ICSE Question Paper (2013)

CHEMISTRY

SECTION–I   (40 Marks)

*Attempt **all** questions from this Section*

Question 1.

(a) *From the list given below, select the word(s) required to correctly complete blanks (i) to (v) in the following passage. The words from the list are to be used only once. Write the answers as (a) (i), (ii), (iii) and so on. Do not copy the passage.*

[ammonia, ammonium, carbonate, carbon dioxide, hydrogen, hydronium, hydroxide, precipitate, salt water] :

    (i) *A solution **M** turns blue litmus red, so it must contain (i) .... ions; another solution **O** turns red litmus blue and hence, must contain (ii) .... ions.*

    (ii) *When solutions **M** and **O** are mixed together, the products will be (iii) .... and (iv) ....*

    (iii) *If a piece of magnesium was put into a solution **M**, (v) .... gas would be evolved.* **[5]**

(b) *Identify the gas evolved in the following reactions when :*

    (i) *Sodium propionate is heated with soda lime.*

    (ii) *Potassium suphite is treated with dilute hydrochloric acid.*

    (iii) *Sulphur is treated with concentrated nitric acid.*

    (iv) *A few crystals of KNO_3 are heated in a hard glass test tube.*

    (v) *Concentrated hydrochloric acid is made to react with manganese dioxide.* **[5]**

(c) *State one appropriate observation for each of the following :*

    (i) *Concentrated sulphuric acid is added drop wise to a crystal of hydrated copper sulphate.*

    (ii) *Copper sulphide is treated with dilute hydrochloric acid.*

    (iii) *Excess of chlorine gas is reacted with ammonia gas.*

    (iv) *A few drops of dilute hydrochloric acid are added to silver nitrate solution, followed by addition of ammonium hydroxide solution.*

    (v) *Electricity is passed through molten lead bromide.* **[5]**

(d) *Give suitable chemical terms for the following :* **[5]**

    (i) *A bond formed by a shared pair of electrons with both electrons coming from the same atom.*

    (ii) *A salt formed by incomplete neutralisation of an acid by a base.*

    (iii) *A reaction in which hydrogen of an alkane is replaced by a halogen.*

    (iv) *A definite number of water molecules bound to some salts.*

(v)   The process in which a substance absorbs moisture from the atmospheric air to become moist, and ultimately dissolves in the absorbed water.

(e)   Give a chemical test to distinguish between the following pairs of compounds :   **[5]**

(i)   Sodium chloride solution and sodium nitrate solution.

(ii)   Hydrogen chloride gas and hydrogen sulphide gas.

(iii)   Ethene gas and ethane gas.

(iv)   Calcium nitrate solution and zinc nitrate solution.

(v)   Carbon dioxide gas and sulphur dioxide gas.

(f)   Choose the most appropriate answer from the following options :   **[10]**

(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 a 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 a non-electrolyte ?
- (A)   Liquid carbon tetrachloride
- (B)   Acetic acid
- (C)   Sodium hydroxide aqueous solution acid
- (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)   Sulphur 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 the above

(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*

(g) *Solve the following :*

(i) *What volume of oxygen is required to burn completely 90 dm³ of butane under similar conditions of temperature and pressure ?* **[2]**

$$2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$$

(ii) *The vapour density of a gas is 8. What would be the volume occupied by 24.0g of the gas at STP ?* **[2]**

(iii) *A vessel contains **X** number of molecules of hydrogen gas at a certain temperature and pressure. How many molecules of nitrogen gas would be present in the same vessel under the same conditions of temperature and pressure ?* **[1]**

Answer.

(a) (i) Hydronium (ii) Hydroxide (iii) Salt

(iv) Water (v) Hydrogen

(b) (i) Ethane (C_2H_6) (ii) Sulphur dioxide (SO_2) (iii) Nitrogen dioxide (NO_2)

(iv) Oxygen (O_2) (v) Chlorine (Cl_2)

(c) (i) The blue colour of the solution changes to white.

(ii) A gas evolved which has the smell of rotten eggs.

(iii) A yellow coloured explosive is formed.

(iv) Curdy white ppt. observed which is soluble in NH_4OH.

(v) Reddish brown vapours of bromine are evolved.

