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1. a) x-2, 8, 3 , √ (1mks)
   Y- 2, 8 6 √ (1mks)
   b) X_2Y_3 √ OR Al_2S_3 (1mk)
2. The mixture would turn brown due to excess $Br_{2\,(g)}$ / H+ ions removes OH- ions from the mixture / equilibrium shifts to the left/observation not there BUT equilibrium shift to the left/ more Br formed for observation (2mks)

3. 1 mole CaCO3 2 moles of HCL
   Therefore 0.1($^1/_2$) mole CaO3 0.2 Mole (½)
   CaCO3 = 40 + 12 + 48 = 100g (½)
   Therefore 15g Ca CO3 = 15 = 0.15Moles
   100g
   Excess moles 0.15 – 0.05 (½)
   Excess mass= (0.05) x 100 (½) = 5g (3mks)

4. a) II because it requires little soap to lather (2mks)
   b) III has temporary (½) hardness, which is removed by boiling (½) (1mk)
5. a) sisal/ Cotton/ wool/ silk /jule/hemp/fur/hair (1mk)
   b) They are stronger than natural fibres/OR are not easily affected by chemicals/lasts longer /durable/ can be produced easily in a large scale therefore cheaper (Reject. Strong bonds) (1mk)
6. a) Pass the mixture through H2SO4 which absorbs D then collect by downward delivery/pass the mixture though NaoH(aq) which absorb D and then collect by downward delivery (upward displacement) (2mks)
   b) Ammonia (½) – Gas- D reacts with the acid (½) / basic/ is less denser / lighter than air. (1 mk)
7. II Because pure substances have sharp MP and BP as shown by the flat regions of curve II. (accept systematic) (2mks)
8. a) $2H_2sO_4$
   b) Insoluble in water/slightly soluble in water (1 mk)
   To ensure that the air that occupied the apparatus initially is expected (reject impurities) (1 mk)
   9. When circuit is completed bulb lights (½) brown substance (½) formed grey (½)substance formed on cathode; because PbBr2 acts as an electrolyte (½) /free /mobile (½) ions; lead ions gain electrons to form pb(½) (Lead) and loses electrons to form (½) Bromine (Br)
   (Equations show ions current flow) (3mks)
10. a) To remove oxide coating which could inhibit reaction (1 mk)
    b) ORP
11. a) addition (1mk)
    b) $CH_3CH = CH_2(g) + Cl_2(g) \longrightarrow$ CH3 CHCICH2 CL (g)
    OR
    $C_3H_6 + Cl_2$ (1 mk)

12. Hydrogen forms compounds by losing one electron like group I elements or by gaining one electron like group VII element /Hydrogen has one electron in outermost shell. (2mks)

Al(s) + 6H+ (aq) 2A13+ (aq) + 1□ (g)

A1(s) +6OH-(aq)⟶A1 (OH)□(aq) + 2H□O (g)

13. a) Wood ash is basic/ alkaline and would therefore react with aluminium Utensils/amphoteric/ 2A(s) + 6H + (aq) 2A13 + (aq)) + 3 H_2 (g) (2mks)

b) It is strong ($^1/_2$) and not easily corroded ($^1/_2$) / Does not rust (1mk)

14. a) (C3H6O)n = 116

(3 x 12 + 6 + 16)n =116 ($^1/_2$) Molecular formulae = 2(C□H□O)

58n = 116 ($^1/_2$) = $C_3H_{12}O_{2(1/2)}$

N = 116 = 2($^1/_2$) (2mks)

58

b)Percentage of Carbon = $\frac{12x6x}{116}$ 1000($^1/_2$) = 62.07 ($^1/_2$) Range (62.05 – 62)

OR

$\frac{3 \times 12}{58}$ x 100 (1/2) = 62.07 (1/2) (mark consequently)

15. Cool the mixture to a temperature below – 196ºC to form a liquid then start warming, Nitrogen distils off a gas at – 196O (cool first) (2mks)

16.a)

Alkaline	Formula	Heat of combustion (△Hc)kjmol^{-1}
Methane	CH_4	- 890
Ethane	C_2H	- 1560
Propane	C_3H_8	- 2220
Butane	C_4H_{10}	- 2870 – 2880($^1/_2$)

(Correct answer only –ve sign)

(award full mark if figure is not ±)

2220 - 1560 = 660

1560 – 890 = 670

2220 + 650 = 2870

(Accept any value 2870)Any calculation (1mk)

b) △Hc is an exothermic reaction. (1mk)

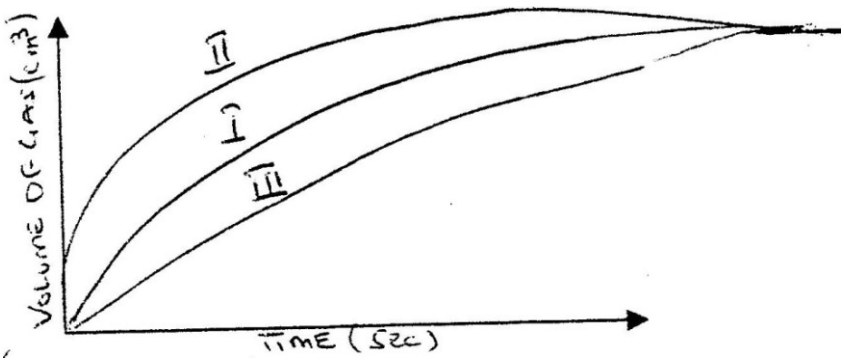
17. a) I – Molten sulphur

b) II – Superheated water / water.

18. a) 2HCl (aq) + Zncl □(aq) + H2 (g) ($^{-1}/_2$) states)

b) $2H_2$ (g) + O_2 (g ⟶ $2H_2O$ (g) (Not L) ($^{-1}/_2$ state)

19. Hydrogen, because it is lighter/ less denser / diffuses faster (2mks)

20. 

21. W because its solubility decreases with increase in temperature

22. a) i) NO-3 : O3- = -6
. . N = + 5 (+5) (don't mark formula) (1mk)
ii) NO
O = 02 . . N = + 2 (1mk)

b) Reduction ($^1/_2$) because the nitrogen ion in NO□ gains 3 electrons ($^1/_2$) to form the nitrogen in NO. (1mks)

23. The chloride form ions in water which conduct electric current. NO ions are formed in methylbenzene /chloride exists in methylbenzene as molecules. (2mks)

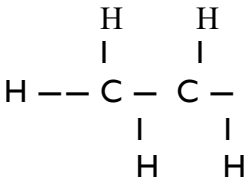
24. A gas with a smell of rotten eggs is formed H_2S gas is formed / A greenish solution is formed? Effervescence / A gas is produced / Black solid dissolves. (1mk)

25. Dissolve the potassium sulphate ($^1/_2$) in water, dissolve ($^1/_2$) the lead carbonate in the nitric acid, mix the two solutions ($^1/_2$) and filter ($^1/_2$) off the lead sulphate precipitate//
Dissolve lead carbonate in nitric acid add solid $pbSO_4$ and filter off (max^1 ½)//
Dissolve this in HNO_3 and add solid $pbCO_3$ and filter off the precipitate.

26. Enthalpy of neutralization between CH_3 CaOH $_{(aq)}$ and NaOH $_{(aq)}$ is lower than that between HCl $_{(aq)}$ and NaOH because CH_3 CaOH $_{(aq)}$ is a weak acid which does not dissociate fully in water thus some of heat produced is used for dissociation fully dissociated and partially dissociated. (2mks)

27. Ca (OH) 2 (aq) forms white precipitate (1/2) with CO2 Can be observed NaOH(1/2)(aq) does not form a precipitate. (1mk)

28. a) Structural formula



Butan – 1 01 But – 2- 01
Butan-2-01($^1/_2$)
Butanol
But-01-01

b) $2CH_3\,CH_2\,CH_2\,OH_{(l)} + 2K_{(S)} \longrightarrow 2CH_3CH_2CH_2CH_2OK^+(l)+H_2(g)$
$2S_9H9OH + 2K \longrightarrow 2C_4H_9OK + H_2$ (1mk)

29. **a)** Yield would increase (1/2) since △ H us position/ thus increase in temperature shift the equilibrium to the right .Since △ H is positive ($^1/_2$) (1mk)
No effect (1/2) volume on the left (1/2) is the same as on the right//moles on left same as moles on the right.(1mk)

30. a) 100g of Pa ⟶ 50g if Pa ⟶ 25g Pa ⟶ 12.5 (g)
.
. . 3t ½ = 81(1/2) t=1/2 = 27 days (1/2) (2mks)

b) Mass number – 233 (1/2)
Atomic number – 92(1/2) (1mk)

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1. a) K and N because they are in the same group OR loses 2 electrons/same number or electrons sins the outer energy level (2mk)
   b) L $_2O_2$ OR L_2O (1mk)
   c) L, because it has 7 electrons in its outermost energy level (2mk)
   d) M, Because its ionic radius is bigger than atomic radius so its tendency to donate its electrons is high
   (e) M and N arc in the same period. Across the period ionic radius decrease due to increase in nuclear charge OR nuclear charge of N is greater than M. L gains electrons to form L. There's increase in repulsion of electrons (2mks)

2. (a) (i) Liquid P – concentrated sulphuric acid (1 mk)
   Solid Q- Aluminium (III) chloride OR $AICI_3$ (1 mk)
   (ii) Anhydrous calcium chloride or fused calcium or lumps of calcium chloride (1 mk)
   (iii) The blue litmus paper turns red because the HCI(g) that does not react with the aluminum dissolves in the water making it acidic. (2mks)

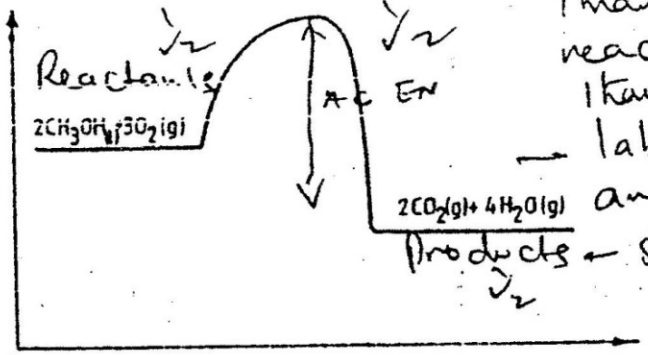
   (b) (i) $NH_4 + HCI\ (g) \rightarrow NH_4\ CI(g)$ (1 mk)
   (ii) $HCI\ (g) + NH_4\ (g) \rightarrow NH_4CI\ (g)$ (½) Penalize ½ for wrong states)
   Moles of HCL = $\frac{200}{24000}$ ½ = 0.00833 ½ moles HCI
   0.00833 moles HCI = 0.00833 moles NH_4CI
   NH_4CI = 14 + 4 + 3.35 = 53.5g ½
   (0.00833) (53.5) = 0.446 g (answers must be to 3dp)
   $CH_3OH + 3O \rightarrow CO_2$ + Heat (penalize ½ if wrong unit for answers)
   (3 mks)

