ICSE QUESTION PAPER

Class X Chemistry

(2016) Solution

Section I

1.

(a)

(i) Metals are good reducing agents because they are electron donors.

(ii) Electrovalent compounds have high melting points.

(iii) Higher the pH value of solution, the more alkaline it is.

(iv) AgCl, a white precipitate, is soluble in excess NH_4OH.

(v) Conversion of ethene to ethane is an example of hydrogenation.

(b)

(i) (A) 17

Element with atomic number 19 will lose 1 electron to achieve the noble gas configuration which can be accepted by element with atomic number 17.

(ii) (C) 1:1

1 mole of hydrogen ≡ 1 g of hydrogen

1 mole of hydrogen ≡ 6.023×10^{23} molecules

1 g of hydrogen ≡ 6.023×10^{23} molecules

2 g of hydrogen ≡ 1.204×10^{24} molecules

1 mole of oxygen ≡ 16 g of oxygen

1 mole of oxygen ≡ 6.023×10^{23} molecules

16 g of oxygen ≡ 6.023×10^{23} molecules

32 g of oxygen ≡1.204×10^{24} molecules

(iii) (D) Copper and tin

Bronze is an alloy which consists of copper and tin.

(iv) (B) mainly ions

Strong electrolytes dissociate into ions.

(v) (C) HCl is highly soluble in water.

HCl is highly soluble in water. Its high solubility may be demonstrated by the fountain experiment.

(c)

(i) $AlN_{(s)} + 3H_2O_{(l)} \rightarrow Al(OH)_{3(aq)} + NH_{3(g)}$

(ii) $Cu_{(s)} + 4HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + 2NO_{2(g)} + H_2O_{(l)}$

(iii) $NaHCO_{3(s)} + HCl_{(l)} \rightarrow NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

(iv) $Na_2SO_{3(s)} + H_2SO_{4(l)} \rightarrow Na_2SO_{4(aq)} + H_2O_{(l)} + SO_{2(g)}$

(v) $CH_3CH_2Cl + KOH_{(aq)} \rightarrow CH_3CH_2OH + KCl_{(aq)}$

(d)

(i) When dil. HCl is added to lead nitrate solution and heated, it forms a white precipitate of lead chloride.
$Pb(NO_3)_2 + 2HCl \rightarrow PbCl_2 + 2HNO_3$

(ii) A white precipitate of barium sulphate forms when barium chloride is mixed with sodium sulphate.
$BaCl_{2(aq)} + Na_2SO_{4(s)} \rightarrow 2NaCl_{(aq)} + BaSO_{4(s)}$

(iii) When sugar reacts with conc. H_2SO_4, it gives a black spongy mass of carbon which is called sugar charcoal.
$C_{12}H_{22}O_{11(s)} \xrightarrow{\text{Conc. } H_2SO_4} 12\,C_{(s)} + 11\,H_2O$

(iv) When dilute hydrochloric acid is added to copper carbonate, it decomposes to give copper chloride.
$CuCO_3 + 2HCl \rightarrow CuCl_2 + H_2O + CO_2 \uparrow$

(v) Dil. HCl reacts with thiosulphates to produce sulphur dioxide and yellow sulphur is precipitated.
$Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2 + S \downarrow$

(e)

(i) The tendency of an atom to attract electrons to itself when combined in a compound: Electronegativity
(ii) The method used to separate ore from gangue by preferential wetting: Froth flotation process
(iii) The catalyst used in the conversion of ethyne to ethane: Lindlar catalyst
(iv) The type of reactions alkenes undergo: Addition reaction
(v) The electrons present in the outermost shell of an atom: Valence electrons

(f)

(i)

Given :

Mass of gas = 32 g

Volume occupied by 32 gms of gas = 20 litres

$$\text{Number of moles of gas} = \frac{\text{volume of gas}}{\text{molar gas volume}} = \frac{20}{22.4} = 0.89 \approx 0.9$$

$$\text{Number of moles of gas} = \frac{\text{Mass of gas}}{\text{Gram molecular weight of gas}}$$

$$\text{Gram molecular weight of gas} = \frac{\text{Mass of gas}}{\text{Number of moles of gas}} = \frac{32}{0.9} = 35.55 \text{ g}$$