(d) (i) Co-ordinate bond (ii) Acidic salt (iii) Halogenation

(iv) Water of crystallisation (v) Deliquescence

(e) (i). Sodium chloride gives white ppt. with silver nitrate solution while sodium nitrate does not.

(ii) Dense white fumes observed when a rod dipped in NH_3 is brought to the mouth of *t.t* containing HCl gas. Whereas no such fumes observed in case of H_2S gas.

(iii) Ethene gas decolorises the purple colour of $KMnO_4$ whereas no change observed with ethane.

(iv) Add NaOH solution to both the solutions. White ppt. observed with $Zn(NO_3)_2$ solution which is soluble in excess. Whereas white ppt. observed with $Ca(NO_3)_2$ which is sparingly soluble in water.

(v) SO_2 turns acidified potassium dichromate solution green whereas CO_2 does not change the colour.

(f) (i) D (ii) B (iii) C (iv) A (v) A

(vi) C (vii) B (viii) C (ix) C (x) C

(g) (i) $$2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$$

2 Volume of butane = 90 dm³

$$1 \text{ Volume of butane} = 45 \text{ dm}^3$$
$$\text{Volume of O}_2 \text{ required} = 13 \times 45$$
$$= 585 \text{ dm}^3 \qquad \textbf{Ans.}$$

(ii)
$$\text{Molecular Weight} = 2 \times VD$$
$$= 16g$$
$$\text{Volume of 16g gas} = 22\cdot4L$$
$$\text{Volume of 1g gas} = \frac{22\cdot4}{16}$$
$$\text{Volume of 24g gas} = \frac{22\cdot4}{16} \times 24$$
$$= 33\cdot6 \text{ litres.} \qquad \textbf{Ans.}$$

(iii)   It will contain X no. of molecules.

SECTION–II (40 Marks)

*(Answer any **four** questions from this section)*

Question 2.

(a)

| Group number	IA 1	IIA 2	IIIA 13	IVA 14	VA 15	VIA 16	VIIA 17	0 18
2ⁿᵈ period	Li		D			O	J	Ne
	A	Mg	E	Si		H	M	
	R	T	I		Q	u		y

- In this table H does not represent hydrogen.
- Some elements are given in their own symbol and position in the periodic table.
- While others are shown with a letter.

With reference to the table answer the following questions

(i)   Identify the most electronegative element.   [1]
(ii)   Identify the most reactive element of group 1.   [1]
(iii)   Identify the element from perod 3 with least atomic size.   [1]
(iv)   How many valence electrons are present in Q ?   [1]
(v)   Which element from group 2 would have the least ionization energy ?   [1]
(vi)   Identify the noble gas of the fourth period.   [1]
(vii)   In the compound between A and B what type of bond would be formed and give the molecular formula for the same.   [2]

(b)   Compare the compounds carbon tetrachloride and sodium chloride with regard to solubility in water and electrical conductivity.   [2]

Answer :

(a)   (i)   J   (ii) R   (iii) M   (iv) 5 electron   (v) T   (vi) y

(vii)   Ionic Bond,

A /H

+1   −2

A₂H
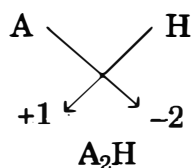
Thus, Molecular formula is A_2H.

(b)   Carbon tetrachloride is insoluble in water and behave as a bad conductor of electricity while sodium chloride is soluble in water and behave as a good conductor of electricity in their aqueous state.

Question 3.

(a) *Choosing the substances from the list given below, write balanced chemical equations for the reactions which would be used in the laboratory to obtain the following salts :*

Dilute Sulphuric acid   *Copper*   *Copper(II) carbonate*
                             Iron   *Sodium carbonate*
                             Sodium   *Sodium chloride*
                                          Zinc nitrate

    (i)   *Sodium sulphate*
    (ii)   *Zinc carbonate*
    (iii) *Copper(II) sulphate*
    (iv) *Iron(II) sulphate.*   **[4]**

(b) *State two **relevant** observations for each of the following :*
    (i)   *Ammonium hydroxide solution is added to copper(II) nitrate solution in small quantities and then in excess.*
    (ii)   *Ammonium hydroxide solution is added to zinc nitrate solution in minimum quantities and then in excess.*
   (iii) *Lead nitrate crystals are heated in a hard glass test tube.*   **[6]**

Answer.