3. (a) $2CH_3OH(g) + 3O_2(g) \rightarrow CO_2\ (g) + 4H_2O(g)$
   (b) (i) 22.98 – 22.11 = 0.87 g methanol
   R.F.M $CH_3\ OH$ = 12 + 3 + 17 = 32 (½)
   0.87 (½) = 0.02718 (½) moles OR 0.02719 moles
   Temp rise = 27 – 20 = 7 (½) (2 mks)
   (ii) Heat change = △H= 500 x 7 (½) x 4.2 = 14700j (½) if unit missing)
   (2 mks)
   (iii) 0.027 moles = 14700J
   1 mole = $\frac{[14700]}{[0.027]} \times \frac{[1]}{[1000]} = 544.4\ kjmol^{-1}$

   $\frac{[14700]}{[0.022718]} = 540.7\ kjmol^{-1}$

   (c) This value is lower than the theoretical value because some of the heat is lost to the surrounding because apparatus is not shielded. Some more heat is also lost to the apparatus. Incomplete combustion of methanol (2 mks)

(d)



1 mark for the reactants is higher than the products
— labelling the reacts and products ½ mark
— showing activation energy ½

4 (a) (i) Sulphur dioxide (1mk)

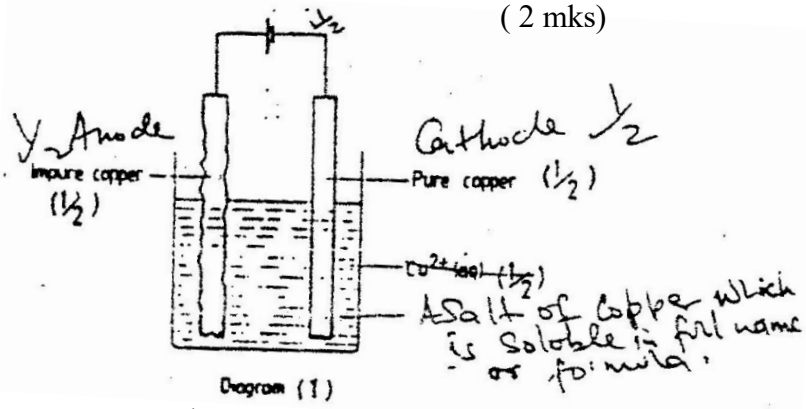
(ii) $2\ cuFeS_2(s) + 4O_2\ (g) \rightarrow 2FeO(s) + Cu_2\ S(s) + 3SO_2(g)$ (1 mk)

(iii) Fe^2 (1 mk)

(iv) P is carbon dioxide/carbon monoxide (1 mk)

(v) Reduction – oxidation (Redox) reaction because Cu_2O is reduced to Cu while coke to $CO_2(g)$ (2 mks)

(b)



(c) 1 mole of CuFeS = 1 mole Cu

210kg Cu = OR $\frac{210}{63.5} \times \frac{183.5}{810} \times 100$ or mass Cu in cores = $\frac{810 \times 63.6}{183.5}$ =

$\%Cu = \frac{210}{280} \times 100 = 74.9\%$

3.3 moles of Cu(s) = 3.3 moles CuFeS2

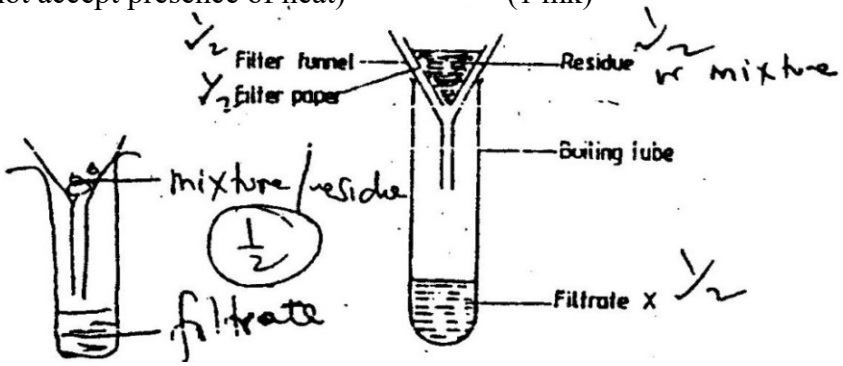
$CuFeS_2 = 63.5 + 56 + 64 = 183.5$ g

$= 183.5 \times 3.3 = 605.6 \times 10^3$g

$\text{Purity} = \frac{605.6 \times 1000 \times 100}{810 \times 1000} = 74.75\%$

(d) Acid rain may from due to presence of SO_2 (g) and CO_2 (g) dumping of the waste like the slag prevent vegetation growth large gullies left after the ore is excavated destroys the environment (Do not accept presence of heat) (1 mk)

5. (a)



(iii) Zn^{2+} (aq) + $4NH^3$ (aq) → $[Zn(NH_3)^4$

(iv) Brown coloured gas OR reddish brown (1 mk)

(v) Addition of anhydrous or white $CuSo_4$ copper (II) sulphate which turns blue in presence of water or cobalt chloride paper which turns pink (1 mk)

(b) (i) One of the salts in R is not soluble in water because a residue is formed on addition of water (2 mks)

(ii) CO_3^{2-} because CO_2 (g) is produced on addition of acid (2 mks)

(iii) Pb^{2-}(aq)

(c) Zinc nitrate (1 mk)

Lead carbonate (1mk)

6. (a) (i) Bitumen, it has highest B.P (2 mks)

(ii) Fractional distillation. During the distillation petrol would distil off at 175^0 and diesel could distil at 350^0C (2 mks)

(iii) Each component is mixture of hydrocarbons which have different boiling points

(iv) Methane CH_4(g)

Ethane C_2H_6

Propane C_3H_8

Butane C_4H_{10}

(b) Burning it in limited amount of air will produce carbon monoxide which is poisonous (2mks)

(c) Manufacture of tar used in tarmac/ sealing of roofs (1mk)

7 (a) (i) Liquid L is water

(ii) Black copper (II) oxide changes to reddish brown because it is reduced to copper by ammonia (1mk)

(iii) $2NH_3$ (g) + 3CuO(s) $3Cu(s) + N_2(g) + H_2O(I)$ (1 mk)

(iv) I 2 moles NH_3 ➡ 1mole N2

$320cm^3NH_3$ ➡ $\frac{320}{2} = 160cm^3$

II Moles of $NH_3 = \frac{320}{24000} = 0.133$

2 moles of NH_3 = 3 moles CuO

Moles pf CuO – $\frac{320}{RFM\ OF\ CuO} \times \frac{½ \times 3}{1/5} = 0.02$ moles

RFM OF CuO = 63.5 + 16 = 79.5

Mass of CuO= 0.02 x 79.5g = 1.59g (3mks)

(v) The excess ammonia from the reaction dissolves in the water in the beaker to form ammonium hydroxide which is a weak alkali or base of pH about 10. (2 mks)

(b) The burning splint would be extinguished (1 mk)

(c) Because it is cheaper and ammonia is made from nitrogen (1mk)

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1. Air is less dense than carbon dioxide and so it enters the polous pot faster than carbon dioxide out of it. This sets up a higher pressure; in the pot and the level rises as shown:

2. $P_1V_1 = P_2V_2$ OR $\frac{V1}{I_2} = \frac{V_2}{I_2}$ (Charles' Law)

$V_2 = \frac{P_1V_1T_1}{T_1P_2}$ $V2 = \frac{250x315}{300}$

$= \frac{750x250\ x315}{300x\ 750} = 262.5$

3. a) Moles of Zn = $\frac{196}{65.4}$ 0.03

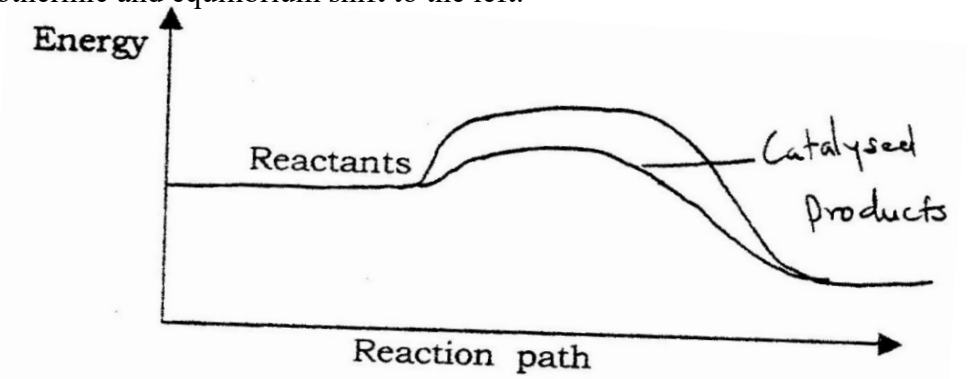
Holes of HCL = $\frac{100 \times 0.2}{1000} = 0.02$

Nine was in excess

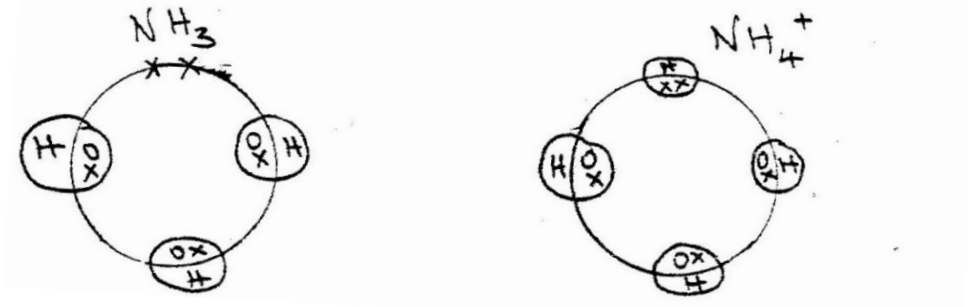
b) Moles of H_2 produced = 0.01

Volume = 22.4 x 0.01 = 0.224 litres or 224 cm^4

4. a) increase in temperature would lower the yield of Nitrogen, this is because the reaction is exothermic and equilibrium shift to the left.