(ii)

$$2\,Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 \uparrow + O_2$$

At STP, 1 mole of any gas contains 22.4 L

Since, 4 moles of NO_2 are produced,

$\therefore$ volume of nitrogen dioxide obtained = $4 \times 22.4 = 89.6$ L

2 moles of $Ca(NO_3)_2$ produces 2 moles of CaO

328 g $Ca(NO_3)_2$ produces = 112 g CaO

1 g $Ca(NO_3)_2$ will produce = $\frac{112}{328}$ g CaO

= 0.34 g CaO

Hence, 82 g of $Ca(NO_3)_2$ will produce = $82 \times 0.34 = 27.88$ g of CaO

(g)

Column-I	**Column-II**
$Pb(NO_3)_2$ from PbO	Precipitation
$MgCl_2$ from Mg	Simple displacement
$FeCl_3$ from Fe	Combination
$NaNO_3$ from NaOH	Neutralisation
$ZnCO_3$ from $ZnSO_4$	Titration

(h)

(i)

1. 1-Propene
2. 2-Butyne
3. Ethanal

(ii)

1. less than
2. less than

2.

(a)

(i) 5

Atom J is a Group 5 element and a group is determined by the number of electrons present in the outermost shell.

(ii) Element M from Group 7 accepts one electron to form an ion with a single negative charge.

(iii) T is more reactive than R.

The tendency of losing electrons increases down the group. Because chemical reactivity depends on the tendency to lose electrons, thus reactivity increases on going down the group.

(iv) Element T has its electrons arranged in four shells.

Element T belongs to Period 4, and all elements of this period have four shells.

(b)

(i) Metallic

(ii) Smallest

(c)

(i)

(1) Ionic bond is formed by transfer of one electron from element W to element X.

(2) Covalent bond is formed by sharing of electrons between elements Y and Z.

(ii)

(1) HCl

(2) NaCl

3.

(a)

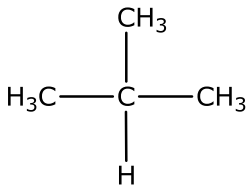
(i) $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$

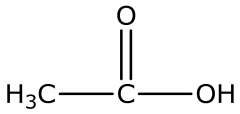
(ii) $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

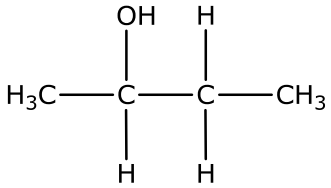
(iii) $C_2H_5OH \xrightarrow{Conc.H_2SO_4/170^\circ C} CH_2 = CH_2 + H_2O$

(b)

(i)



(ii) 

(iii) 

(c)

(i) $CH_2 = CH_2$

(ii) When bromine dissolved in CCl_4 is added to ethene, the orange colour of bromine disappears because of the formation of colourless ethylene bromide.

(d)

(i) Nitric oxide

(ii) Nitrogen dioxide

4.

(a)

(i) Sulphur dioxide

Freshly prepared $K_2Cr_2O_7$ paper changes from orange to green.

(ii) Hydrogen sulphide

The gas released has a rotten egg smell.

(b)

(i) When NH_4OH is added to copper sulphate solution drop-wise, a pale blue ppt. is obtained.

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

With excess of NH_4OH, the ppt. dissolves to give a deep blue solution of tetrammine copper(II)sulphate.

$$Cu(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH \longrightarrow [Cu(NH_3)_4]SO_4 + 4H_2O$$

When NH_4OH is added to zinc sulphate solution drop-wise, a white, gelatinous ppt. is obtained.

$$ZnSO_4 + 2NH_4OH \longrightarrow Zn(OH)_2 + (NH_4)_2SO_4$$

With excess of NH_4OH, the ppt. dissolves to give a colourless solution of tetrammine zinc(II)sulphate.

$$Zn(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH \longrightarrow [Zn(NH_3)_4]SO_4 + 4H_2O$$

(c)

(i) Electrodes: Cathode: Copper
Anode: Platinum
Reaction at the cathode: $Cu^{2+} + 2e^- \rightarrow Cu$
Reaction at the anode: $4OH^- - 4e^- \rightarrow 4OH$
$2OH + 2OH \rightarrow 2H_2O + O_2$

(ii) The cathode and anode are both made of graphite plates.
Reaction at the cathode: $Pb^{2+} + 2e^- \rightarrow Pb$
Reaction at the anode: $Br^- - e^- \rightarrow Br$
$Br + Br \rightarrow Br_2$

(d)

(i) Oxygen is the product formed at the anode.
(ii) Ag^+ and Na^+.

