ICSE Board
Class X Chemistry
Board Paper Solution - 2018

Time: 2 hrs. **Max. Marks: 80**

SECTION I

Answer 1

(a)
(i) Calcium nitrate
(ii) C_2H_6
(iii) Redox reaction
(iv) Methoxy methane
(v) Vanadium pentoxide

(b)
(i) Electron affinity
(ii) Ionisation
(iii) Catenation
(iv) Efflorescence
(v) Froth flotation

(c)
(i) Action of concentrated sulphuric acid on carbon.

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

(ii) Reaction of sodium hydroxide solution with iron (III) chloride solution.

$$FeCl_3 + 3NaOH \longrightarrow Fe(OH)_3 \downarrow + 3NaCl$$

(iii) Action of heat on aluminium hydroxide.

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

(iv) Reaction of zinc with potassium hydroxide solution.

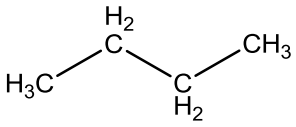
$$Zn + 2KOH \longrightarrow K_2ZnO_2 + H_2 \uparrow$$

(v) Action of dilute hydrochloric acid on magnesium sulphite.

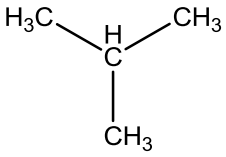
$$MgSO_3 + 2dil.HCl \longrightarrow MgCl_2 + H_2O + SO_2 \uparrow$$

(d)
(i)
1. Methanal
2. Propan-1-al
3. But-2-ene

(ii) Structural formulae of the isomers of butane:



n-Butane



Iso-butane

(e)

(i) Lead nitrate solution is treated with sodium hydroxide solution drop-wise till it is in excess and then a white precipitate of lead hydroxide is formed.

$$Pb(OH)_2 + \underset{(excess)}{2NaOH} \rightarrow \underset{\text{Sodium plumbite}}{Na_2PbO_2} + 2H_2O$$

(ii) At the anode, when molten lead bromide is electrolysed using graphite electrodes, dark reddish brown fumes of bromine are evolved.

$$PbBr_{2(l)} \rightarrow Pb_{(s)} + \underset{\text{Reddish brown gas}}{2Br_{(g)}}$$

(iii) Lead nitrate solution is mixed with dilute hydrochloric acid and heated to give a white precipitate of lead (I) chloride.

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

(iv) Anhydrous calcium chloride is exposed to air for some time, and then it will absorb moisture as it is a deliquescent substance and dissolves in it.

(v) Barium chloride solution is slowly added to sodium sulphate solution, and it gives a white-coloured precipitate of barium sulphate.

$$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 \downarrow + 2NaCl$$

(f)

(i) Ionic compounds have a high melting point, because the ionic bond in these compounds is very strong and a lot of energy is required to break the bond.

(ii) To attain stability, atoms need to complete their octet by sharing, losing or gaining electrons. In inert gases, the octet is completed and they do not need to gain, lose or share electrons; hence, they do not form ions.

(iii) Ionisation potential increases across a period from left to right because the atomic size decreases due to an increase in the nuclear charge. The electrons in the outermost shell lie close to the nucleus and this makes the removal of electrons difficult and requires more energy.

(iv) Reducing agents are elements or groups of elements which easily lose their electrons. Alkali metals are good reducing agents because they have only one extra electron in their outermost shell; hence, to attain stability, they easily lose the electron.

(v) Conductivity of dilute hydrochloric acid is greater than that of acetic acid. This happens because hydrochloric acid is a strong acid. It ionises completely and forms more ions than weak acetic acid.

(g)

(i) Nitrogen dioxide (NO_2)
(ii) Hydrogen sulphide (H_2S)
(iii) Nitric oxide (NO)
(iv) Oxygen (O_2)
(v) Hydrogen (H_2)

(h)

(i) Ionic or electrovalent compounds do not conduct electricity in their **solid** state.
(iii) Electrolysis of aqueous sodium chloride solution will form **sodium metal** at the cathode.
(iv) Dry hydrogen chloride gas can be collected by the **upward** displacement of air.
(v) The most common ore of iron is **haematite**.
(vi) The salt prepared by the method of direct combination is **iron (III) chloride**.