5.

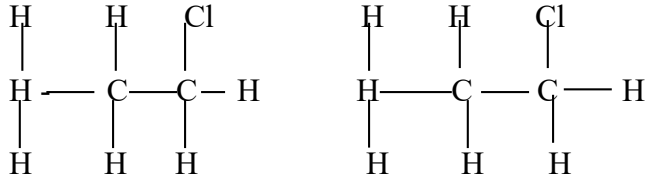


It has a lone pair of electrons which it uses to form a dative bond with H ions (1mk)

6. a) G
b) E

7. a) U-V Light/ sunlight

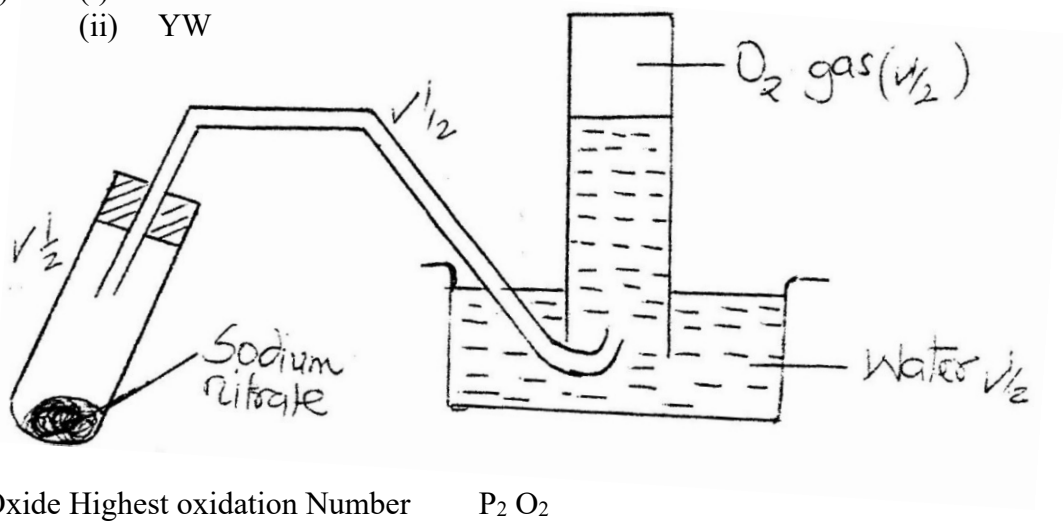
b)



8. Sulphur dioxide, it reacts with limewater being an acid gas
9. Add solid hydrogen carbonate; CH_3COOH produces effervescence; while $CH_3CH_2CH_2OH$ does not (Accept any other carbonate that behaves
10 The ionic end lowers the surface tensions of water , facilitating mixing while the non- ionic end (non-polar end) mixes with grease, dislodging it from the fabric.
11. Number of neutrons =1
Number of electrons=1

12 $2mg_{(s)} + O_{2\,(g)} \longrightarrow MgO_{\,(s)}$
$3Mg_{(s)} + N_{2\,(g\,)} \longrightarrow Mg_3N_{2(s)}$

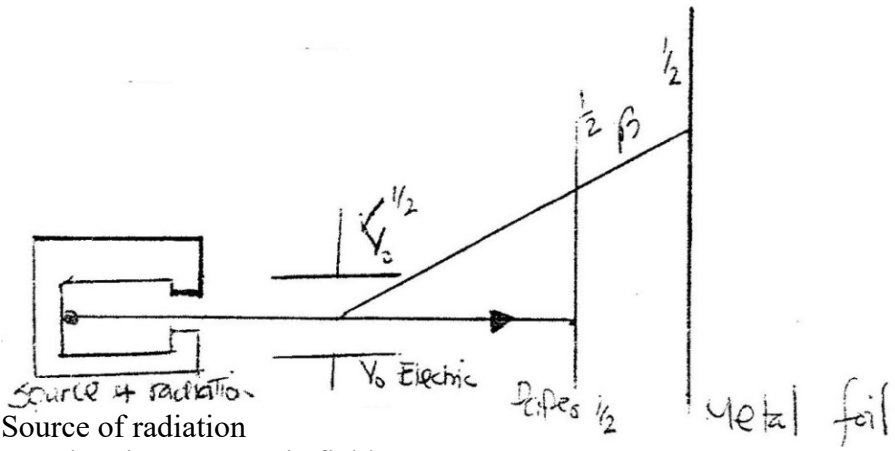
13. I, production of carbon dioxide or carbon is oxidized to its highest oxidation number/ carbon dioxide cannot burn further or carbon dioxide cannot burn further or carbon monoxide can burn further.
14. Increase in pressure would shift the equilibrium to the left; since in pressure favors the reaction will produce less volume of gas.
15. a) X, both energy levels are full i.e 2:8 outer energy level full/has octane structure/inert gas structure.
b) (i) W and Y
(ii) YW
16



17. Oxide Highest oxidation Number P_2O_2
C_2O_7
18. Sodium chloride will remove Pb from the insoluble pbC12. This affects the value of the cell voltage.
19. a) The energy change that takes place when one mole of the compound is formed from its constituents elements in their state
b) 3x-286 = 2x-394-(277)

858 + 788+ 277 = 11369kjmol

20.



Source of radiation
For electric or magnetic field
For showing how α and β are attracted
For showing how α stopped by paper, β by metal foil.

21. a) The colourless solution would turn brown, chloride displaces iodine from iodine solution

$$C_{2(g)} + 2I_{(aq)} \longrightarrow C\ (aq) + I2_{(aq)}$$

b) Covalent, because elements are non-metals

22. a) $Li(s) + 2H\square O(s) \longrightarrow 2I\ (aq)$

b) Potassium is very reactive; and so the reaction is likely to be very violent

23. Dissolve in water, filter to remove lead carbonate as a residue, evaporate filter to saturation and allow to cool. Crystallization to take place. Filter the crystals and dry. Evaporate to dryness.

24. a) H2S because it is oxidized by losing hydrogen/oxidation number s us increased from -2 to 0. Cl2 is reduced form 0 to -1.

b) Theoretical yield of S = $2.4 \times \frac{100}{75} = 3.2g$

Mole of H2S(g) = Moles of S(s) = $\frac{3.2}{32} = 0.1mol$

25. Monomer $CH2 = \underset{\underset{CH}{|}}{CH}$

R.M.M of monomer = 36+3+14 =53

No. of monomer $= \frac{5194}{53}$

26. (a) (i) Iron (II) nitrate solution – turns lead acetate paper black/give yellow solid with SO_3 amphoteric/soluble both acids and bases.

29. $CO(g) + PbO_{(s)} \longrightarrow Pb(s) + CO_2(g)$

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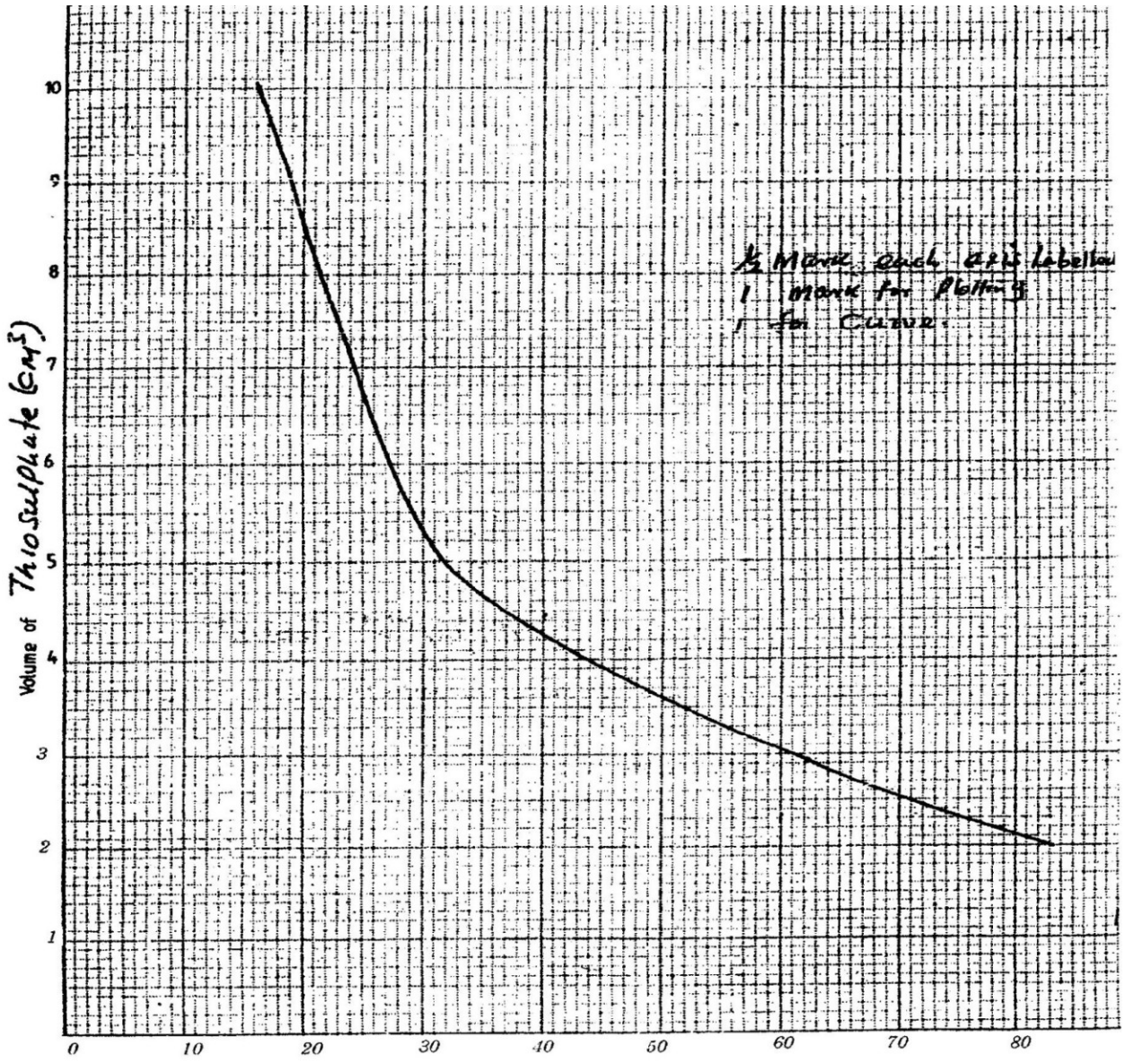
1. (a) i)



ii) I. 27-28 seconds (1mark)
II 54- 56 seconds (1 mark)

