ICSE SEMESTER 2 EXAMINATION

SPECIMEN QUESTION PAPER

CHEMISTRY

(SCIENCE PAPER 2)

Maximum Marks: 40

Time allowed: One and a half hours

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 10 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.

---

*Attempt **all** questions from **Section A** and **any three** questions from **Section B**.*

The intended marks for questions or parts of questions are given in brackets [ ].

SECTION A

*(Attempt **all** questions.)*

Question 1

Choose the correct answers to the questions from the given options. (Do not copy the question, Write the correct answer only.) [10]

(i) The IUPAC name of Ethylene is:

(a) Propane

(b) Propyne

(c) Ethene

(d) Ethyne

(ii) Carbon to carbon double bond is found in:

(a) 2-butylene

(b) Acetaldehyde

(c) Acetic acid

(d) Ethyl alcohol

(iii) Fused alumina is reduced to aluminium by electrolytic reduction, since:

(a) Alumina is highly stable

(b) Alumina is least stable

(c) Alumina is not reduced by drying agents.

(d) Alumina is not reduced by reducing agents.

(iv) The catalyst preferred in the conversion of Sulphur dioxide to Sulphur trioxide is:

(a) Finely divided iron

(b) Graphite

(c) Vanadium pentoxide

(d) platinum

(v) Substitution reaction is a characteristic property of:

(a) Alcohols

(b) Alkanes

(c) Alkenes

(d) Alkynes

(vi) The gas evolved when dilute sulphuric acid reacts with iron sulphide:

(a) Sulphur dioxide

(b) Carbon dioxide

(c) Hydrogen sulphide

(d) Nitrogen dioxide

(vii) An acid obtained from concentrated nitric acid on reaction with Sulphur:

(a) Carbonic acid

(b) Sulphuric acid

(c) Nitric acid

(d) Hydrochloric acid

(viii) The hydroxide soluble in excess of ammonium hydroxide is:

(a) Zinc hydroxide

(b) Lead hydroxide

(c) Magnesium hydroxide

(d) Ferrous hydroxide

(ix) The chemical name of the principal ore of aluminium:

(a) Sodium aluminium fluoride

(b) Aluminium oxide

(c) Hydrated Aluminium fluoride

(d) Hydrated aluminium oxide

(x) A hydrocarbon which is a greenhouse gas.

(a) Acetylene

(b) Ethylene

(c) Ethane

(d) Methane

SECTION B

*(Attempt **any three** questions from this Section.)*

Question 2

(i) Define: [2]

(a) Catenation

(b) Alloy

(ii) Name the compound formed when: [2]

(a) Ethene reacts with hydrogen in the presence of a catalyst.

(b) Bauxite reacts with sodium hydroxide

(iii) Draw the structural diagram of: [3]

(a) Propanal

(b) Ethanoic acid

(c) 1,2 dichloroethane

(iv) Complete and balance the following chemical equations: [3]

(a) $C_2H_6 + O_2 \rightarrow$

(b) $C_2H_2 + I_2 \rightarrow$

(c) $NH_3 + HCl \rightarrow$

Question 3

(i) Identify the anion present in the following compounds. [2]

(a) Compound Z which on reacting with dilute sulphuric acid liberates a gas which has no effect on acidified potassium dichromate but turns lime water milky.

(b) The solution of Compound L on reacting with freshly prepared ferrous sulphate solution followed by addition of few drops of concentrated sulphuric acid to the reactants along the sides of a test tube forms a brown ring at the junction of the two liquids.

(ii) State the following: [2]

(a) The drying agent used in the laboratory preparation of HCl gas.

(b) Products formed when ammonia is burnt in excess of oxygen.

(iii) State the observation for the following, when: [3]

(a) Manganese dioxide reacts with concentrated HCl.

(b) A glass rod dipped in concentrated HCl acid is brought near ammonia gas.

(c) Concentrated sulphuric acid is added to carbon.

(iv) Write balanced equation for the following conversions: [3]

(a) Lead sulphate from lead nitrate and sulphuric acid.

(b) Nitrogen tri chloride from ammonia.

(c) Sodium chloride from sodium sulphite and dilute hydrochloric acid.

Question 4

(i) State the relevant reason for the following: [2]

(a) A layer of powered coke is used over the electrolytic mixture in Hall Heroult's process.

(b) Graphite anodes are continuously replaced during the electrolysis of alumina.

(ii) Name the alloys for the given composition: [2]

(a) Magnesium and aluminium

(b) Magnesium + Manganese + Aluminium + Copper

(iii) Identify the terms for the following: [3]

(a) The experiment which demonstrates high solubility of ammonia gas.