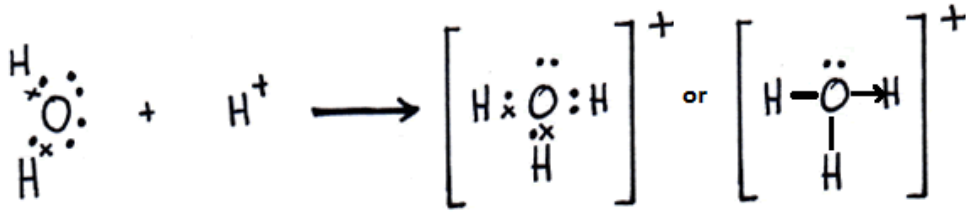
SECTION II

Answer 2

(a)

(i) A lone pair of electrons: A pair of electrons which is not shared with any other atom is known as a lone pair of electrons. It is provided to the other atom for the formation of a coordinate bond.

(ii) Electron dot diagram of hydronium ion:



Water Hydrogen ion Hydronium ion

(b)

(i) The clement B would have **lower** metallic character than A.
(ii) The element A would probably have **higher** electron affinity than B.
(iii) The element A would have **smaller** atomic size than B.

(c)

Conversion	Ionic Equation	Oxidation/Reduction
(i) Chloride ion to chlorine molecule	(i) $Cl^- - e^- \rightarrow Cl$ $Cl + Cl \rightarrow Cl_2$	(i) Oxidation
(ii) Lead (II) ion to lead	(ii) $Pb^{2+} + 2e^- \rightarrow Pb$	(ii) Reduction

Answer 3

(a)

(i) The balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali.

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

(ii) Ammonia is basic in nature. If we use sulphuric acid as a drying agent, then it reacts with acid to give water and salt.

(iii) Ammonia gas is not collected over water because it is highly soluble in water and dissolves to form ammonium hydroxide.

(b)

(i) Concentrated sulphuric acid is used for the preparation of hydrogen chloride gas in the laboratory. It is preferred over conc. nitric acid because it is volatile and may volatilise out along with hydrogen chloride.

(ii) Balanced chemical equation for the laboratory preparation of hydrogen chloride gas:

$$NaCl + H_2SO_4 \xrightarrow{<200^oC} NaHSO_4 + HCl_{(g)}$$

$$NaCl + H_2SO_4 \xrightarrow{>200^oC} Na_2SO_4 + HCl_{(g}$$

(c) For the preparation of hydrochloric acid in the laboratory:

(i) Direct absorption of hydrogen chloride gas in water is not feasible because it is highly soluble in water.

(ii) Hydrochloric acid is prepared by dissolving hydrogen chloride gas in water using a special funnel arrangement because direct absorption of HCl gas in water using a delivery tube causes back suction.

(d) For the electro-refining of copper:

(i) The cathode is made of a thin strip of copper.

(ii) The reaction which takes place at the anode is

$$Cu - 2e^- \rightarrow Cu^{2+}$$

Question 4

(a) Given:

N = 82.35%

H =17.64 %

Element	% composition	Atomic mass	Atomic ratio	Simplest ratio
H	17.64	1	17.64	3
N	82.35	14	5.8	1

So, the empirical formula is NH_3.

(b)

$$\underset{\substack{1\ V\\ 144g}}{Al_4C_3} + 12\ H_2O \longrightarrow \underset{\substack{3\ V\\ 3x22.4\ vol}}{3CH_4} + \underset{312g}{4Al(OH)_3}$$

(i)

since 144 g of Al_4C_3 gives $= 312\,g\,of\,Al(OH)_3$

So, 12 g of Al_4C_3 will give $= \frac{312\ x12}{144}$

$= 26\ g\ Al(OH)_3$

(ii)

Now, since 144 g of Al_4C_3 gives $= 3x22.4$ litre of CH_4

So, 12 g of Al_4C_3 will give $= \frac{3x22.4\ x12}{144}$

$= 5.6$ litre CH_4

(c)

(i) According to Avogadro's law, under the same conditions of temperature and pressure, equal volumes of different gases have the same number of molecules.
As 150 cc of gas A contains X molecules, 150 cc of gas B also contains X molecules.
So, 75 cc of B will contain X/2 molecules.

