, Ag^+ (*The order of Preferential discharge at the cathode*)

Answer:

(i) (a) $CH_4 < C_2H_2 < C_2H_4 < C_3H_6$

(b) $Na^+ < Zn^{2+} < Cu^{2+} < Ag^+$

(ii) Differentiate between the following pairs based on the criteria given in the brackets:

(a) Cane sugar and hydrated copper sulphate [using concentrated H_2SO_4]

(b) Sulphuric acid and hydrochloric acid [type of salts formed]

Answer:

(ii) (a) **Reaction of concentrated H_2SO_4 with cane sugar:**

- When the concentrated sulphuric acid is poured on the cane sugar, it turns into a spongy mass of carbon. The spongy mass of carbon is called sugar charcoal.
- The concentrated sulphuric acid acts as a dehydrating agent which removes the hydration from the sugar.

Reaction of concentrated H_2SO_4 with hydrated copper sulphate:

- When concentrated Sulphuric acid (H_2SO_4) is added dropwise to the crystals of hydrated Copper sulphate ($CuSO_4 \cdot 5H_2O$), it changes the colour of hydrated copper Sulphate from blue to white.
- H_2SO_4 acts as a dehydrated agent, it removes the water molecule from the compound and forms the anhydrous Copper sulphate which has white colour.

(iii) Convert the following reactions into a balanced chemical equation:

(a) Ammonia to nitric oxide using oxygen and platinum catalyst.

(b) Sodium hydroxide to sodium sulphate using sulphuric acid.

(c) Ferrous sulphide to hydrogen sulphide using hydrochloric acid.

Answer:

(iii) (a)

$$4NH_3 + 5O_2 \xrightarrow[Pt]{800^\circ C} 4NO + 6H_2O + \Delta$$

(b) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

(c) $FeS + 2HCl \rightarrow FeCl_2 + H_2S$

(iv) Choose the answer from the list which fits in the description:

[CCl_4, PbO, NaCl, CuO, NH_4Cl]

(a) A compound which undergoes thermal dissociation.

(b) An amphoteric oxide.

(c) A compound which is a non-electrolyte.

Answer:

(iv)

(a) Ammonium chloride(NH_4Cl), a sublimable solid undergoes thermal dissociation on heating and forms ammonia and hydrogen chloride.

$$NH_4Cl + \text{Heating} \rightarrow NH_3 + HCl$$

(b) Lead (II) oxide can react with acids as well as bases, so it is an amphoteric oxide.

(c) Carbon tetrachloride is a non-electrolyte as it is a Non-polar covalent compound. Nonelectrolytes are substances that do not conduct electricity in their molten state or when they are dissolved in a solvent.