(Answers should also be read from the graph concentration in part II is half that of part I)

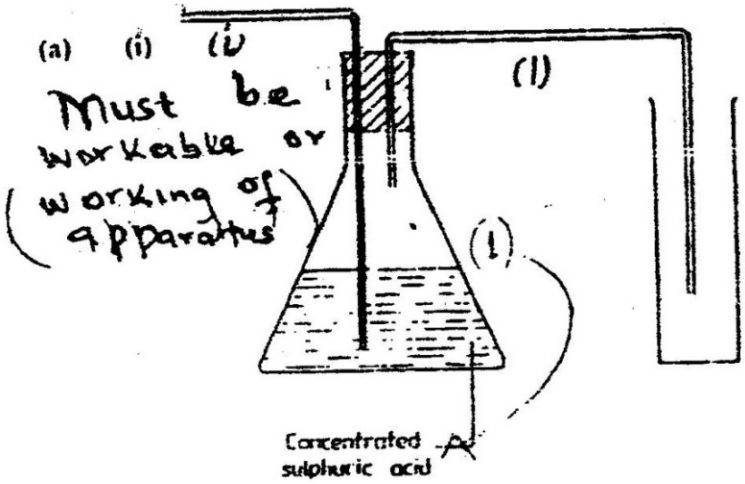
b) (i) I Moles of thiosulphate = $\frac{10}{1000}$ x 0.4 = 0.004 moles

II Moles of hydrochloric acid = $\frac{10}{1000}$ x 2 = 0.02 moles (2 mks)

(ii) Thiosulphate – hydrochloric acid is in excess (1 mark)

c) Same across should be used in each experiment (1 mark)
Cross should be viewed from the same position (1 mark)

2. a) (i)



(ii) MnO_2 is reduced
In MNO_2 Mn has oxidation +4 where as on $MnCl_2$ it has oxidation number +2 (2mks)

(iii) To remove HCL fumes/ absorb as/spray (1 mk)

b) (i) X- Oxygen (do not allow chlorine) (1mk)
Y- Hydrogen (1mk)

(ii) Water is a poor electrolyte when HCL gas dissolves in form hydrochloric acid which is an electrolyte. (2mks)

(iii) $4OH^-_{(aq)} \longrightarrow O_2(g) + 2H_2O(l) + 4e$

OR

$4H^+_{(aq)} + 4e \longrightarrow H_2(g)$ s (1mk)

b) (i) X-Oxygen (do not allow chlorine) 1mark)
Y- Hydrogen (1mk)

(ii) Water is a poor electrolyte when HCL gas dissolves in form hydrochloric acid which is an electrolyte. (2mks)

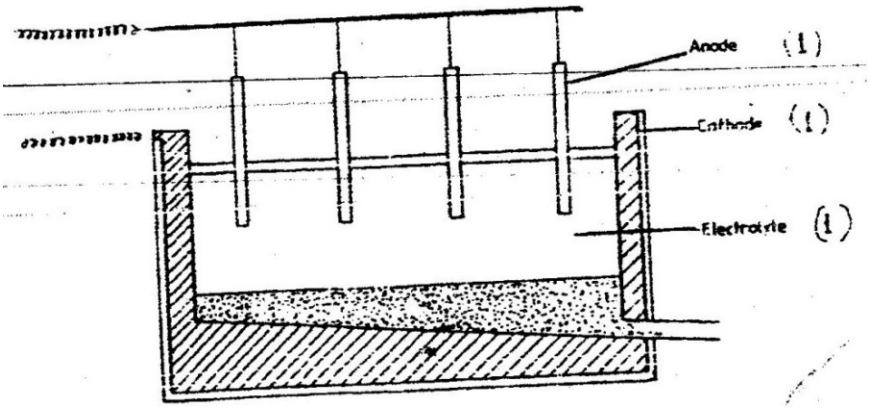
(iii) $4OH^-_{(aq)} \longrightarrow O_2(g) + 2H_2O(l) + 4e$

OR

According to the equations the gases are produced in the ratio (2mks)
$O_2 : H_2 = 1:2$ (2mks)

3. a) (i) Bauxite (1mk)
(ii) Iron (III) Oxide/ silicon (IV) / silicon dioxide/ silica (1mk)

b) (i)



(ii) I. It is uneconomical/ expensive, because a lot of energy is required to produce this high temperature.

II. Addition of cryolite

(iii) The melting point is below 8000C.

C) Quantity of electricity = 40,000 x 60 x60 coulombs.

3x96, 500 coulombs of produce 27g of Al

40,000x 60 x 60 x27

3x 96,500x 1,000

= 13.4kg.

4 a) C=6, H=1, Na= 11, Ne = 20.

b) Ca+ 2, 8, 8

p3- 2, 8, 8

c) -259 + 273 = 14k.

d) Red phosphorus this is because it has a higher melting point.

e) The one of atomic number 24 because it is closer to the R.A.M (24.3) that means it contributes to R.A.M more than the other two (2mks)

f) Al4C3 (1mk)

g) The melting point of a magnesium is higher than of sodium because its effective nuclear chare is higher/ it contributes more electrons to the metallic bonding as compared to Na which contributes/magnesium has 2 outer electron(+2) where as sodium has only one(+1) which can be delocalized. (2 mks)

5. a) i) $C_2H_4O_2$. Its M.P is higher than 10^oC

ii) C_5H_{12} and C_6H_{14}

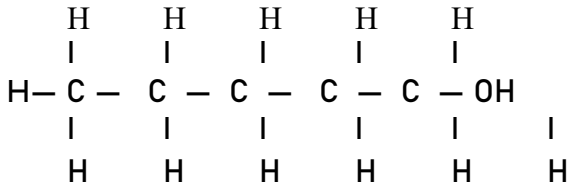
C_6H_{14} has a higher M.P therefore stronger van der waal force / intermolecular forces.

iii) C_3H_8O is more soluble in water than $C5H_{12}$ because it forms hydrogen ` bonds with water molecules OR because it is polar due to the presence of OH / OH mixes with water (Hydrogen bond if formed)

b) i) C_4H_8

ii) $C_4H_8 + 6O_2 \longrightarrow 4\ Co_2 + 4\ H_2O$

c) i)



ii) Concentrated sulphuric acid / Al_2O_3 / Concentrated phosphoric acid.
Heat (160 – 180^{o}C)

d) i) Saponification / Hydrolysis. (1mk)

ii) Esters / fats (1mk)

6. a) i) Hygroscopic / Hygroscopy (1mk)

ii) Deliquescent / Deliquescence (1mk)

iii) Efflorescent / efflorescence's (1mk)

b) i) $Zn(OH)^{2+}_4$

ii) $Cu\ (OH)_4^{2-}$

c) i)

Fe	O	S	H_2O	
	20.2	23.0	11.5	45.3
	56	16	32	18
	0.36	1.44	0.36	2.52
	1	4	1	6

Empirical formula $FeSO_4\ 7H_2O$

Empirical mass = (56+3+64+7(18)) = 278

Formula $FeSO_4\ 7H_2O$

ii) 6.95g =6.95 = 0.025 moles

0.05 moles in 50cm3 = $\frac{0.025 \times 1000}{250}$ = 0.1

Concentration is 0.1 Mol^{-1} $\frac{6.95 \times 1000}{278 \times 250}$

7. a) i) I) 18.8°C (avoid 17.5°C)

II) Solubility at 100oC is 153 – 154 in $100cm^3$

Maximum mass in 15 litres = 154 x 15g.

ii) Solubility at 23°C is 98g in $1{,}000cm^3$

Moles of SO2 = $\frac{98}{64}$ = 1.53

Moles of NaOH = 2 x 1.53 = 3.06

Volume of 2M NaOH $\frac{3.06 \times 1000}{2}$ = $1{,}530cm^3$

b) i) I) $4FeS_{2(s)} + HO = (g) \longrightarrow 2FeO_{3(s)} + 8SO_{2(g)}$

II) $SO_3(g) + H_2SO_4 \longrightarrow H2S2O7(10)$

III) $H_2S_2O_{7(l)} + H_2O_{(10} \longrightarrow 2H_2SO_{4(l)}$ or $_{(aq)}$

ii) I) Excess to shift equilibrium position to the right increases yield of SO_4

Or produces more SO_3 / complete oxidation of SO_2

II) Vanadium (V) oxide / platinum or V_2O_5 / Vanadium pentoxide.

CHEMISTRY PAPER 233/1 K.C.S.E 1997
MARKING SCHEME

1. - Iron wool turns or rusts due to formation of hydrated iron (III) oxide
   - Level of water inside the tube rises to occupy the space left by oxygen
   - Level of water in the beaker will fall

2. - Kerosene floats on water therefore it continues to burn
   - Carbon dioxide blanket covers the flame OR cuts off the supply of oxygen

3.

