30.6 CHEMISTRY (233)

30.6.1 Chemistry Paper 1 (233/1)

1. Observations:
   - Crystal dissolves
   - Purple colour spreads in the way

   Explantion: The crystal break into small particles of potassium manganate (VII) which move in all directions. ***(2 marks)***

2. Mass of hydrated salt=(33.111 – 30.296) =2.815g
   Mass of anhydrous salt =(32.781- 30.296) = 2.485g
   Mass of water =(2.815 – 2.485) =0.330g
   33.111 – 32.781 = 0.330 g ***(3 marks)***

   $CaSO_4$: xH_2O
   Mass 2.485 0.330

   Moles $\frac{2.485}{136} = 0.0183$ $\frac{0.330}{18} = 0.0183$

   Ratio $\frac{0.0183}{0.0183} = 1$ $\frac{0.0183}{0.0183} = 1$

   Formula $CaSO_4H_2O$ ***(3 marks)***

3. I The red litmus paper turns white/the litmus paper is bleached.
   II Put a filter paper dipped in acidified potassium dichromate (VI) into the gas.
   III The bromine water is decolourised. ***(3 marks)***

4. (a) $C_{13}H_{27}COO^-Na^+$ or $C_{14}H_{27}O_2^-Na^+$
   (b) Soap detergent or Soap
   (c) $(C_{13}H_{27}COO^-)_2Ca^{2+}$ or $(C_{13}H_{27}C00^-)_2\ Mg^{2+}$ ***(3 marks)***

5. R.M.M of Ca3(PO4)2
   Ca=40 × 3 = 120
   P=31 × 2 = 62
   O=16 × 8 = 128
   H_3PO_4 H=1 × 3 = 3
   P=31× 1 = 31
   O=16 × 4 = 64
   98

   I mole $Ca_3(PO_4)_2$ gives 2 moles of H_3PO_4
   310g of $Ca_3(PO_4)_2$ gives 2 × 98g of H_3PO_4 = 196g
   Therefore 155 x 1000g $\frac{2\times98\times155\times1000}{310}$
   =98000g
   =98kg ***(2 marks)***

6.
   - Propanol ***(2 marks)***

- Butanoic acid

7. (a) Atoms of the same element having different masses.

   (b) (18-8)=10 neutrons *(2 marks)*

8. (a) A black solid.

   (b) $FeS_{(s)} + 2HCl_{(aq)} \longrightarrow FeCl_{2(aq)} + H_2S_{(g)}$

   (c) The powder has a larger surface area than the iron fillings hence the reaction is faster. *(3 marks)*

9. $Zn_{(s)} + H_2SO_4(aq) \longrightarrow ZnSO_{4(aq)} + H2_{(g)}$
   $Zn(s) + 2H_2SO_{4(1)} \longrightarrow ZnSO_{4(aq)} + 2H_2O_{(1)}$ *(2 marks)*

10. Magnesium burns in air to form MgO and Mg_3N_2
    Mg_3N_2 reacts with water to liberate ammonia gas *(2 marks)*

11. (a) Ionic or Electrovalent

    (b) ***W:*** has 7 electrons in its outermost energy level and hence easily gains an electrons to complete the octet. *(3 marks)*

12. (a) Oxygen

    (b) The pH decreases
    HOCI decomposes to give more HCI in the mixture. *(3 marks)*

13. Pass product E over anhydrous copper (II) Sulphate (1) which turns from white to blue.
    Or
    (Use Cobalt Chloride (anhydrous) which turns from blue to pink. *(2 marks)*

14. (a) G

    (b) A_1 *(2 marks)*

15. ***J:*** the solubility of the substance decreases with increase with temperature. *(2 marks)*

16.
- Heat the metal in air to form the oxide (CuO).
- Add excess dcl HCI to the oxide to get $CuCl_2$.
- Concentrate the filtrate and leave to crystalise.
- Filter and dry the crystals at room temp/between pieces of filter paper. *(3 marks)*

17. (a) Amphoteric
    (b) Lead, Zinc, and aluminium *(3 marks)*

18. (a) Position for silicon.