(a)   (i)

$$2NaCl + H_2SO_4(dil.) \longrightarrow Na_2SO_4 + 2HCl$$

        Sodium chloride   Sulphuric acid   Sod. Sulphate   Hydrogen chloride

  (ii)

$$Zn(NO_3)_2 + Na_2CO_3 \longrightarrow ZnCO_3 + 2NaNO_3$$

        Zinc Nitrate   Sodium Carbonate   Zinc Carbonate   Sodium Nitrate

  (iii)

$$CuCO_3 + H_2SO_4 (dil.) \longrightarrow CuSO_4 + H_2O + CO_2$$

        Copper Carbonate   Sulphuric Acid   Copper Sulphate

  (iv)

$$Fe + H_2SO_4 (dil.) \longrightarrow FeSO_4$$

        Iron   Sulphuric Acid   Iron (II) Sulphate

(b) (i)   (a) When NH_4OH is added to copper (II) nitrate solution in small quantities then a pale blue ppt. is observed.
        (b) When added in excess it disolves to give an inky blue solution forming a complex salt.
    (ii) (a) When added in small quantities is forms a gelatinous white ppt.
        (b) When added in excess it dissolves to form a complex salt.
    (iii) (a) Reddish brown gas is evolved.
        (b) Colourless, odourless gas evolved which rekindles a glowing splinter.

Question 4.

(a) *Copper sulphate solution is electrolysed using copper electrodes.*
Study the diagram given below and answer the question that follows
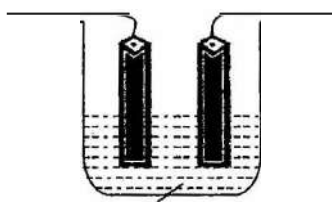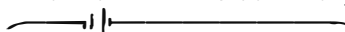
Copper (II) Sulphate Solution

(i)   Which electrode to your left or right is knwon as the oxidising electrode and why ?   **[2]**

(ii)   Write the equation representing the reaction that occurs.   **[1]**

(iii) State two appropriate observations for the above electrolysis reaction. **[2]**

(b)

	X	Y
Normal Electronic Configuration	2, 8, 7	2, 8, 2
Nature of oxide	Dissolves in water and turns blue litmus red	Very low solubility in water. Dissolves in hydrochloric acid
Tendency for oxidising and reducing reactions	Tends to oxidise elements and compounds	Tends to act as a reducing agent
Electrical and Thermal conductivity	Very poor electrical conductor Poor thermal conductivity	Good Electrical conductor Good Thermal conductor
Tendency to form alloys and amalgums	No tendency to form alloys	Forms alloys

Using the information above, complete the following :

(i)   .... is the metallic element.

(ii)   Metal atoms tend to have a maximum of .... electrons in the outermost energy level.

(iii) Non-metallic elements tend to form .... oxides while metals tend to form .... oxides.

(iv)   Non-metallic elements tend to be .... conductors of heat and electricity.

(v)   Metals tend to .... electrons and act as .... agents in their reactions with elements and compounds.   **[5]**

Answer :

(a) (i)   Right electrode is known as oxidising electrode because copper ion gain electron to form copper metal *i.e.,* reduction takes place.

(ii)   **At Catode :** $Cu^{2+} + 2e^- \longrightarrow Cu$

At Anode : $Cu - 2e^- \longrightarrow Cu^{2+}$

(iii) (a) Reddish brown metal copper is deposited at cathode.

(b) Blue colour of electrolytic solution *i.e.,* $CuSO_4$ does not fades during the process.

(b) (i) Y   (ii) 2   (iii) Acidic, Basic   (iv) Bad

(v)   lose, reducing

Question 5.