(b) A method used to collect HCl gas.

(c) The electrode where reduction takes place.

(iv) Complete the table given below: [3]

Name of the process	Reactants	Acid product formed
(a) _____	Nitrogen dioxide + water + oxygen	(b) _____
(c) _____	Oleum + water	Sulphuric acid

Question 5

(i) Write the balanced chemical equation to show the concentration of ore in Baeyer's process. [2]

(a) Sodium aluminate to aluminium hydroxide

(b) Aluminium hydroxide to alumina

(ii) Select the correct answer from the brackets to complete the following statements: [2]

(a) The catalyst used in the oxidation of ammonia is _____ [zinc / platinum].

(b) The product formed when ammonia reacts with oxygen is _____ [nitric oxide / nitrous oxide]

(iii) Name the following organic compound: [3]

(a) The compound with 3 carbon atoms whose functional group is a carboxylic acid.

(b) The first homologue whose general formula is C_nH_{2n}.

(c) The compound formed by complete chlorination of ethyne.

(iv) Answer the following questions related to the laboratory preparation of the hydrogen chloride gas: [3]

(a) Why is sodium chloride preferred to other metallic chlorides?

(b) State the temperature required in the preparation.

(c) Write the chemical equation.

Question 6

(i) Distinguish between the following: [2]

(a) Dilute HCl and dilute HNO_3[using silver nitrate solution]

(b) Dilute HCl and dilute H_2SO_4[using lead nitrate solution]

(ii) Give one word for the following statements: [2]

(a) Naturally occurring minerals from which metals are extracted.

(b) Organic compounds having the same molecular formula but different Structural formula.

(iii) A, B and C are the chemical properties of sulphuric acid: [3]

A. Oxidizing agent

B. Dehydrating agent

C. Non volatile acid

Match the following equations 1 to 3 to the above chemical properties of sulphuric acid.

1. $KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3$

2. $C_{12}H_{22}O_{11} \rightarrow 12C + 11H_2O$

3. $S + 2H_2SO_4 \rightarrow 2H_2O + 3SO_2$

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

Homologous series	Alkane	Alkyne
General formula	C_nH_{2n+2}	1. _____
IUPAC name	2. _____	Ethyne
Common name	Marsh gas	3. _____

Answers

Section-A

Answer 1.

(i) (c) Ethene

Explanation :

Ethylene is the common name of ethene. Its structure is given by $CH_2 = CH_2$. Ethene is called ethylene because it looks like an ethyl group having a double bond between the two carbon atoms.

(ii) (a) 2-Butylene

Explanation :

Structure of 2-butylene contains a double bond between the two carbon atoms. It can also be verified directly by its IUPAC name. As its name contains 'ene' as a suffix, this means it contains a double bond. On the other hand, acetaldehyde contains an aldehyde group; acetic acid is common name of ethanoic acid which contains a carboxylic group; and ethyl alcohol contains an alcoholic group.

(iii) (a) Alumina is highly stable

Explanation :

Alumina or aluminium oxide (Al_2O_3) is a very stable compound as it has great affinity for oxygen. Therefore, it is not reduced by common reducing agents like carbon, hydrogen or carbon monoxide. Hence it is reduced by electrolytic reduction known as Hall Heroult's process.

(iv) (c) Vanadium pentoxide

Explanation :

Vanadium pentoxide is appropriate catalyst which is preferred over platinum in conversion of sulphur dioxide to sulphur trioxide because platinum is more expensive and get easily poisoned with impurities.

(v) (b) Alkanes

Explanation :

Alkanes undergoes substitution reaction with halogens like chlorine, bromine, iodine in presence of sunlight or ultraviolet light to give respective alkyl halides as a product.

(vi) (c) Hydrogen Sulphide

Explanation :

Iron sulphide reacts with dilute sulphuric acid to give ferrous sulphate and hydrogen sulphide (H_2S) gas. The reaction is given as

$$FeS + H_2SO_4 \rightarrow FeSO_4 + H_2S\ (\uparrow)$$

(vii) (b) Sulphuric acid

Explanation :

Concentrated nitric acid reacts with sulphur to give H_2SO_4, water and nitrogen dioxide gas. Therefore,

the acid obtained during this reaction is sulphuric acid. The reaction is given as:

$$S + 6HNO_3 \rightarrow H_2SO_4 + 2H_2O + 6NO_2$$

(viii) (a) Zinc hydroxide

Explanation :

Zinc hydroxide ($Zn(OH)_2$) is amphoteric in nature, *i.e.*, it can react with both acid and base. Excess of ammonium hydroxide can easily dissolve zinc hydroxide.