						R	**S**	
N	**Q**			**V**			**T**	**U**
P								

    (b) U
    (c) $2Q_{(s)} + T_{2(g)} \longrightarrow 2QT_{2(g)}$ *(3 marks)*

19. (a) $Zn_{(s)}/Zn^{2+}_{(aq)}//Ag^{+}_{(aq)}/Ag_{(s)}^{-}$

$Cu_{(s)}/Cu^{2+}_{(aq)}//Ag^{+}_{(aq)}/Ag_{(s)}$

(b)

- The solution changes to blue because Cu metal dissolves to form $Cu\,2+^{2+}_{(aq)}$
- Metal silver is deposited on the sides of beaker because Ag^{+} reduced to $Ag_{(s)}$ ***(3 marks)***

20. (a) At constant temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density.

(b) $$\frac{RW}{RX}=\sqrt{\frac{MMX}{MMW}}=\sqrt{\frac{44}{16}}$$

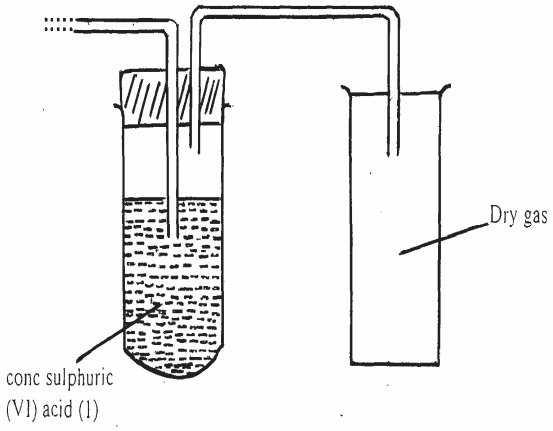
$$\frac{12.0}{RX}=\frac{\sqrt{44}}{4}$$

$$RX=\frac{12\times 4}{\sqrt{44}}=\frac{48}{6.63}=7.24cm^3S^{-1}$$ ***(3 marks)***

21. (a) Cu^{2+}(1) moving towards the cathode .

(b) $40H^{-}-4e \longrightarrow 2H_2O_{(1)}+)_{2(g)}^{-}$ ***(3 marks)***

22.



(3 marks)

23. The brown colour of the mixture intensifies/increases and the green colour of the mixture fades/decreases. Iron (II) is converted to Fe^{3+} ***(2 marks)***

24. (a) $^{4}_{2}H_e$

(b) (i) $Z_1 = 235, (½)\ Z_2 = 54$

(ii) Nuclear fission ***(3 marks)***

25. (a) Cooling

(b) Latent heat of fusion ***(2 marks)***

26. (a) I – Pb^{2+}

II – CO^{2-}_{3}

(b) $PbO_{(s)} + 2H^{+}_{(aq)} \rightarrow Pb^{2+}_{(aq)} + H_2O_{(1)}$ ***(3 marks)***

27. (a) $Mg(0H)_{2(ag)} + 2HCI_{(aq)} \rightarrow MgCl_{2(aq)} + H_2O_{(1)}$ or mole ratio

No of moles of acid = $\frac{0.1 \times 23}{1000} = 0.0023$

Moles of $Mg(OH)_2$ in antacid

$= 0.00115 \times 58 = 0.067g$

(b) % of Mg(OH)2 in anticid

$Mg(OH)^{1}_{2} = \frac{0.067}{0.50} \times 100 = 13.4\%$ ***(3 marks)***

28. (a) (i) $C\text{-}_1$Cryolite

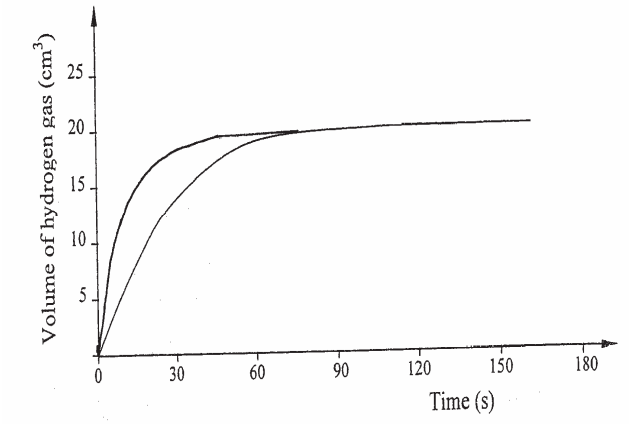
(ii) $D\text{-}_1$ Electrolysis ***(2 marks)***