(ii) The problem is based on Avogadro's law.

(d) The main component of the following alloys:

Name	Composition	Uses
(i) Brass	Cu = 60–80% Zn = 40–20%	For making utensils, cartridges
(ii) Duralumin	Al = 95%, Cu = 4% Mn = 0·5%, Mg = 0·5%	For making bodies of aircraft

Answer 5

(a)

General formula	IUPAC name of the homologous series	Characteristic bond type	IUPAC name of the first member of the series
C_nH_{2n-2}	(A) Alkyne	(B) Triple covalent bonds	(C) Ethyne
C_nH_{2n+2}	(D) Alkane	(E) Single covalent bond	(F) Methane

(b)

(i)

Ore of Al	**Chemical name**	**Formula**
Bauxite	Hydrated aluminium oxide	$Al_2O_3.2H_2O$
Cryolite	Sodium aluminium fluoride	$Na3AlF_6$
Corundum	Anhydrous aluminium oxide	Al_2O_3

(ii) The process by which impure ore of aluminium gets purified by using concentrated solution of an alkali is **Bayer process.**

(iii) The equation for the formation of aluminium at the cathode during the electrolysis of alumina.

Cathode: $2Al^{3+} + 6e^- \rightarrow 2Al$

Answer 6

(a) As compound X has vinegar-like smell, i.e. it is definitely acetic acid CH_3COOH. When treated with ethanol in the presence of acid Z, the given compound Y has a fruity smell. So, compound Y is an ester.
The by-product is a water molecule which means acid Z will be a dehydrating agent, i.e. conc. sulphuric acid H_2SO_4.

Reaction:

$$\underset{\text{Ethanol}}{C_2H_5OH} + \underset{[X]}{CH_3COOH} \xrightarrow{\text{conc.}H_2SO_4\,[Z]} \underset{[Y]}{CH_3COOC_2H_5} + H_2O$$

The above reaction is an **esterification** reaction.

(b)

$$\underset{2V}{2C_2H_6} + \underset{7V}{7O_2} \rightarrow \underset{4V}{4CO_2} + 6H_2O$$

$$2 \times 22400 \quad 2 \times 22400 \quad 4 \times 22400$$

(i)

$$300\text{cc of } C_2H_6 \text{ will give} = \frac{4 \times 22400 \times 3000}{2 \times 22400}$$

So volume of CO_2 formed $= 600$ cc

(ii)

For 300cc of C_2H_6 1050cc of O_2 will required.

$\therefore$ unused $O_2 = (1250 - 1050)$

$= 200$ cc

(c)

(i) Solution Q is a weak acid.

(ii) Solution R is a strong alkali.

Answer 7

(a)

(i) Lead nitrate solution can be distinguished from zinc nitrate solution with the help of a base, i.e. NaOH. Lead nitrate gives a white precipitate of lead hydroxide on treatment with a base.

(ii) To distinguish between sodium chloride and sodium nitrate, a solution of silver nitrate can be used. This gives a white precipitate with sodium chloride.

(b)

(i) Copper sulphate from copper carbonate

$$CuCO_3 + H_2SO_4 \longrightarrow CuSO_4 + H_2O + CO_2 \uparrow$$

(ii) Zinc carbonate from zinc sulphate

$$ZnSO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + ZnCO_3 \downarrow$$

(c)

(i) Potassium/sodium bisulphate is formed when potassium nitrate/sodium nitrate and conc. H_2SO_4 are heated at <200°C temperature for the preparation of nitric acid.

(ii) During the preparation of nitric acid, the complete apparatus is made of glass. This is because nitric acid is a powerful oxidising agent, and it vigorously oxidises non-metals, metals, inorganic compounds and organic compounds.

(d)

(i) As a dehydrating agent

(ii) As an oxidising agent