1.　　i)

```
         H     H     H
         |     |     |
a)   Q   C  =  C  -  C  -  H
         |     |     |
         H     H     H
```

```
        H     H     H     H
        |     |     |     |
 P  H - C  -  C  -  C  -  C  -  H
        |     |     |     |
        H     H     H     H
```

b) Ethanol and Conc. Sulphuric (vi) acid

c) Polypropene

d)Its non- biodegradable

ii) a)

	Carbon	hydrogen	Oxygen
mass	64.86	13.51	$100 - 78.37 = 21.63$
RAM	12	1	16
Moles	$\frac{64.86}{12} = 5.405$	$\frac{13.51}{1} = 13.51$	$\frac{21.63}{16} = 1.352$
Mole ratio	$\frac{5.405}{1.352} = 4$	$\frac{13.51}{1.352} = 10$	$\frac{1.352}{1.352} = 1$

Empirical formula $C_4H_{10}O$

Molecular formula $(C_4H_{10}O)$ n

n= $\frac{74}{74}$ = 1

Molecular formula = $C_4H_{10}O$

b) Alcohols / Alkanols

c) $2C_4H_{10}O_{(l)} + 2Na_{(s)} \longrightarrow 2\ C_4H_9ONa_{(aq)} + H_{2(aq)}$

d) Displacement

e) i) Butanoic acid

ii) Colour changes from purple to colourless/ purple colour of potassium manganate (VII) is decolourised

2 (A). i)   a) no reaction

b) does not conduct

c) react readily

d) conducts

ii)   a) $SO_3 + H_2O \longrightarrow H_2SO_4$

b) $SO_3 + 2NaOH \longrightarrow Na_2SO_4 + H_2O$

iii) The reaction is highly exothermic producing sulphuric (vi) acid fumes which are harmful

iv) P_2O_5 exists as a dimer (P_4O_{10}) with stronger covalent bonds than SO_3

v) Concentrated phosphoric acid exists in molecular form hence no ions. In dilute state the ions are free and mobile

(B)

i) $H_2 + Cl_2 \longrightarrow 2HCl$

ii) to increase the surface area for the absorption of hydrogen chloride gas

iii) mass of 1L HCl solution $= 1.18 \times 1000 = 1180g$

Actual mass of HCl $= 35\%$ of $1180 = 413g$

Moles of HCl $= 413/ (1+35.5) = 11.31$ moles/ litre

3.   a)   i) $31.0 - 25.0 = 6\ C = 6K$

ii) $50cm \times 1.0g/cm^3 = 50g$

iii) $50 \times 4.2 \times 6 = 1260$ joules

iv)   Moles of copper(II) sulphate
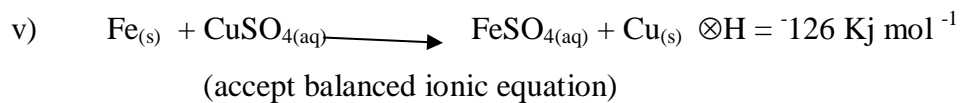
$$\frac{50 \times 0.2}{1000}$$

$$= 0.01 \text{ mole}$$

$$= 0.01 \longrightarrow 1.26 \text{ kJ}$$

$$1 \longrightarrow x$$

$$x = \frac{1.26 \times 1}{0.01}$$

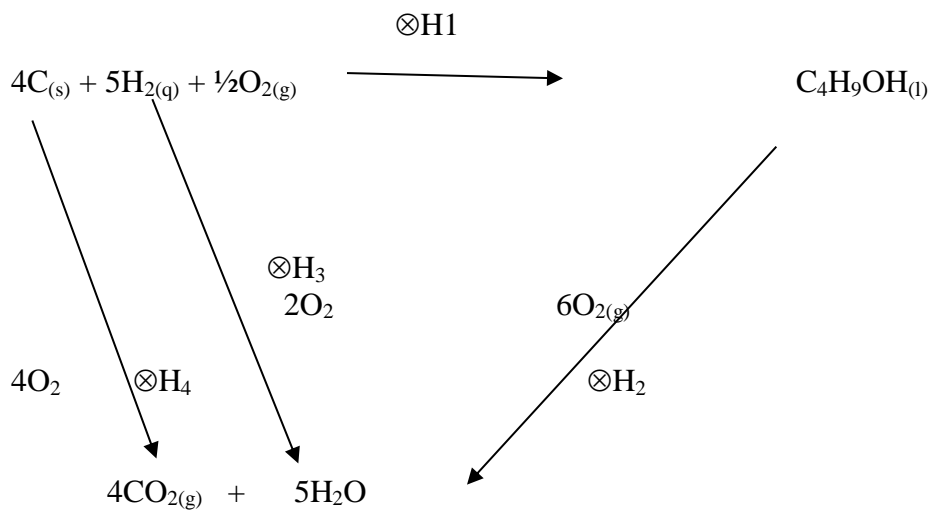$$= \underline{^-126 \text{ kJ mol}^{-1}}$$