(ix) (d) Hydrated aluminium oxide

Explanation :

The principal ore of aluminium is bauxite having molecular formula $Al_2O_3.2H_2O$. Since it contains two molecules of water of crystallisation therefore its chemical name is hydrated aluminium oxide.

(x) (d) Methane

Explanation :

Methane gas (CH_4) absorbs outgoing heat radiation from the earth and hence is a greenhouse gas which leads to change in temperature and climate of earth's atmosphere. It is a primary component of natural gas.

Section-B

Answer 2.

(i) **(a) Catenation:** The self-linking property of atoms of an element to form very long straight or branched chains and cyclic rings is known as catenation. This property is shown by carbon whose small size and tetravalency helps it to form large structures by self-linking.

(b) Alloy: A homogeneous mixture of two or more metals or metals with non-metals is known as alloy. For example- Duralumin is a homogeneous mixture of aluminium, copper, magnesium and manganese.

(ii) (a) Ethane

Explanation :

When ethene reacts with hydrogen in presence of suitable catalyst like Ni at about 150°C temperature then ethane is formed, i.e., saturated compound is formed from unsaturated compound. This reaction is known as hydrogenation of ethene and is given as

$$CH_2 = CH_2 + H_2 \xrightarrow[150°C]{Ni} CH_3 - CH_3$$

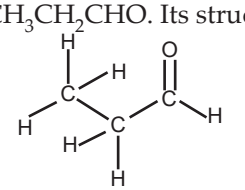
(b) Sodium meta aluminate

Explanation :

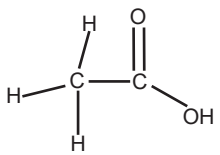
Bauxite reacts with sodium hydroxide at 140°C – 150°C to give sodium meta aluminate and water. Also, insoluble impurities are left behind as mud which consists ferric oxide, sand, etc. The reaction is given as:

$$Al_2O_3.2H_2O(s) + 2NaOH(aq) \rightarrow 2NaAlO_2(aq) + 3H_2O$$

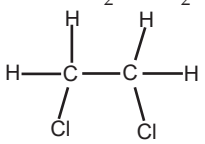
(iii) (a) The propanal consists of three carbon atoms and an aldehyde as a functional group. Its molecular formula is given by C_3H_6O or CH_3CH_2CHO. Its structure is given as:



(b) Ethanoic acid consists of two carbon atoms and carboxylic acid as a functional group. Its molecular formula is CH_3COOH. Its structure is given as:



(c) 1,2-Dichloroethane has only two carbon atom and two chlorine atoms one at each carbon atom. Its molecular formula is $C_2H_4Cl_2$ or $ClCH_2—CH_2Cl$. Its structure is given as:



(iv) (a) $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

Explanation :

When hydrocarbons are heated in presence of oxygen then combustion reaction takes place giving carbon dioxide gas, water and heat and light energy.

(b) $C_2H_2 + I_2 \rightarrow C_2H_4I_2$

Explanation :

When ethene (C_2H_2) reacts with iodine then addition reaction takes place leading to attachment of iodine on both sides. The product formed is 1,2-Di-iodoethane or Ethylene iodide.

(c) $NH_3 + HCl \rightarrow NH_4Cl$

Explanation :

When ammonia gas is added to hydrochloric acid then ammonium chloride is produced whose presence can be detected by formation of white fumes.

Answer 3.

(i) (a) Carbonate ion (CO_3^{2-})

Explanation :

Compound Z is a salt of carbonate (CO_3^{2-}) or bicarbonate (HCO_3^-). Carbonates and bicarbonates react with dilute sulphuric acid to give metallic sulphate, water and carbon dioxide gas. This gas has no effect on acidified potassium dichromate but it turns lime water milky which confirms the evolution of carbon dioxide gas during the reaction.

(b) Nitrate ion (NO_3^-)

Explanation :

The formation of brown ring at the junction of the two liquids indicates the brown ring test which is generally performed to test the presence of nitrate ion (NO_3^-). Hence the compound L must contain the nitrate ion in order to give brown ring on reacting with ferrous sulphate followed by addition of sulphuric acid along the sides of the test tube.

(ii) (a) The drying agent used in laboratory preparation of HCl gas is concentrated sulphuric acid. As sulphuric acid is non-volatile in nature therefore it helps in removing the moisture and hence act as drying agent.