(b)

- Good conductor.
- Meleable.
- Light.
- Does not corrode easily.
- High melting point.
- Does not rust. ***(1 mark)***

29. (a) Gas syringe/graduated gas cylinder.

(b) (i)



(ii) The molecules of the reactants have higher energy the reaction is faster.

(3 marks)

30. It burns to form SO2 which is a pollutant as it causes breathing problems and acid rain.

(1 mark)

31. (a) Neutralization

(b) (i) Calcium hydrogen carbonate.

(ii) Drying agent. ***(3 marks)***

30.6.2 Chemistry Paper 2 (233/2)

1. (a) (i) Biogas contains methane which is a fuel ***(1 mark)***

(ii) Pass a known volume of (V1) through NaOH or KOH or lime water CO_2 will be absorbed. Collect all the gas that comes out of NaOH/KOH or lime water in a gas syringe (V_2).

$$\% = \frac{V_2}{V_1} \times 100$$

(3 marks)

(b) (i) Moles of methane in the

$$\text{Cylinder} = \frac{35.2 \times 5 \times 1000}{100 \times 16}$$
$$= 110 \text{ moles}$$

(4 marks)

(c) (i) Global warming

(ii) I N_2O=Ammonium fertilizer (nitrate)
II CCl_3F=Aerosals, Sprays, Propellants, Refrigerators ***(3 marks)***

2. (a) (i) $2KNO_3(s) \rightarrow 2KNO_2(s) + O_{2(g)}$

(ii) $2AgNO_3(s) \rightarrow 2Ag(s) + 2NO_{2(g)} + O_{2(g)}$ ***(2 marks)***

(b) (i) ***Period 2*****:** It's electronic arrangement is 2, 3 and this means that it is the 2nd energy level

being filled. Therefore it belongs to period 2. ***(2 marks)***

(ii) I. Across a period from left to right the nuclear charge increases exerting grater pull on the available electrons resulting in reduction of atomic radius. ***(2 marks)***

II. A4 gains an electron: The incoming electron is reppelled by other electrons in the atom. ***(2 marks)***

3. (a)

- Filtration of air.
- Passing through sodium hydroxide.
- Air cooled to become liquid.
- Liquid air is allowed to evaporate . ***(4 marks)***

(b) (i) Nitrogen (II) oxide ***(1 mark)***

(ii) Oxidation

$$NH3(g) + CuO_{(S)} \rightarrow N_{2(g)} + H_2O + Cu_{(S)}$$

Reduction ***(2 marks)***

(iii) $NH_4NO_{3(s)} \rightarrow N_2O_{(g)} + 2H_2O_{(1)}$ ***(1 mark)***

(iv) Fertilizers making explosives. ***(1 mark)***

(c) (i) G or G^{2+} ***(1 mark)***

(ii) $E^{2+}_{(aq)} + 20H^{-}_{(aq)} \rightarrow E(OH)_{2(s)}$ ***(1 mark)***

4. (a) (i) When a change is made to the conditions of a system is dynamic equilibrium the system moves so as to oppose that change. ***(1 mark)***

(ii) Pressure has no effect on the position of the equilibrium since the number of moles of gaseous reactants is equal to number of moles of gaseous products. ***(2 marks)***

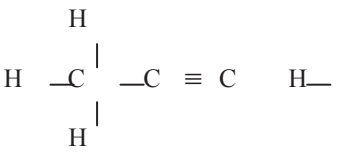
(iii) ΔH is Negative: Since lowering of temperature moves the equilibrium in the direction in which heat energy is absorbed. ***(2 marks)***