(a) *Give balanced equations for each of the following :*

(i)   *Reduction of hot Copper(II) oxide to copper using ammonia gas.*

(ii)   *Oxidation of carbon with concentrated nitric acid.*

(iii) *Dehydration of concentrated sulphuric acid with sugar crystals.*   **[3]**

**(b)** *Copy and complete the following table relating to important industrial process :* **[3]**

Name of the process	Temperature	Catalyst	Equation for the catalyzed reaction
Haber's process			

(c) *The following questions relate to the extraction of aluminium by electrolysis :*

(i) *Name the other aluminium containing compound added to alumina and state its significance.*

(ii) *Give the equation for the reaction that takes place at the cathode.*

(iii) *Explain why is it necessary to renew the anode periodically.* **[4]**

Answer :

(a) (i) $3CuO + 2NH_3 \longrightarrow 3Cu + N_2 \uparrow + 3H_2O$

(ii) $C + 4HNO_3 \longrightarrow CO_2 + 2H_2O + 4NO_2$
(Conc.)

(iii) $C_{12}H_{22}O_{11} \xrightarrow{\text{Conc. } H_2SO_4} 12C + 11H_2O$
Sugar

(b) **Temperature :** 450–500 $^\circ$C

Catalyst : Finely divided iron.

Equation : $N_2(g) + 3H_2(g) \xrightarrow[\text{Fe\textbackslash Mo}]{450-500 \ C} 2NH_3 (l)$
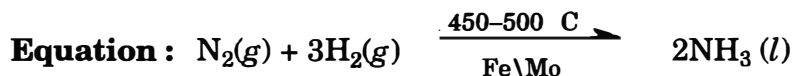
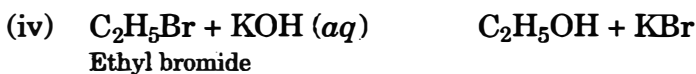**(c)** (i) Cryolite (Na_3AlF_6)
It reduces the temperature and enhance conductivity.

(ii) **At Cathode :** $Al^{3+} + 3e^- \longrightarrow Al$

(iii) The anode has got to be replaced periodically, as it gets oxidised by the oxygen evolved at the anode.
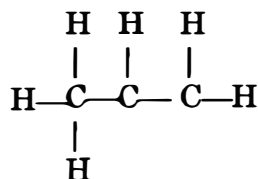
Question 6.

(a) *Give balanced equations for the laboratory preparations of the following organic compounds*

(i) *A saturated hydrocarbon from iodomethane.*

(ii) *An unsaturated hydrocarbon from an alcohol.*

(iii) *An unsaturated hydrocarbon from calcium carbide.*

(iv) *An alcohol from ethyl bromide.* **[4]**

(b) *Give the structural formulae for the following :*

(i) *An isomer of n-butane.*

(ii) *2-propanol.*

(iii) *Diethyl ether.* **[3]**

(c) *Give reasons for the following :*

(i) *Methane does not undergo addition reactions, but ethene does.*

(ii) *Ethyne is more reactive than ethane.*
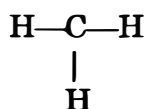
(iii) *Hydrocarbons are excellent fuels.* **[3]**

Answer :

(a) (i) $CH_3I + 2[H] \longrightarrow CH_4 + HI$
Iodomethane

(ii) $C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} C_2H_4 + H_2O$
Alcohol

    (iii) $CaC_2 + 2H_2O$ $C_2H_2 + Ca(OH)_2$
           Calcium carbide

    (iv) $C_2H_5Br + KOH\ (aq)$ $C_2H_5OH + KBr$
           Ethyl bromide

(b)   (i)   **Isomer of *n*-butane**

$$\underset{\displaystyle \underset{\displaystyle H}{|}}{H-C}\ \overset{\displaystyle H}{\underset{\displaystyle |}{-C-}}\ \overset{\displaystyle H}{\underset{\displaystyle |}{C-H}}$$

                                   2-methyl propane

$$H-\overset{\displaystyle H}{\underset{\displaystyle H}{C}}-H$$

    (ii) **2-Propanol**

$$H-\overset{\displaystyle H}{\underset{\displaystyle H}{C}}-\overset{\displaystyle OH}{\underset{\displaystyle H}{C}}-\overset{\displaystyle H}{\underset{\displaystyle H}{C}}-H$$

    (iii) **Diethyl ether :**

$$H-\overset{\displaystyle H}{\underset{\displaystyle H}{C}}-O-\overset{\displaystyle H}{\underset{\displaystyle H}{C}}-H$$
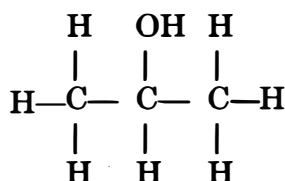
**(c)**   (i)   Methane does not undergo addition reaction, because it is bonded with four H–atom while in ethene double bond breaks and provide site for addition.