Name of polymer	Name of monomer	One use of the polymer
Polystyrene	Styrene (Phenylethene)	Insulation, plastic pipes, Biros, Artifi rubber, care tyres manufacture of plas
Polymhyl chloride Polychloethane polychoeroethane	Vinyl chloride (chloroethane)	Insulation of electric cables, plastics, p cups, pipes, making plastic tiles, plasti shoes, water tanks

4. - K^+, / Na^+ / (Lit) and CO_3^{2-}

5. - B
   Give a reason
   - B does not form scum / A forms scum
   - B is soapless detergent

6. (a) - White solid/ white ring/ white substance
   (b) - Nearer to HCI than to NH_3
   NB. Not to touch the cotton wool

7. (a) - Time taken for a given mass of radioactive isotope to reduce to Half
   (b) No. of t ½ = $\frac{100}{25} = 4$
   $\frac{5}{M} = (^1/_2)^4 = M = 80g$

8. (a) $C_2H_3 = 27$
   $27n = 54$
   $n = 2$
   MF = $(C_2H_3)_2 = C_4H_6$

H- C - = - C - C - H
I I
H H

(c) Alkyne/ Alkene
Depending on the structure

9. (a) - Barium Sulphate ($BaSO_3$)
(b) - $BaSO_{3(s)} + 2HCI\ (aq) \rightarrow BaCI_{2(aq)} + SO_{2(aq)}$
(c) - Changes from orange to green

10. (a) - $Pb^{+}\ (aq) + SO_4^{2-}(aq) \rightarrow PbSO_{4(s)}$
(b) RFM of $PbSO_4$ = 207 + 32 (16 x 4) = 303
0.63g pf Pb are in $\frac{303}{207}$ x 0.63
= 0.92g

11. - Aluminum chloride is covalent while magnesium chloride is ionic

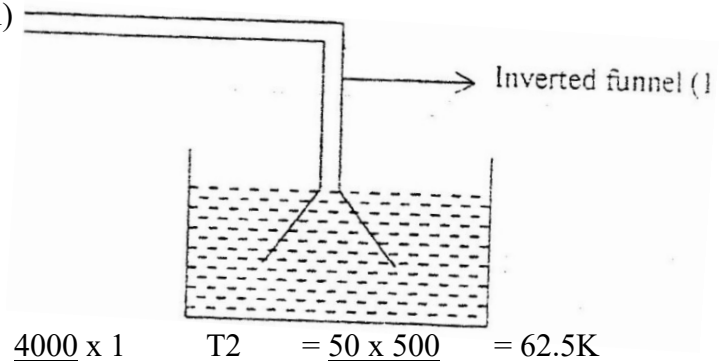
12. - Tetrachlomethane/ carbon tetrachloride

Cl
I
Cl - C - Cl
I
Cl

13. (a) ΔH_1 – Bond breaking/ activation Energy
ΔH_3 – Energy evolved during reaction
(b) - $\Delta H_3 = \Delta H_1 + \Delta H_2$

14. (a) - Yellow solid formed/ yellow substance/ sulphur deposited
(b) - $_2S(g) + Cl_2(g) \rightarrow 2HCl(g) + S(s)$
(c) - In a fume cupboard/ in open air
- Both $H_2S(g)$ and Cl_2 (g) are poisonous gases (They have irritating/ pungent smell)

15.



16. - $\frac{0.5 \times 100}{T_2} = \frac{4000}{500} \times 1$ T2 $= \frac{50 \times 500}{400} = 62.5K$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{1 \times 400}{500} = \frac{0.5 \times 100}{T_2}$

$T_2 = \frac{0.5 \times 100 \times 500}{400}$

$T_2 = 62.5\ K$

17. - $H_2O(l)$ – It accepts a proton (H+) forward r x n
    - or HO_2 – it accepts a proton (H+) Backward r x n

18. (a) - Fe^{3+}
    (b) - Oxidizing/ oxidation property
    (c) - $2Fe(OH)_3(s) \rightarrow Fe2O_3(s) + 3H_2O(g)$ or (l)

19. (a)- $Ca(OH)_2(aq) + Ca(HCO_3)_2(aq) \rightarrow 2CaCO_3\ (s) + H_2O(l)$
    (b) Moles $= \frac{\text{Volume x Morality}}{1000}$

    Moles of $CO^{2+} = \frac{90 \times 0.01}{1000}$

    $= 0.009$ moles

(c) - It forms scum initially then produces lather
    - All the Ca^{2+} had not been precipitated.
    - Water was still hhard

20. $\Delta H = 500 \times 9 \times 4.2$

    $\Delta H = 18900J$

    18900J produced by $\frac{0.6 \times 38000}{18900}$

    $= 12.06$

21. - (a) To generate stream which pushes out air
    (b) The air would oxidize zinc oxide no gas would be obtained
    (c) It is less than air

22. (a) - Thermometer should not be dipped in the mixture thermometer be at outlet point of condenser
    - The direction of water flow is wrong/ condenser wrongly fixed
    - Named flask used/ No water bath is used

    (b) - Boiling point/ Freezing point
    - Density / refractive index

23. a) - period 3 / Third period
    - Y^{3-} / p^3
    - Ionic radius is large – Atomic radius smaller
    - Incoming electron repelled by electron in shell / energy level.

24. a) Cathode - Hydrogen
    Anode - Oxygen

    b) - It increases

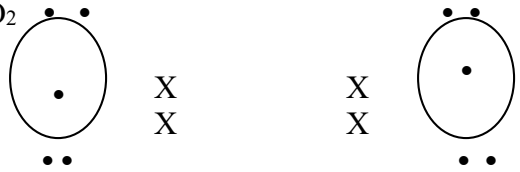
c) - There would be an explosion potassium is very reactive.
- It would react with the solvent.

25. TQRL / LRQT AND LRQT

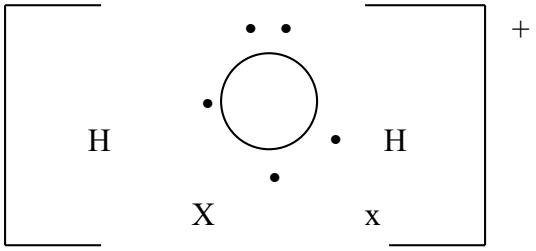
26. a) -pbO, ZnO, pbO_2, SnO,Sno_2,Al_2O_3

b) pb ($OH0^{2-}{}_4$, $Zn(OH)^{2-}{}_4$, $Zn(OH)^{2}{}_{-4}$, Na_2pbO_2,$NaZnO_2$, $NaAlO_2$, $NaSnO_2$

27. a) CO_2



b) H_3O+



28. - No. of moles of hydrogen H_2 = $^{10}/_{2}$ = 5 Moles
No. of moles of Nitrogen dioxide NO_2 = 46
Relative molecular mass of NO_2 = 46
1 Mole of No_2 = 5 x 46
5 Moles = 30g

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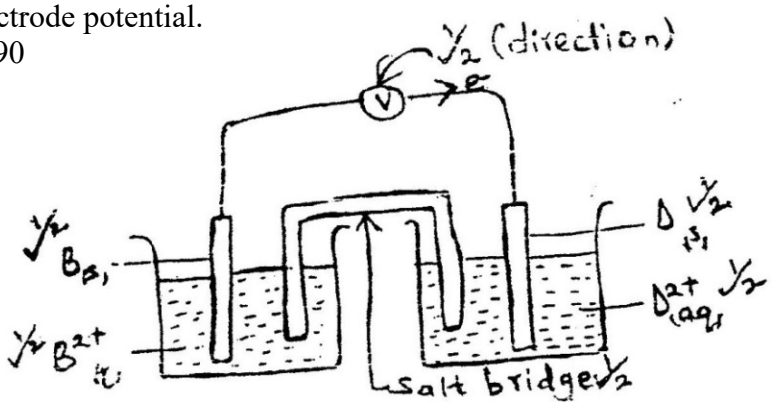
MARKING SCHEME.

1. i) C / C_2 Hydrogen is used as the reference electrode/ E^{θ} value is 0.000 / standard electrode potential.

ii) -2.90

iii)



iv) 2.38 + 0.34 = 2.72

OR

0.34 – (- 2.38) = 2.72

b) i) $CU_{(S)} \longrightarrow CU^{2+}(aq) + 2e$

OR

$CU(S) + e \longrightarrow CU^{2+}_{(aq)}$

ii) 0.2 x 5 x 60 x 60 ½ = 3600 coulombs.

63.5g Cu requires 2x96500

3600 C produce $\frac{63.5 \times 3600}{2 \times 96500} = 1.18gm$

$\frac{0.2 \times 5 \times 60 \times 60 \times 63.5}{2 \times 96500}$

2. a) i) Buta – 1 – ol

ii) Propanoic acid

iii) Ethylethanoate.

b) i) CnH2n n = No. of carbon atoms

ii) 70(not 70g if g = ½ mk)

iii) C_5H_{10}; $Ch_3CH = CHCH_2$ CH $CH_3CH = C - Ch_3$

c) i) Step I……Hydrogen

Step II …….. Hydrogen chloride gas. / $HCl_{(g)}$

Step III …….. NaOH / soda lime / sodium hydroxide

ii) $2CH_{(g)} + 5O_{2(g)} \longrightarrow 4\,CO_{2(g)} + 2H_2O_{(g)}$

iii) Environmental pollutant

It is not biodegradable / decomposed by bacteria.

3. i) G, H, L ($^1/_2$ Mk if 2)

Reason = Have a 1, 2,2 e'd respectively in outer orbit / their

Chlorides have a high M.P easily looses e,s / outer orbital have less than 4 e's.

ii) HK or Mgs (not KH or smg)

iii) J has strong covalent bonds / has a giant covalent / atomic structure / weak van der waals between molecules.

iv) +4 /4-

v) I – M.p of fluoride of G is higher because fluorine is more reactive than chlorine / forms stronger ionic bonds G than chlorine/Flourone is more electronegative
II – reactivity of L is higher. Reactivity within metallic group increases down the group and L is below H. L looses e's easily // L is more electropositive.

4. a) (i) - To lower M.P of NaCl from 800-600^{0}C hence reducing the cost of production of Na.

(ii) - Steel would react chlorine while graphite will not.

(ii) - M.P lower than that of the electrolyte

- Less dense than that of the eleactrolyte

(iv) - To prevent the chlorine and sodium from mixing / coming into conduct/ prevent products from mixing.