(b) Ammonia burns with yellowish green flame in excess of oxygen. The products obtained during this reaction are nitrogen gas and water. The reaction is given as:

$$4NH_3 + 3O_2 \text{ (excess)} \rightarrow 2N_2 + 6H_2O$$

(iii) (a) When manganese dioxide gas reacts with concentrated HCl then liberation of greenish – yellow gas is observed. This gas is chlorine which turns moist iodide starch paper blue black. The reaction is given as:

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$

(b) When a glass rod dipped in HCl is brought near to the ammonia gas then thick white fumes coming out of the glass rod is observed. These white fumes are observed due to the formation of ammonium chloride gas. The reaction is given as:

$$NH_3 + HCl \rightarrow NH_4Cl$$

(c) Sulphuric acid is a strong oxidising agent. When it is added to carbon it oxidises carbon and evolution of colourless gas is observed. This gas is carbon dioxide along with sulphur dioxide gas. The reaction is given as:

$$C + 2H_2SO_4 \rightarrow CO_2\uparrow + 2H_2O + 2SO_2\uparrow$$

(iv) (a) The reaction of lead nitrate with sulphuric acid to give lead sulphate is given as:

$$Pb(NO_3)_2 + H_2SO_4 \rightarrow PbSO_4 + 2HNO_3$$

(b) The reaction of ammonia with excess of chlorine gives yellow coloured highly explosive liquid nitrogen trichloride. The reaction is given as:

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

(c) The reaction of sodium sulphite with dilute hydrochloric acid gives sodium chloride, water and sulphur dioxide gas. The reaction is given as:

$$Na_2SO_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2\ (\uparrow)$$

Answer 4.

(i) (a) A layer of powdered coke is used over the electrolytic mixture in Hall Heroult's process due to following reason:

(I) It prevents burning of anode.

(II) It reduces heat loss by radiation.

(b) Oxidation process takes place at anode. In this process oxygen is released which oxidises the anode made up of graphite to carbon monoxide which further oxidises to give carbon dioxide. Therefore, the anode is needed to be replaced from time to time.

(ii) (a) Magnalium

Explanation :

Magnalium is an alloy of aluminium in which homogeneous mixture of aluminium and magnesium is made. This alloy is light and strong in nature.

(b) Duralumin

Explanation :

Duralumin is an alloy of aluminium in which a homogeneous mixture of aluminium, copper, magnesium and manganese is made. It is light in nature but as strong as steel.

(iii) (a) Fountain Experiment

Explanation :

The high solubility of ammonia gas in water can be demonstrated by performing the fountain test in which fountain of litmus solution is obtained when ammonia dissolves in water.

(b) Upward displacement of air (or downward delivery)

Explanation :

HCl gas is heavier than air therefore it is collected by displacing air from downward position to upward position. The HCl gas is collected at the bottom of the container. This process is known as upward displacement of air.

(c) Cathode

Explanation :

The cathode is a negatively charged electrode in electrolytic process where reduction takes place. This electrode is rich in electrons therefore it helps cation to gain electrons and undergo a reduction reaction.

(iv) (a) Fixation of atmospheric nitrogen.

Explanation :

The reaction of nitrogen dioxide with water and oxygen is the last step of the preparation of nitric acid from atmospheric nitrogen gas. The conversion of free atmospheric nitrogen into useful nitrogenous compounds in the soil is called fixation of atmospheric nitrogen.

(b) Nitric acid

Explanation :

The reaction of nitrogen dioxide with water and oxygen gives nitric acid. The reaction is given as:

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

(c) Contact process

Explanation :

Contact process is the process used for the manufacturing of sulphuric acid at industrial scale. The given reaction is the last step of the contact process in which oleum is diluted to give sulphuric acid.

Answer 5.

(i) (a) $NaAlO_2 + 2H_2O \rightarrow NaOH + Al(OH)_3 (\downarrow)$

Explanation :

Sodium aluminate on hydrolysis at 50°C gives sodium hydroxide and precipitates of aluminium hydroxide. This step is done in order to remove the impurities.

(b) $2Al(OH)_3 \rightarrow Al_2O_3 + 3H_2O$

Explanation :

Aluminium hydroxide upon heating at 1000°C gives alumina, *i.e.*, aluminium oxide and water.

(ii) (a) Platinum

Explanation :

The catalyst used in catalytic oxidation of ammonia is platinum whereas zinc is not suitable for this purpose as it can react with ammonia in presence of moisture.