    (ii) Due to the presence of triple bond it provide site for addition, hence ethyne is more reactive than ethane.

    (iii) Hydrocarbon are excellent fuels as they produces lot of heat during combustion.

Question 7.

(a)   *O_2 is evolved by heating $KClO_3$ using MnO_2 as a catalyst*

$$2KClO_3 \xrightarrow{\ MnO_2\ } 2KCl + 3O_2$$
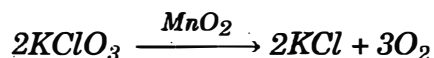
    (i)   *Calculate the mass of $KClO_3$ required to produce 6.72 litre of O_2 at STP. [atomic masses of K = 39, Cl = 35.5, O = 16]*   **[2]**

    (ii) *Calculate the number of moles of oxygen present in the above volume and also the number of molecules.*   **[2]**

    (iii) *Calculate the volume occupied by 0.01 mole of CO_2 at STP.*   **[1]**

(b)   *Identify the following substances which are underlined :*

    (i)   *<u>An alkaline gas</u> which produces dense white fumes when reacted with hydrogen chloride gas.*

    (ii) *<u>An acid</u> which is present in vinegar.*

    (iii) *<u>A gas</u> which does not conduct electricity in the liquid state but conducts electricity when dissolved in water.*
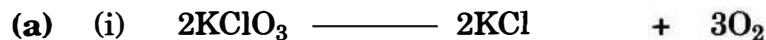
(iv) *A dilute mineral acid* which forms a white precipitate when treated with barium chloride solution.

(v) *The element* which has the highest ionization potential. **[5]**

Answer.

(a) (i)

$$2KClO_3 \longrightarrow 2KCl + 3O_2$$

$2 \times (39 + 35 \cdot 5 + 3 \times 16) \quad 2\,(39 + 35 \cdot 5)$
$= 2 \times 122 \cdot 5 = 245g \quad\quad = 2 \times 74 \cdot 5 = 149g \quad 3 \times 22 \cdot 4 = 67 \cdot 2l$

$$67 \cdot 2l \text{ of } O_2 \text{ produced by } KClO_3 = 245 \text{ g}$$

$$1l \text{ of } O_2 \text{ produced by } KClO_3 = \frac{245}{67 \cdot 2}$$

$$6 \cdot 72 \text{ of } O_2 \text{ produced by } KClO_3 = \frac{245 \times 6 \cdot 72}{67 \cdot 2}$$

$$= 24 \cdot 5 \text{ g} \qquad \textbf{Ans.}$$

(ii)

$$245g \text{ of } KClO_3 \text{ contains} = 3 \text{ moles of oxygen}$$

$$24 \cdot 5g \text{ of } KClO_3 \text{ contains} = \frac{3 \times 24 \cdot 5}{245}$$

$$= 0 \cdot 3 \text{ mole.} \qquad \textbf{Ans.}$$

Since, $\quad\quad$ 1 mole of oxygen contain $= 6 \cdot 022 \times 10^{23}$ molecules

Therefore, $\quad$ 0·3 mole of oxygen contain $= 6 \cdot 022 \times 10^{23} \times 0 \cdot 3$

$$= 1 \cdot 8066 \times 10^{23} \text{ molecules}$$

(iii)

$$1 \text{ mole of } CO_2 \text{ occupied} = 22 \cdot 4 \, l$$

$$0 \cdot 01 \text{ mole of } CO_2 \text{ occupied} = 22 \cdot 4 \times 0 \cdot 01$$

$$= 0 \cdot 224 \, l$$

(b) (i) Ammonia gas (NH_3) $\quad\quad$ (ii) Acetic Acid (CH_3COOH)

(iii) Hydrogen chloride (HCl) $\quad\quad$ (iv) Sulphuric Acid (H_2SO_4)

(v) Helium (He)