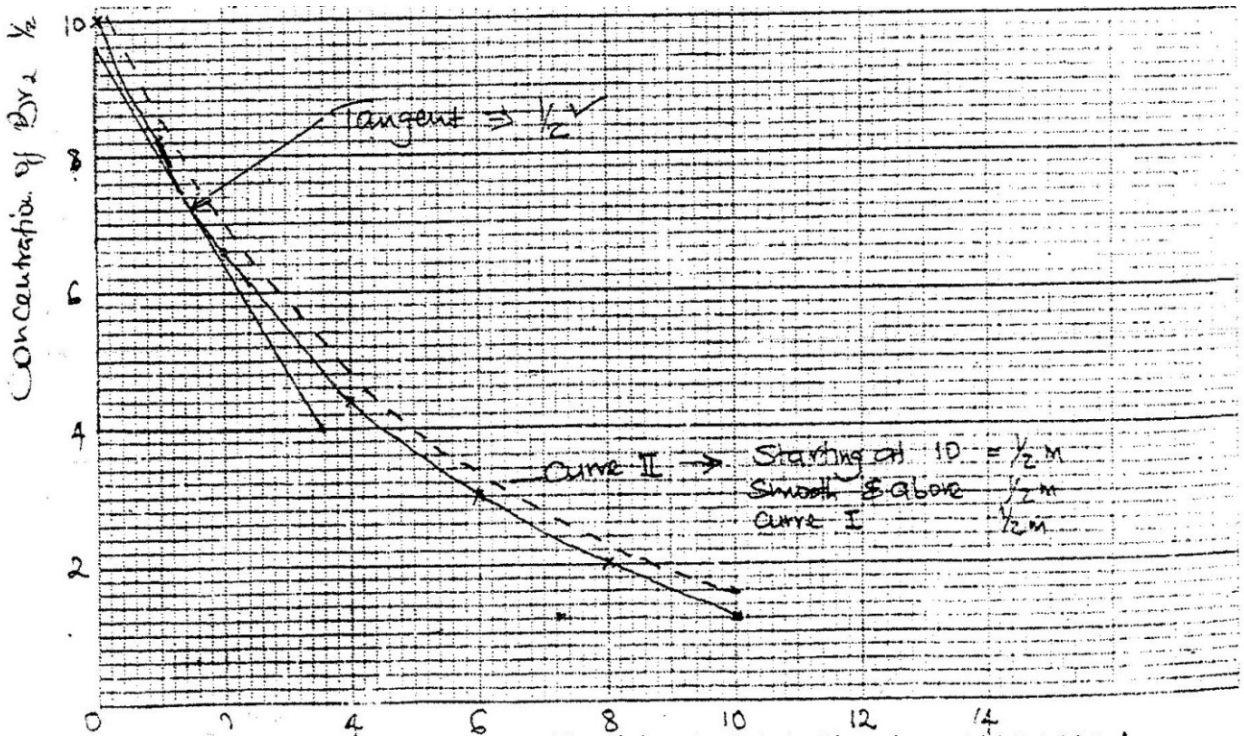
(v) I Cathode $Na^+ (i) + e^- \longrightarrow Na (l)$

II Anode $2Cl^- (l) \longrightarrow Cl_{2\,(g)} + 2e^-$

(i) Manufacture of Na2O2, NaCN / alloy of Na + Pb to make T.E.L / Liquid Na – coolant in nuclear reactors / Na vapour used in extraction of titanium.

(b) To prevent from reacting with air and water.

5 a)



(b) (i) 5.3x103 moldm3 (units not necessary/do not penalise)

Change in conc. = (9.6 -4) x 103 = 5.6 x 103

Change in time = 3.7-0 =3.7 min

Rate of reaction $\frac{5.6}{3.7}$ = 1.51 x 103

(C) At high concentration the rate of reaction is high because the more particles in solution collide at high frequency.

(d) At lower temps; the particles have les K.e / frequency of collision is reduced/ few particles/ less activation energy.

6. (a) (i) Anhydrous /fused CaCl /CaO /quick lime

(ii) To remove CO_2 $\longrightarrow$ $2Fe\ O_3$ (s)

(iii) $4Fe(s) + 3O2_{(g)}$

$3Fe(s) + 2O2_{(g)} \longrightarrow Fe3\ O4_{(s)}$

(iii) Argon // Helium// Krypton // Neon

(iv) Provide low temperature so that semen does not decompose// destroyed (low temp. tied with storage// decompose/destroyed.

b) (i) Conc. Sulphuric acid.

(ii) $NaNO_{3(s)} + H2SO4(l) \longrightarrow NaHSO_4(s) + HNO_{3(g)}$ //

$NaNO_{3(s)} + H2SO4(l) \longrightarrow Na2SO_4(s) + 2HNO_3$

(iii) I To avoid decomposition of nitric acid by sunlight/light

II Copper react with 50% Nitric acid to form colourless NO_2 then NO react with O_2 to form brown fumes of NO_2.

a) 1 mole $NHa4NO_3$ is formed from 1 M of NH_3

80Kg of $Nh4NO_3$ is formed from 17Kg NH3

4800 Kg of NH_4NO_3 requires $\frac{17x4800}{80}$ kg

= 1020Kg (penalise ½ mk if units are missing or wrong.

7. a) (i) To remove excess / unreacted HCL gas.

(ii) S

$2HCl(g) + Zn(s) \longrightarrow ZnCl_2(s) + H_2(g)$

$PbO(s) + H_2(g) \longrightarrow Pb(s) + H2O\ (g)$

(i) Mass will be lower at the end of the experiment because the combined O_2 in PbO is removed/reduced.

b) (i) I To produce HCl gas /$HCl_{(g)}$

II To oxidize $HCl_{(g)}$ to chlorine gas/produce chlorine gas.

(ii) Sodium hypochlorite/ NaOCl / Sodium chlorate

(iii) Kill germs /disinfectant/antiseptic

c) $MgCl_2$ requires 2 mol of Ag.NO3

Moles of $MgCl_2$ $= \frac{1.9}{95} = 0.02$

Moles of AgNO3 $= \frac{1.9}{95} \times 2 = 0.04$

R.F.M of AgNO3 = 170

Mass of AgNO3 $= \frac{1.9x2x170}{95} = 0.04x170$

= 6.8 gm

CHEMISTRY PAPER 233/1 K.C.S.E 1998
MARKING SCHEME

1. (a) - $234U \rightarrow 230Th + 4He$
   (b) - Gamma rays will penetrate through the walls of the container and causes damage

2. - Add water to the solid mixture A dissolves while B does Not
   - Filter the mixture
   - Evaporate the filtrate to dryness

3. Advantage
   - Prevents knocking engines
   - Prevent premature ignition
   - Increase the Octane rating (Number)

Disadvantage
   - Poisonous lead or lead compounds are released into the environment/ pollutes the atmospheres

4. (a) $|\ Al(s)\ |\ Al^{3+}(aq)\ ||\ Fe^{2+}(aq)\ |\ Fe(s)\ |$

   EMF $= E^{\theta}_{R}. E^{\theta}O$
   $= (-0.44) - (-1.66) = 1.22V$

   (b) - It is always on the left cell rep
   - Correspond on iron/ element lower in E.C.S of the two
   - Has less negative

5. (a) -D
   (b) -E

6. ALT 1

   $CxHy + O_2$ x $CO_2 + {}^{y}/_{2}\ H_3O$

   XCO_2 ${}^{y}/_{2}\ H_2O$

   3:52 1:44

   r: $\frac{3.52}{44} = 0.08$ $\frac{1.44}{44} = 0.08$

   $= \frac{0.08}{0.08} = 1$ $\frac{0.08}{0.08} = 1$

   $X = 1$ ${}^{y}/_{2} = 1$

   =E.F = CH_2 y = 2

   E.F.M = 14

   N= $\frac{56}{14} = 4$

   M.F. $(CH_2)_4 = C_4H_8$

   Mass of C = $\frac{12}{44} \times 3.52 = 0.96$

   Mass of H = $\frac{2}{18} \times 1.44 = 0.16g$

Moles of C = 0.96 = 0.08
12

Moles of H = 0.16 = 0.16
1

Ratio	0.08	:	0.16
	0.08	:	0.08
	1		2
	EF	:	CH_2
	N	:	4

MF = $(CH_2)_4 = C_4H_8$

7. (a) SO_5^{2-}
NH_4^+
(Acc. Sulphate ions, ammonia ions)

(b) From ammonia and sulphate based fertilizer

3. $FeCl_2$ oxidation No. of Fe increase from +2 to +3
Or oxidation No. of Cl_2 decreases from 0 to -1

4. (a) – Rxn where the rates of forward and backward rxns are the same
(b) – The mixture becomes more yellow reasons: The equilibrium Position Shifts/ moves to the right since more OH- ions have been added

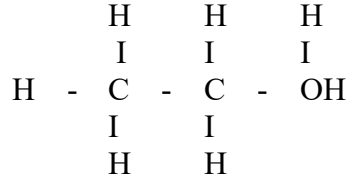
5. 16N
15P

6. (a) In Diamond all the C- atoms are joined together by covalent in a three dimensions (3 –D) structure/ Tetrahedral structure thus very hard
(a) The C- atoms in graphite are bonded in layers/ hexagonal strata's, those thus slide over one another easily.

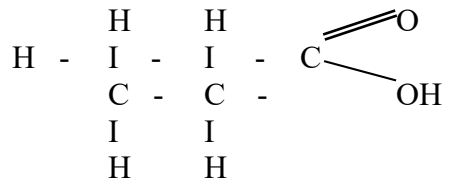
7. Strong acid - one which is fully dissociated when in water e.g HCI, Hi, Hi, HBr
Weak Acid: one which is partially dissociated when in water e.g. CH_3COOH

8. (a) Because concentration of Cu^{2+} is high at the beginning and decreases as the ions are discharged during electrolysis
(b) Cu^{2+} (aq) + 2e = Cu(s)

9. (a) Ethanol



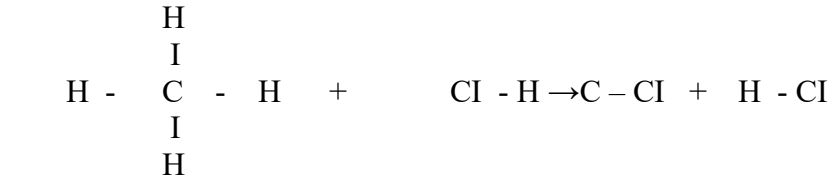
(b) Propanoic



(c) – Ethylpropanoate

10. (a) (i) - F
(ii) - I
(b)

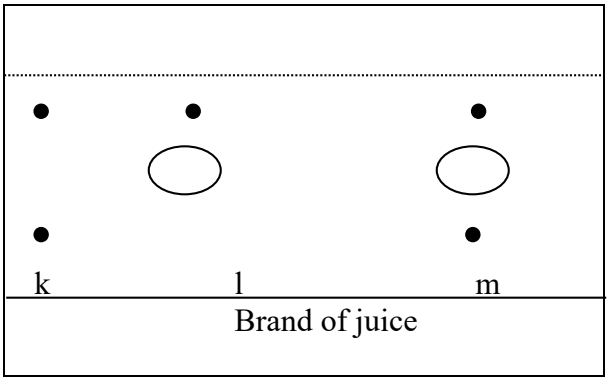
11. $CH_4(g) + CI_2(g) \rightarrow CH_3CI(g) + HCI(g)$



$\underline{414 + 244}$ = $\underline{326 + 431}$
BBE 658 BFE 757

ΔHd = BBE – BFE = 658 – 758 = -99KJ
ALT2
4(414) + 244 = 3(414) + 326 + 431
BBE 1900 – 1999 = -99KJ

12.