5.

(a)

1 mole oxygen molecule $= 6.022 \times 10^{23}$ molecules
x moles of oxygen molecule $= 12 \times 10^{24}$ molecules
19.93 moles of oxygen molecule $= 12 \times 10^{24}$ molecules

$$\text{Number moles of } O_2 = \frac{\text{Mass of } O_2}{\text{Molar mass of } O_2}$$

Mass of $O_2 = 32 \times 19.93 = 637.76$ g
6.022×10^{23} molecules occupies 22.4 L

$$12 \times 10^{24} \text{ molecules occupies} = \frac{12 \times 10^{24} \times 22.4}{6.022 \times 10^{23}} = 446.36 \text{ L volume.}$$

(b) Vapour density = 29

Element	Percentage	At. mass	Gram atom	Ration	
Carbon	82.76	12	82.76/12 = 6.9	6.9/6.9 = 1	**2**
Hydrogen	17.24	1	17.24/1 = 17.24	17.24/6.9 = 2.5	**5**

Empirical formula is C_2H_5
Molecular weight = 2 × Vapour density
Molecular weight = n × (Empirical formula weight)
58 = n × (12 × 2 + 1 × 5)
n = 2
So, molecular formula = C_4H_{10}

(c)

$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

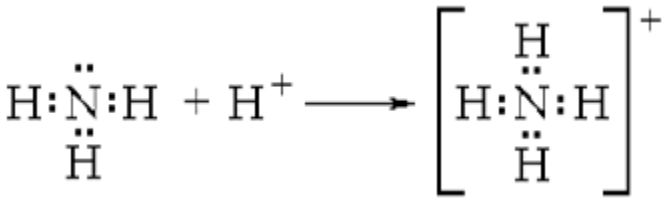
4 moles of ammonia = 100 cm^3

1 mole of ammonia = 25 cm^3

4 moles of ammonia requires 5 moles of O_2.

So, volume of oxygen required = $5 \times 25 = 125$ cm^3

(d)



6.

(a)

(i) Ammonia

(ii) Nitrogen

(b)

(i) $8NH_3 + 3Cl_2 \rightarrow N_2 + 6NH_4Cl$

(ii) $3PbO + 2NH_3 \rightarrow 3Pb + 3H_2O + N_2$

(c)

(i) B

(ii) A

(iii) C

(d)

(i) Electrostatic forces of attraction between ions in the solid state are very strong. These forces weaken in the fused state or in the solution state. Hence, ions become mobile.

(ii) If silver nitrate solution is used directly instead of double cyanide of silver and sodium, the deposition of silver will be very fast and hence not very smooth and uniform.

(iii) Copper has no mobile electrons in the solid state and an electrolyte should dissociate into oppositely charged ions to conduct electricity. Hence, copper is a non-electrolyte.

7.

(a)

(i) Conc. caustic soda

(ii) $2Al(OH)_3 \xrightarrow[1000^\circ C]{Heat} Al_2O_3 + 3H_2O$

(iii) Cryolite

(iv) At the cathode: $Al^{3+} + 3e^- \rightarrow Al$

(v) The anode has got to be replaced from time to time as it gets oxidised by the oxygen evolved at the anode.

(b)

(i) When exposed to the atmosphere, it becomes a monohydrate.

$Na_2CO_3.10H_2O \xrightarrow{Dry\ air} Na_2CO_3.H_2O + 9H_2O$

(ii) It absorbs moisture from the atmosphere to become moist and ultimately dissolves in the absorbed water, forming a saturated solution.

(c)

(i) Fe^{3+} ion

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

(Reddish brown ppt.)

(ii) Pb^{2+} ion

$Pb(NO_3)_2 + 2NH_4OH \longrightarrow Pb(OH)_2 + 2NH_4NO_3$

(chalky white ppt. insoluble in excess)

(iii) Ca^{2+} ion

$Ca(NO_3)_2 + 2NaOH \longrightarrow Ca(OH)_2 + 2NaNO_3$

(White ppt. sparingly soluble)