v) $Fe_{(s)} + CuSO_{4(aq)} \longrightarrow FeSO_{4(aq)} + Cu_{(s)}$ $\otimes H = {^-}126 \text{ Kj mol}^{-1}$

(accept balanced ionic equation)

vi)   To make sure that all the Cu^{2+} has been displaced/ used up.

b)   i)   Any substance that can be burnt to produce energy

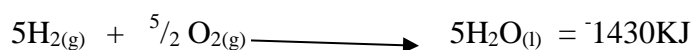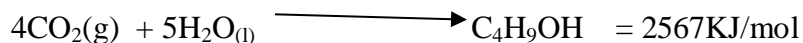$$\otimes H1 + \otimes H2 = \otimes H3 + H4$$

$$\otimes H1 + (-2567) = 5(-286) + 4(^-394)$$

$$\otimes H1 = -3006 + 2567$$

$$= -439 \text{KJ mol}^{-1}$$

OR Use of equations

$$4CO_2(g) + 5H_2O_{(l)} \longrightarrow C_4H_9OH = 2567KJ/mol$$

$$4C_{(s)} + 4O_{2(g)} \longrightarrow 4CO2(g) = -1576KJ$$

$$5H_{2(g)} + {}^5/_2 O_{2(g)} \longrightarrow 5H_2O_{(l)} = {}^-1430KJ$$

Heat of formation = 2567 + (-1576) + (-1430)

$$= -439KJmol^{-1}$$

4a) B or G <u>Reason</u>: - During ion formation it losses its two outermost electrons

b) IONIC or ELECTROVALENT
Two atoms of C will lose electrons to three oxide ions; C^{3+} and O^{2-} ions will form
which will attract each other forming an ionic bond

c) - H is less reactive than E OR E is more reactive than H
They react through gaining electrons; E has a greater <u>tendency to gain</u>

<u>electrons(s)</u>

mark than H due to its <u>smaller atomic size // greater nuclear attraction</u>

d) - G has a smaller atomic radius than F
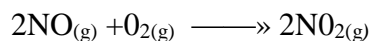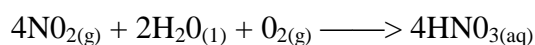
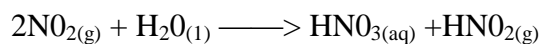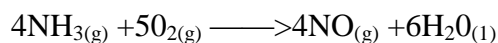i) OR F has a larger atomic radius than G
Since atom G has increased nuclear attraction which tend to pull the
outermost electrons closer to the nucleus

ii) Aqueous solutions of the oxide of B has a PH value above 7 while that of
D is below 7 since the oxide of B is basic while that of D is acidic in
nature

e)