13. ALT 1
RMM of (NH_2) CO = 28 – 4 + 16 = 60
$NH_3^2 : (NH_2)_2CO$
2 x 17kg 60kg
680 kg = $\frac{60 \text{ kg x } 680}{2 \text{ x } 17}$ = 1200kg

ALT 2
Moles: $\frac{680000g}{17}$ = 40,000 moles, 40,000 = 20,000 moles

Mg = n x R.F.M
20,000 x 60

1200000g
1200kg

14. **ALT 1**

- Add dilute HNO_3 to the carbonate
- Allow the rxn to go to completion
- Add excess dilute HCI to the mixture
- Filter

15. I. $C(s) + O_2(s) \rightarrow CO_2(g)$
II $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

16. (a) Polystyrene or polyphenylethene

17. (a) Zinc/Zn

(b) $Zn(NH_3)_4^{2+}$

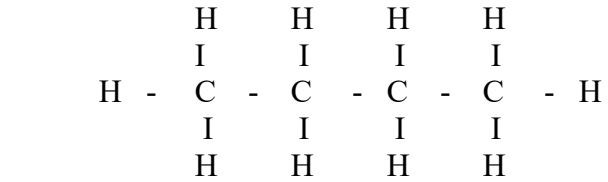
18. $P_1 + P_2$ Vol is constant
T_1
$\frac{760}{273} = \frac{P_2}{373}$ $P_2 = \frac{760 \times 373}{273} = 1038 \pm$ mmHg

19. Sting from a bee contains an acid which causes irritation $NaHCO_3$ being alkaline neutralizes the acid

20. R- Melting/ fusion
V- Boiling/ vaporization
W – Condensation/ liquefaction
U- Freezing/ solidification

21. IV, II, I,III

22. Butane



23. (i) The Ca^+, Mg^{2+} ions in water are exchanged with Na^+ ions in the permutit
(ii) By passing a solution of Conc. Sodium chloride through the Column
(iii) Provides Ca^{2+} required for teeth and bones formation
It coats lead pipes insides hence preventing lead poisoning

24. $x + 4(-2) = -1$
$x - 8 = -1$
$x = 7$

CHEMISTRY PAPER 233/ 2 K.C.S.E – 1998
MARKING SCHEME

1. (a) – To a sample of the ore add dilute sulphuric acid or hydrochloric acid (I) and warm (½)
   - Filter the mixture (½)
   - To a portion of the filtrate, add sodium hydroxide or ammonium hydroxide drop wise until in excess (½)
   - Formation of the dirty green precipitate (½) OR
   - To a portion of the filtrate, add sodium hydroxide or ammonia hydroxide drop wise until in excess (I) formation of brown precipitate (½) shows presence of Fe^{3-} (½)

   (b) (i) Mass of oxygen = 13.30 – 12.66 = 0.64(g) (½)
   Mass of iron = 12.66 – 10.98 = 1.68 (g) (½)
   168 = 0.03 0.64 = 0.04
   52 16
   Rate of moles Fe: O = 3:4(½)
   Molecules formula = Fe_3O_4(I)

   (ii) $Fe_3O_4(S) + 4CO(s) \rightarrow 3Fe(s) + 4CO_2(g)$

   (c) (i) Oxygen (½), water (½)
   (ii) Galvanizing, painting, electroplating e.t.c

   (d) Seawater contains ions (I), which accelerate the rate of corrosion

2. (a) (i). Polymerization
   (ii) Substitution (I) (accept chlorination)
   (b) (i) distillation
   (ii) – Sodium metal disappears/ dissolves/ clarts around (½)
   - Bubbles of a colourless gas/ effervescence (½) beaker become warm
     Sodium metal reacts with ethanol to produce hydrogen gas (I)
     The reaction is exothermic/ heat is evolved

   (iii) Fuel/gasoline
   - Solvent
   - Starting material for manufacture of P.V.C, etheneglycol e.t.c
   - Skin disinfect/ antiseptic
   - In thermometer/ in making alcohol thermometers

(c) (i) Name: Propane
Structural formula
(ii) Bromine water is decolourised (I) because is unsaturated (I) or has a double bond
(iii) $C_3H_8(g) + 5O_2(g) \; 3CO_2(g) + 4H_2O(I)$

3. (a) (i) Fractional distillation
   (ii) Neutralization
   (b) - Electrolysis of brine

(c) - High pressure brings the molecules closer/ increases the concentration of gas molecules
(I)The pressure shifts the equilibrium to the right hence the yield of ammonia (product) increases.

(d) $2NH_3$ (g) + H_2SO_4 (aq) (NH_4) $2SO_4$(aq)

(e) Platinum or Rhodium
Reagent
Water (½), Oxygen (½)

(f) Ammonium nitrate / NH_4NO_3

(g) Fertilizer

4. (a) Remove oxygen (I) which could react with the element to form an oxide

(b) absorb excess chloride
- Absorb moisture from the atmosphere

(c) Sodium chloride has a high melting point (I) and the burner flame
Temperature is not able to vaporize sodium chloride

(d) Calcium oxide OR quick lime/ CaO

(e) $2P(s) + 3CI_2(g)$ $2 PCI_3(g)$ $P_4 + 6CI_2$ (g) $4 PCI_3(I)$

(f) – Heat the mixture
- Aluminium chloride sublimes
- Cool to obtain aluminium chloride
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Mass of NaCI in $5cm^3$ = 2.41 x 10-2 x 58.5
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(v) Mass of water = 5.35 – 1.41
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(vi) 3.94 of water contains 1.41g of NaCI
100g of water = $\frac{1.41 \times 100}{3.94}$
=35.7

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0.1 moles = 5376 joules
therefore 1 mole = $\frac{5376}{0.1 \times 1000}$
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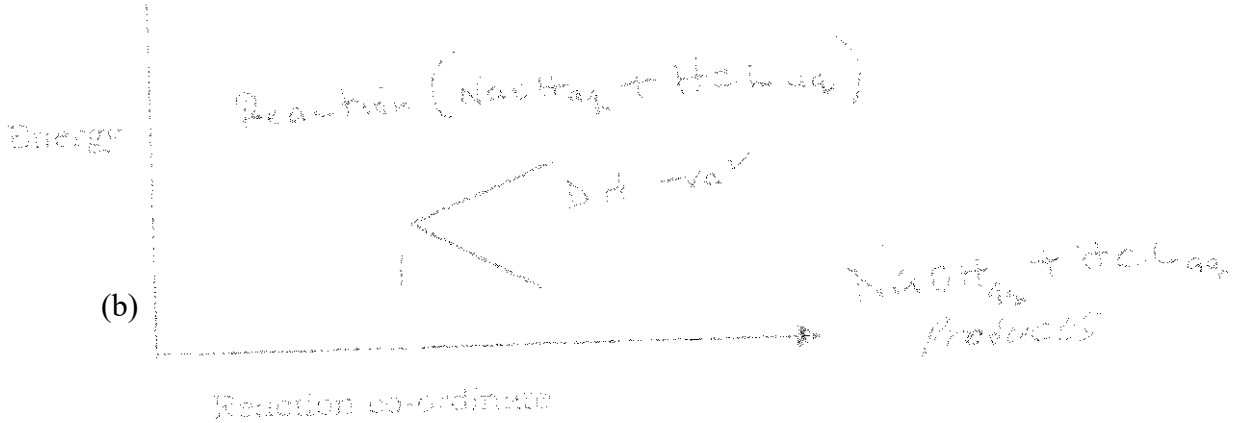
(b)



7. (a) (i) S and W

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(c) (i) $T(NO_3)_3$

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(e) (i) Cathode
Hydrogen (I)

(ii) Anode
Oxygen (I)

CHEMISTRY PAPER 233/1 K.C.S.E 1998
MARKING SCHEME

1. (a) - $234U \rightarrow 230Th + 4He$
   (b) - Gamma rays will penetrate through the walls of the container and causes damage

2. - Add water to the solid mixture A dissolves while B does Not
   - Filter the mixture
   - Evaporate the filtrate to dryness

4. Advantage
   - Prevents knocking engines
   - Prevent premature ignition
   - Increase the Octane rating (Number)

Disadvantage
   - Poisonous lead or lead compounds are released into the environment/ pollutes the atmospheres

4. (a) $\vert$ Al(s) $\vert$ $Al^{3+}(aq)$ $\vert$ $Fe^{2+}(aq)$ $\vert$ Fe(s) $\vert$

   EMF $= E^{\theta}_{R}. E^{\theta}O$
   $= (-0.44) - (-1.66) = 1.22V$

   (b) - It is always on the left cell rep
   - Correspond on iron/ element lower in E.C.S of the two
   - Has less negative

5. (a) -D
   (b) -E

6. ALT 1

   $CxHy + O_2 \; x\,CO_2 + {}^{y}/_{2}\,H_3O$

   XCO_2 $\quad {}^{y}/_{2}\,H_2O$

   3:52 $\quad$ 1:44

   r: $\frac{3.52}{45} = 0.08$ $\quad \frac{1.44}{44} = 0.08$

   $= \frac{0.08}{0.09} = 1$ $\quad \frac{0.08}{0.08} = 1$

   $X = 1 \; {}^{y}/_{2} = 1$

   $=E.F = CH_2 \; y = 2$

   $E.F.M = 14$

   $N = \frac{56}{14} = 4$

   M.F. $(CH_2)_4 = C_4H_8$

   Mass of C $= \frac{12}{44} \times 3.52 = 0.96$

   Mass of H $= \frac{2}{18} \times 1.44 = 0.16g$

Moles of C = 0.96 = 0.08
12

Moles of H = 0.16 = 0.16
1

Ratio	0.08	:	0.16
	0.08	:	0.08
	1		2
	EF	:	CH_2
	N	:	4

MF = $(CH_2)_4 = C_4H_8$

7. (a) SO_5^{2-}
NH_4^+
(Acc. Sulphate ions, ammonia ions)

(b) From ammonia and sulphate based fertilizer

25. $FeCl_2$ oxidation No. of Fe increase from +2 to +3
Or oxidation No. of Cl_2 decreases from 0 to -1

26. (a) – Rxn where the rates of forward and backward rxns are the same
(b) – The mixture becomes more yellow reasons: The equilibrium Position Shifts/ moves to the right since more OH- ions have been added

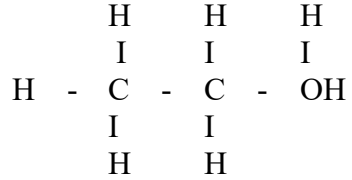
27. 16N
15P

28. (a) In Diamond all the C- atoms are joined together by covalent in a three dimensions (3 –D) structure/ Tetrahedral structure thus very hard
(b) The C- atoms in graphite are bonded in layers/ hexagonal strata's, those thus slide over one another easily.

