CHEMISTRY PAPER 233/1

K.C.S.E 2005 MARKING SCHEME

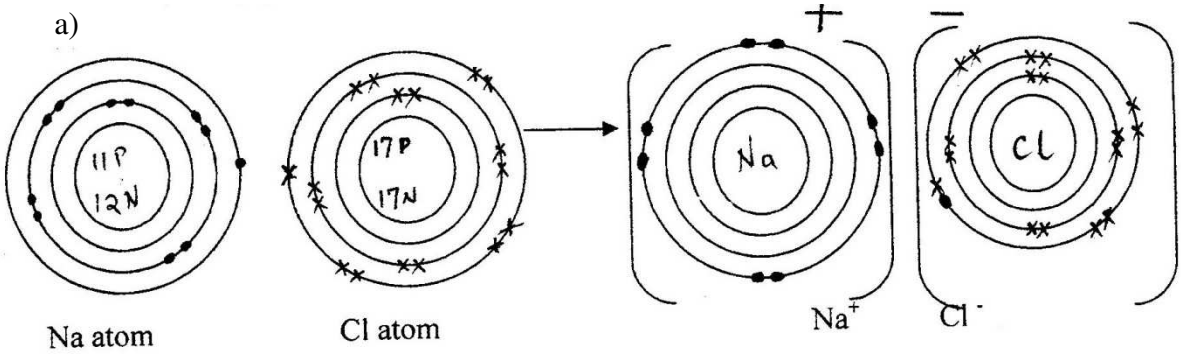
1. Used in the manufacture of glass, treatment of hard water, making of baking powder preservation of soft drinks etc. (1mk)

2. Hydrogen chloride reacts with calcium oxide in the presence of water to form calcium chloride.
$CaO(s) + 2HCl\ (g) \rightarrow CaCl_2(aq) + H_2O(l)$ (2mks)

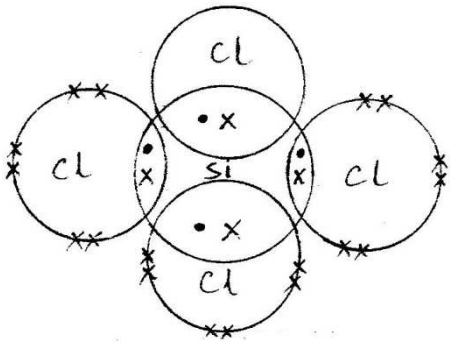
3. (a) Carbon dioxide gas
(b) Temporary hard water dissolves hydrogen carbon salts which decomposes on heating to produce carbon dioxide

$$Ca(HCO_3)_2\ (aq) \xrightarrow{Heat} CaO_3(s) + H_2O(l) + CO_2(g)$$

4. Si = 2:8:4 Na = 2:8:1 and Cl = 2:8:7
a)



b)



Silicon (IV) Tetra Chloride

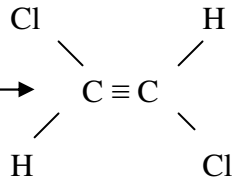
5. (a) (i) $ZnO(s) + H_2SO4(aq) \rightarrow ZnSO_4(aq) + H_2O(I)$
(ii) $ZnO(s) + 2NaOH(aq) \rightarrow Na_2ZnO_2(aq) + H_2O(l)$
(a) Basic oxide

6. (a) B and F
They are isotopes i.e. atoms of the same element with same mass number but

different atomic number

(b) Mass number = Atomic number + No. of neutrons

7 = 3 + n
7 = 3n
N = 4

7. H-C ≡C- H+ C12 ⟶ 

1,2 Dichloro ethane

8. Let the oxidation state of S be X:

(a) H_2S: $2H^+ + S^x = 0$
$+ 2 + x = 0$
$X = -2$

(b) $S_2O_3 = -2$
$2x + 3x - 2 = 2$
$2x + 6 = 2$
$2x = 4$
$X = 2$

9. $GCO_3(s) + 2HCI\ (aq) \rightarrow GCl_2(aq) + CO_2(g) + H_2O(l)$
1 mol 2 mol

Moles of acid used = $\frac{20}{1000} \times 1 = 0.02$ moles
Of the carbonate = ½ of acid = 0.01 moles
0.01 moles = 1 g
1 mole = $\frac{1 \times 1}{0.01} = 100g$
Molar mass of GCO_3 = G + 16 x 3
100 = G + 60
G = 40
R.A.M of G = 40

10. The reaction has stopped as substance H has all been converted to J yet the time is Continuing

11. (a) $2NaOH(aq) + 2\ Cl_2(g) \rightarrow NaOCI_3\ (aq) + NaCl\ (aq) + H_2O(l)$
(b) Manufacture of bleaching agents

12. (a) Coke reduces lead (II) oxide to lead metal
$Pb(s) + C(s) \rightarrow Pb(s) + CO(g)$

(b) Limestone (calcium oxide) combine with Silica to form Calcium Silicate
$CaO(s) + SiO_2(s) \rightarrow CaSiO_3$
(c) Scrap iron reduces any remaining lead sulphide to lead metal
$Fe(s) + PbS(s) \rightarrow FeS(s) + Pb(s)$

13. From the equation:
1 mole of metane produces 890kj
Hence 890 Kj = 24 litres
111.25 KJ = 111.25 x 24 litres
= 3 litres

14.