$^{-3}$

The charge

of ion $^{-3}$

Three energy levels of 2.8.8 electron arrangement
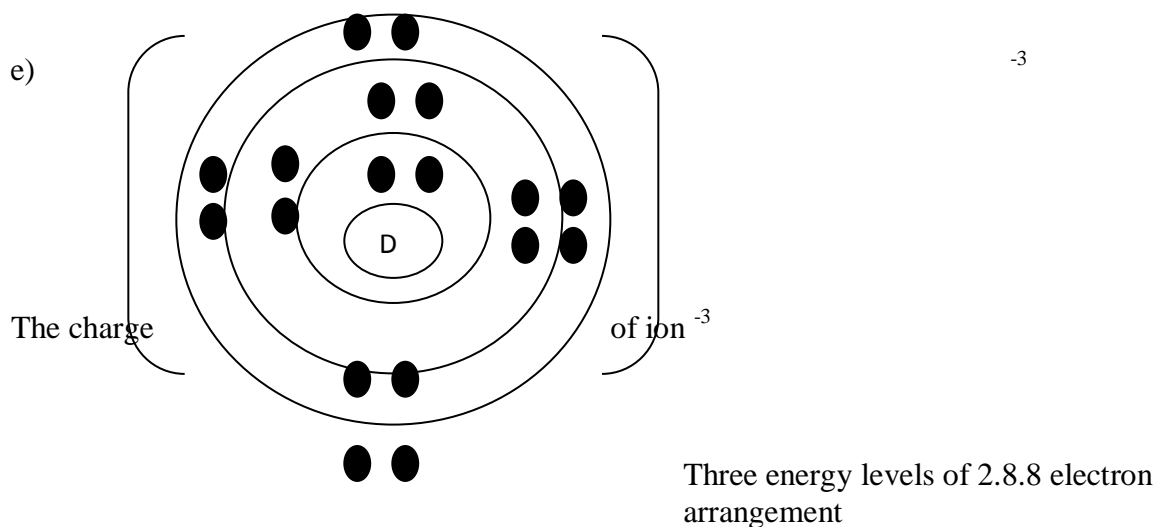
5.i) platinum or rhodium or platinized asbestos (any one 1mk)

(ii) Write any two equations for reactions taking place in step I.

$4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(1)}$

$2NO_{2(g)} + H_2O_{(1)} \longrightarrow HNO_{3(aq)} + HNO_{2(g)}$

$4NO_{2(g)} + 2H_2O_{(1)} + O_{2(g)} \longrightarrow 4HNO_{3(aq)}$

$2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$

(accept any two equations)

(iii) $HNO_3 + KOH \longrightarrow KNO_3 + H_2O$

(iv) Explain how the reaction in step III takes place.

> *H_2S is oxidized by HNO_3 to sulphur because it loses hydrogen to form Sulphur.*

(v) Name a chemical substance that can be added to solution K to form a solid.
> *Zn, Mg, Fe, (metals above Cu in reactivity series)*

(vi) Write the formula of compound J.

NH_4NO_3

vii) *Calculate the percentage of Nitrogen by mass that is present in compound J.*
R.F.M = 28 + 4 + 48 = 80

$$4\frac{28}{80} \text{ x } 100 = 35 \text{ \%}$$

(b) (i) *Ammonia can be used to manufacture ammonium sulphate $(NH_4)SO_4$ and ammonium*

. phosphate $(NH_4)PO_4$ fertilizers. Give one advantage that ammonium phosphate has over ammonium sulphate as a fertilizer

Calculation for percentage by mass of nitrogen in each fertilizer (1mk)

$(NH_4)_3PO_4$ has more macro nutrients; more Nitrogen and Phosphorous necessary for plants.   (conclusion 1mk)

6.   a) (i) I. Cl^-OH^-

   II. H^+

ii)   Gases are oxygen and chlorine

At higher concentration CL^- ions are preferentially discharged to give chlorine

gas

When concentration of CL^- ions falls

Preferential discharge of OH^- ions occurs to produce oxygen gas

iii)   Q = 1t

    = 2 x 12000 = 12000 coulombs

= moles of H_2= $\dfrac{24000}{2 x 96500}$ = 0.12435

= Volume of H_2 = $\dfrac{0.12435}{1}$ X 24000cm^3
                    = 2984.4cm^3

b).   - Electroplating

        - Extraction of reactive metals

        - Purification of copper

        - Anodising aluminium

c) (i)   Na, has the most negative E^{θ} value,

  (ii)   F, because it has the most positive E^{θ} value

  (iii) E^{θ} cell $= E^{\theta}$ (Red) $- E^{0}$ (oxide)

          $= + 2.87 - (-2.92)$

          $= + 5.79v$

7. a) The surface area of lead (II) carbonate

b) i)   workable diagram

      labeled reagents

      measurement of volume

ii)   all curves originate from origin

      order of curves from top (2,1,3)

      all curves flatten at same level

iii $PbCO_3 + 2HNO_3 \longrightarrow Pb(NO_3)_2 + CO_2 + H_2O$

    c)   When hydrochloric acid is used, an insoluble coating of lead (II) chloride is formed which prevents further reaction of the acid on the carbonate.