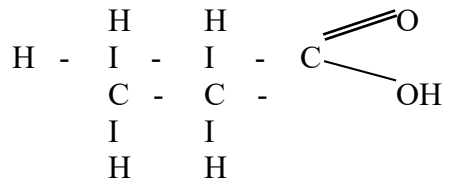
29. Strong acid - one which is fully dissociated when in water e.g HCI, Hi, Hi, HBr
Weak Acid: one which is partially dissociated when in water e.g. CH_3COOH

30. (a) Because concentration of Cu^{2+} is high at the beginning and decreases as the ions are discharged during electrolysis
(b) Cu^{2+} (aq) + 2e = Cu(s)

31. (a) Ethanol



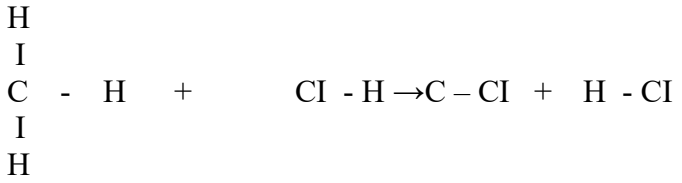
(b) Propanoic



(c) – Ethylpropanoate

32. (a) (i) - F
(ii) - I
(b)

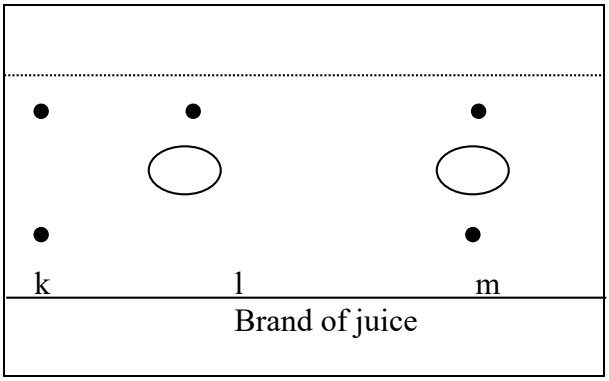
33. $CH_4(g) + CI_2(g) \rightarrow CH_3CI(g) + HCI(g)$



$\underline{414 + 244}$ = $\underline{326 + 431}$
BBE 658 BFE 757

ΔHd = BBE – BFE = 658 – 758 = -99KJ
ALT2
4(414) + 244 = 3(414) + 326 + 431
BBE 1900 – 1999 = -99KJ

34.



35. ALT 1
RMM of (NH_2) CO = 28 – 4 + 16 = 60
$NH_3^2 : (NH_2)_2CO$
2 x 17kg 60kg
680 kg = $\frac{60 \text{ kg x } 680}{2 \text{ x } 17}$ = 1200kg

ALT 2
Moles: $\frac{680000g}{17}$ = 40,000 moles, 40,000 = 20,000 moles

Mg = n x R.F.M
20,000 x 60

1200000g
1200kg

36. **ALT 1**

- Add dilute HNO_3 to the carbonate
- Allow the rxn to go to completion
- Add excess dilute HCI to the mixture
- Filter

37. I. $C(s) + O_2(s) \rightarrow CO_2(g)$
II $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

38. (a) Polystyrene or polyphenylethene

39. (a) Zinc/Zn

(b) $Zn(NH_3)_4^{2+}$

40. $\frac{P_1}{T_1} + \frac{P_2}{T_1}$ Vol is constant

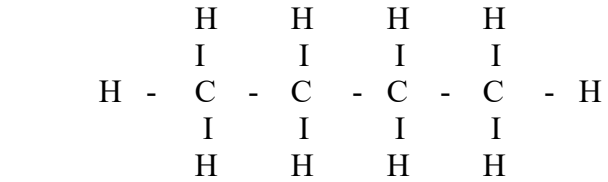
$\frac{760}{273} = \frac{P_2}{373}$ $P_2 = \frac{760 \times 373}{273} = 1038 \pm$ mmHg

41. Sting from a bee contains an acid which causes irritation $NaHCO_3$ being alkaline neutralizes the acid

42. R- Melting/ fusion
V- Boiling/ vaporization
W – Condensation/ liquefaction
U- Freezing/ solidification

43. IV, II, I,III

44. Butane



45. (i) The Ca^+, Mg^{2+} ions in water are exchanged with Na^+ ions in the permutit
(ii) By passing a solution of Conc. Sodium chloride through the Column
(iii) Provides Ca^{2+} required for teeth and bones formation
It coats lead pipes insides hence preventing lead poisoning

46. $x + 4(-2) = -1$
$x - 8 = -1$
$x = 7$

CHEMISTRY PAPER 233/ 2 K.C.S.E – 1998
MARKING SCHEME

8. (a) – To a sample of the ore add dilute sulphuric acid or hydrochloric acid (I) and warm (½)
   - Filter the mixture (½)
   - To a portion of the filtrate, add sodium hydroxide or ammonium hydroxide drop wise until in excess (½)
   - Formation of the dirty green precipitate (½) OR
   - To a portion of the filtrate, add sodium hydroxide or ammonia hydroxide drop wise until in excess (I) formation of brown precipitate (½) shows presence of Fe^{3-} (½)

   (b) (i) Mass of oxygen = 13.30 – 12.66 = 0.64(g) (½)
   Mass of iron = 12.66 – 10.98 = 1.68 (g) (½)
   $\frac{168}{52} = 0.03$ $\frac{0.64}{16} = 0.04$
   Rate of moles Fe: O = 3:4(½)
   Molecules formula = Fe_3O_4(I)

   (ii) $Fe_3O_4(S) + 4CO(s) \rightarrow 3Fe(s) + 4CO_2(g)$

   (c) (i) Oxygen (½), water (½)
   (ii) Galvanizing, painting, electroplating e.t.c

   (d) Seawater contains ions (I), which accelerate the rate of corrosion

9. (a) (i). Polymerization
   (ii) Substitution (I) (accept chlorination)
   (b) (i) distillation
   (ii) – Sodium metal disappears/ dissolves/ clarts around (½)
   - Bubbles of a colourless gas/ effervescence (½) beaker become warm
     Sodium metal reacts with ethanol to produce hydrogen gas (I)
     The reaction is exothermic/ heat is evolved

   (iii) Fuel/gasoline
   - Solvent
   - Starting material for manufacture of P.V.C, etheneglycol e.t.c
   - Skin disinfect/ antiseptic
   - In thermometer/ in making alcohol thermometers

(c) (i) Name: Propane
Structural formula

(ii) Bromine water is decolourised (I) because is unsaturated (I) or has a double bond

(iii) $C_3H_8(g) + 5O_2(g) \; 3CO_2(g) + 4H_2O(I)$

10. (a) (i) Fractional distillation
   (ii) Neutralization
   (b) - Electrolysis of brine

(c) - High pressure brings the molecules closer/ increases the concentration of gas molecules
(I)The pressure shifts the equilibrium to the right hence the yield of ammonia (product) increases.

(d) $2NH_3$ (g) + H_2SO_4 (aq) (NH_4) $2SO_4$(aq)

(e) Platinum or Rhodium
Reagent
Water (½), Oxygen (½)

(f) Ammonium nitrate / NH_4NO_3

(g) Fertilizer

11. (a) Remove oxygen (I) which could react with the element to form an oxide

(b) absorb excess chloride
- Absorb moisture from the atmosphere

(c) Sodium chloride has a high melting point (I) and the burner flame
Temperature is not able to vaporize sodium chloride

(d) Calcium oxide OR quick lime/ CaO

(e) $2P(s) + 3CI_2(g)$ $2 PCI_3(g)$ $P_4 + 6CI_2$ (g) $4 PCI_3(I)$

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- Cool to obtain aluminium chloride
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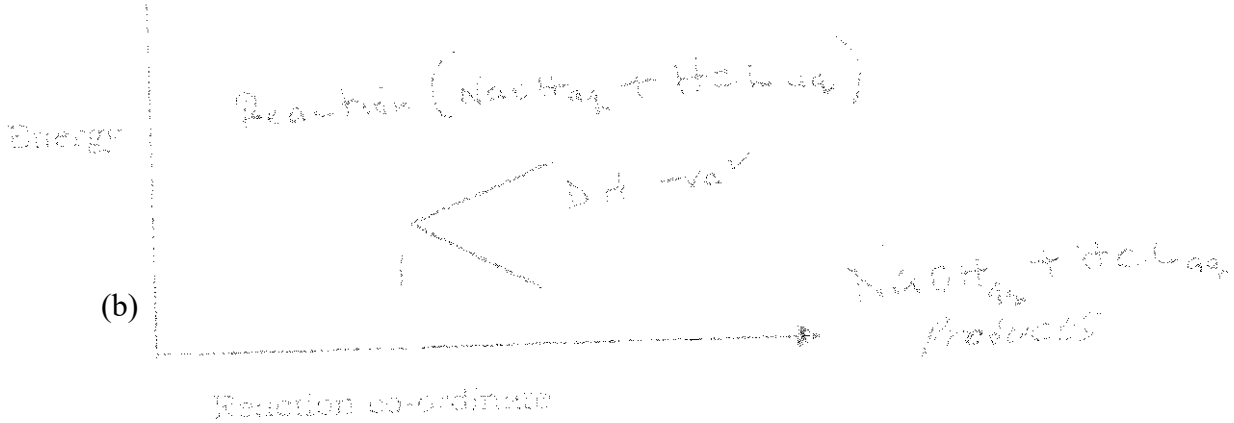

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