(b) Nitric oxide

Explanation :

When ammonia is oxidised in presence of suitable catalyst then nitrous oxide (NO) is formed. The reaction is given as:

$$4NH_3 + 5O_2 \rightarrow 4NO (\uparrow) + 6H_2O$$

(iii) (a) Propanoic acid

Explanation :

As the compound consist of 3 carbon atoms therefore its IUPAC name will start from propane. The suffix for functional group carboxylic acid is 'oic acid'. This suffix is added to base name by removing letter '*e*'. Therefore, the final name is propanoic acid.

(b) Ethene

Explanation :

C_nH_{2n} is the general formula for the homologous series of alkene. The first member of alkene family is the compound having two carbon atoms which is known as ethene. Methene is not possible as at least two carbons are required for the formation of double bond.

(c) 1,1,2,2-Tetrachloro ethane

Explanation :

The complete reaction of ethyne with chlorine gives 1,1,2,2-Tetrachloro ethane. The reaction in steps is given as:

(I) $C_2H_2 + Cl_2 \rightarrow ClCH = CHCl$

(II) $ClCH = CHCl + Cl_2 \rightarrow Cl_2CH - CHCl_2$

(iv) (a) Sodium chloride also known as common salt is cheap and easily available. Therefore, it is used over other metallic chlorides in the preparation of hydrogen chloride.

(b) The temperature used during the laboratory preparation of hydrogen chloride is nearly 200°C. The temperature above 200°C is not preferred as it can lead to breakage of glass apparatus and wastage of fuel.

(c) The chemical reaction of sodium chloride with sulphuric acid is given as:

$$NaCl + H_2SO_4 \rightarrow HCl(\uparrow) + NaHSO_4$$

Answer 6.

(i) (a) We can distinguish between dilute HCl and dilute HNO_3 using silver nitrate. Dilute HCl reacts with silver nitrate solution to give white precipitate of silver chloride. On the other hand, dilute HNO_3 does not reacts with silver nitrate. The reaction of HCl with $AgNO_3$ is given below:

$$HCl + AgNO_3 \rightarrow AgCl\ (\downarrow) + HNO_3$$

(b) Both dilute HCl and dilute H_2SO_4 will react with lead nitrate to give white precipitates of lead chloride and lead sulphate respectively. In order to distinguish them, both are added to hot water. The $PbCl_2$ precipitates dissolve in hot water while $Pb(SO_4)_2$ precipitates does not dissolve in hot water. The reactions involved are given as:

$2HCl + Pb(NO_3)_2 \rightarrow PbCl_2\ (\downarrow) + 2HNO_3$

$H_2SO_4 + Pb(NO_3)_2 \rightarrow PbSO_4\ (\downarrow) + 2HNO_3$

(ii) (a) Ores

Explanation :

Ores are those naturally occurring minerals from which the metals can be extracted commercially at comparatively low cost and with minimum effort.

(b) Isomers

Explanation :

More than one structure can be drawn from same molecular formula. For example, three different structures can be drawn from pentane (C_5H_{12}). These different structures having same molecular formula are called isomers.

(iii) The chemical properties of sulphuric acid along with their correct chemical equation is given below in the table:

Chemical Properties	Chemical Equations
A. Oxidizing agent	3. $S + 2H_2SO_4 \rightarrow 2H_2O + 3SO_2$
B. Dehydrating agent	2. $C_{12}H_{22}O_{11} \rightarrow 12C + 11H_2O$
C. Non-volatile acid	1. $KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3$

Explanation :

(A) Sulphuric acid is a strong oxidising agent which means it can easily add oxygen to other elements or compounds. So, it is used to oxidise sulphur to sulphur dioxide.

(B) Sulphuric acid is a very strong acid therefore it can easily remove water from carbohydrates like sucrose ($C_{12}H_{22}O_{11}$). In this reaction pure form of carbon is obtained along with water.

(C) Sulphuric acid has high boiling point therefore it is considered as almost non-volatile in nature and hence this property is used in manufacturing of other volatile mineral acids like HNO_3. Therefore, reaction of sulphuric acid with potassium nitrate represents the non-volatile character of sulphuric acid.

(iv) 1. C_nH_{2n-2}

Explanation :

The general formula of alkyne is C_nH_{2n-2}. Due to the presence of triple bond four hydrogens are removed from the molecular formula of alkane. For example, in case of ethyne the two carbons have already formed triple bond therefore they only need one more bond in order to complete their octet.

2. Methane

Explanation :

The IUPAC name of the first member of alkane family is methane. Also, the common name given in the table is Marsh gas which is common name of methane gas.

3. Acetylene

Explanation :

The common name of ethyne is acetylene as it contains acetyl group. This name was coined by a French chemist (Marcelin-Pierre-Eugene Berthelot) in 1864.

❑❑