(b) (i) MnO_2 ***(1 mark)***

(ii) Decomposition at 24 secs is 1.428 cm^3/sec ***(2 marks)***

(iii) The reactant has been used up after 50 secs ***(1 mark)***

5. (a)



or CH_3CCH ***(1 mark)***

(b) (i) Heat 700 – 900k ***(1 mark)***

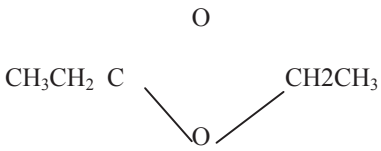
Use of catalyst such alumina (AI_2O_3) or Selica (SiO_2)

(ii) H – is ethane CH_3CH_3 or C_2H ***(1 mark)***

(iii) I. They pollute environment produces poisonous gases. ***(1 mark)***

i. Hydration. ***(1 mark)***

ii. Ethyl Propanoate.



$(C_2H_4)n=16,800$ ***(2 marks)***

(iv) $\therefore n = \frac{16,800}{28} = 600$ monomer ***(7 marks)***

(c) (i) ***M***: is unsaturated hydrocarbon and hence it undergoes addition reaction. ***(2 marks)***

(ii) ***N***: this because N is an acidic compound. ***(2 marks)***

6. (a) (i) Both OH^- and SO_4^{2-} migrate to the anode where OH^- are preferentially discharged forming oxygen gas. ***(2 marks)***

(ii) Copper anode would dissolve to give Cu^{2+} ions as less energy is required for this process. ***(2 marks)***

(b) (i) Copper ore - Copper pyrites
Copper glance
Malachite ***(1 mark)***

(ii) $Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$ ***(1 mark)***

(iii) Q=IT

$0.5 \times 18 \times 60$

$= 540$ coulombs

1 mole of electronics deposits 1 mole of silver

$96500C \equiv 108g$ of silver

$540C = \frac{108 \times 540}{96500}$

$= 0.604g$

(3 marks)

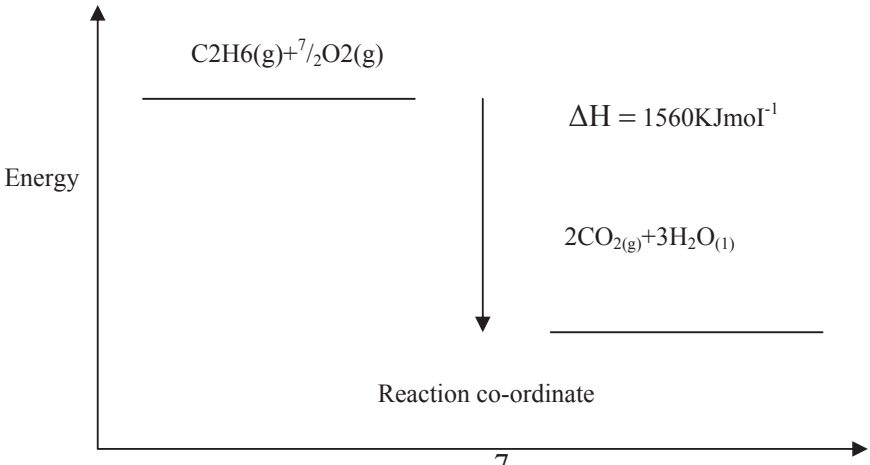
(iv) Prevent rusting.
Decoration/improve appearance. ***(2 marks)***

7. (a) (i) This is the heat change (($\Delta\Delta H$ when one mole of a substance is formed from its constituent elements under standard conditions. ***(1 mark)***

(b) (i) Heat of combustion of hydrogen.

Heat of formation of water. ***(2 marks)***

(ii)



(3 marks)

(iii) $2CO_{2(g)} + 3H_xO_{(c)} \rightarrow C_2H_{6(g)} + \frac{7}{2}O_{2(g)} \Delta H = 156 kJmol^{-1}$

$2C_{(s)} + 2O_{2(g)} \rightarrow 2CO_{2(g)} \Delta H = 788 kJmol^{-1}$

$$\frac{3H_{2(g)} + \frac{7}{2}O_{2(g)} \rightarrow 3H_2O_{(g)} \quad \Delta = 858 kjmol^{-1}}{2C_{(s)} + 3H_{2(g)} \rightarrow C_2H_{6(g)} \quad \Delta H = -86 kjmol^{-1}}$$

or if compressed ***(2 marks)***

(iv) I. Heat change $= \frac{500 \times 21.5 \times 4.2}{1000}$ kJ

$= 45.15 kJ$

II. No. of moles of ethane

$$\frac{45.15}{1560} = \quad 0.0289423 \text{ moles}$$

Therefore mass of ethane = 0.0289423 × 30g

= 0.868269g

= 0.9g ***(4 marks)***

30.6.3 Chemistry Paper 3 (233/3)

Procedure A

Table 1

Time (min)	0	½	1.0	1.5	1.0	2.5	3.0	3.5	4.0	4.5	5.0
Temperature ^oC)	19	18.5	18.0	18.0	18.0	X	13.0	13.0	13.5	13.5	14.0

(5 marks)

(3 marks)

(ii) ΔT = 6^oC ***(1 mark)***

(iii) ΔH = $20 \times 4.2 \times 6$
= 504 joules ***(2 marks)***

Procedure B

Table 2

	I	II	III
Final burette reading	16.5	32.20	32.20
Initial burette reading	0.0	16.0	16.0
Titre (cm^3)	16.5	16.20	16.20

(3 marks)

(i) $\frac{16.2+16.2}{2}$ = 16.2 cm^3 ***(1 mark)***

(ii)

I $\frac{16.2\times 0.1}{1000}$ = 0.00162m ***(1 mark)***

II Moles of HCI = Moles of NaOH ***(1 mark)***
= 0.00162

III 0.00162×10 = 0.0162m ***(1 mark)***

IV $\frac{20\times 2}{1000}$ 0.04 ***(1 mark)***

V 0.04-0.00162 = 0.00238 ***(1 mark)***

(c) 0.0238 moles = 504

1 mole = $\frac{504}{0.0238}\times\frac{1}{1000}$

= +21.176 $kjmol^{-1}$ ***(2 marks)***

2.

Observations	***Inferences***
(a) ▪ Green solid turned black. ▪ Colourless liquid condenses on cool part water of crystallization. ▪ Blue litmus paper turned pink. ▪ Red litmus paper remains the same.	▪ Solid d is hydrated or contains water of crystallization. ▪ Acidic gas is produced ***(3 marks)***
(b) ▪ No effervescence. ▪ Black solid reacts to form a green solution.	▪ Black solid is basic. ▪ Coloured ion present i.e Fe^{2+}orCu^{2+}. ***(2 marks)***
(c) (i) ▪ Blue precipitate formed. ▪ Re-dissolves in excess to form a deep. blue/Royal blue solution.	▪ Cu^{2+} present. ***(2 marks)***

Observations	*Inferences*
(ii) ▪ Effervescence occurs. ▪ Brown solid deposited. ▪ Colourless formed. ▪ Green solution turns. ▪ Test-tube gets warm.	▪ E is a metal more reactive than copper or E displaces Copper or E reduces Cu^{2+} to Cu. ***(2 marks)***
3. (a) Yellow smoky flames/sooty flame.	F is along chain hydrocarbon or an unsaturated organic compound. ***(1 mark)***
(b) Dissolves to form a colourless.	It is probably a soluble salt or Polar organic compound. ***(2 marks)***
(c) (i) ▪ Effervescence occurs. ▪ Colourless gas given out.	Compound is acidic – COOH or H^+ or H_3O_+ ***(2 marks)***
(ii) Orange/Yellow colour persists.	Absence of Hydroxyl group. ***(2 marks)***
(iii) $KMnO_4$(aq) is decoloursied.	$\diagdown$C= C or –C≡C- $\diagup$ present. $\diagup$ $\diagdown$ ***(2 marks)***