Year	Mass (g)	
0	100	
5.2	50	1^{st} half- life
10.4	25	2^{nd} half- life
15.6	12.5	3^{rd} half - life

Let half- life be x
3x = 15.6
X=5.2 yrs

15. Graphite structure is layered with layers together by weak vander waals force.
These forces are easily broken making layers to slide over each other hence good lubricant

16. Increases atomic radius results in decrease of 1^{st} ionization energy
Increasing the radius, decreases the force of attraction from to the outermost electron. Hence decreasing in the 1^{st} ionization energy down the group.

17. a) When the rate of forward reaction is equal to the rate of backward reaction.
b) The equilibrium shift to the right potassium hydroxide reacts with Carbon dioxide concentration of CO_2

18. a) Source of heat
b) The solid $pbBr_2$melts to form pb^{2+} and 2Br- that conduct electric current in the circuit. Hence the bulb lights.

19. a) Molar heat of fusion
b) $-\Delta H^3$ process to exothermic (heat given out to the sourrounding)

20. M is a strong acid while L is a weak acid.M has many ions in solution that take part in a reaction forming more product that L with few ions in solution.

21. a) Nitric acid is volatile hence turns into vapour while sulphuric acid is non – volatile
b) Sodium nitrate
c) Manufacture of fertilizers eg:NH_4NO_3
Manufacture of explosive eg: TIN Any of the four
Manufacture of dyes and drugs

Treatment of metal

22. a) N is Sodium ethanoate (CH_3COONa)while P is methane (CH4)
    b) Substitution reaction

23. $C_{(s)} + O2_{(g)} \rightarrow 2CO_{(g)}$
    $Fe_2O_3 + 3CO(g) \rightarrow 2Fe_{(s)} + 3CO_{2(g)}$

24. a) A yellow deposit of sulphur and a colourless liquid are formed.
    b) The experiment should be performed in a fume chamber as both the reactants are poisonous.

25. a) Copper (II) ions
    b) Tetra ammine copper ions (Complete salt)

26. No.of coulombs = 0.82 x 5 x 60 x 60
    = 14760 coulombs
    14760C = 2.65g
    96500 C = $\frac{96500 \times 2.65}{14760} = 17.3255g$
    2.65g = 14760C
    52g = $\frac{52 \times 14760}{96500}$ =

27. a) Reduction
    b) i) Removal of oxygen from a substance is a reduction
    ii) Lead ion has gained electrons to become lead metal gain of electron(s) is a reduction.
    c) Hydrogen sulphide

28.

Products	CO_2		H_2O	
Formula mass	44		18	
No. of moles		Mass / R.F.M		Mass / R.F.M
		$\frac{4.2}{44}$		$\frac{1.71}{18}$
		0.095		0.095
Mole ratio	=	1	:	1

The masses of carbon and hydrogen in CO_2 and H_2O formed

Products	Carbon (CO_2)	Hydrogen (H_2O)
	$\frac{12}{44} \times 4.2$	$\frac{2}{18} \times 1.71$
	1.145	0.19
No. of moles	$\frac{1.145}{12} = 0.095$	$\frac{0.19}{1} = 0.19$
Mole ration	$\frac{0.095}{0.095} = 1$	$\frac{0.19}{0.095} = 2$

0.95 0.095

Therefore the empirical formula is CH_2

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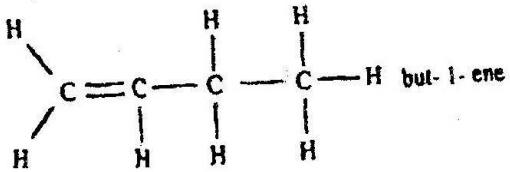
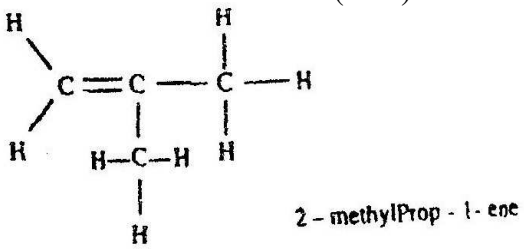
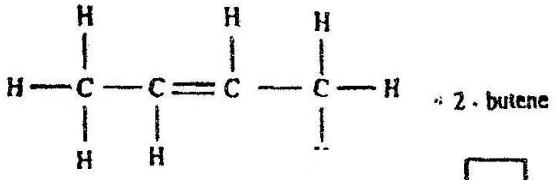
K.C.S.E 2006 MARKING SCHEME

1 a) Compounds with the same molecular formula but different structural formulae. (1mk)

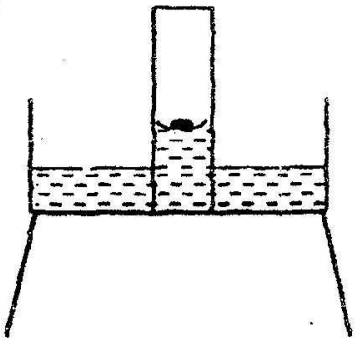
b)







2 a)



b) Calibrate athe gas jar before the start of experiment (1mk)

3. $\frac{\text{Time for } SO_2}{\text{Time for } O_2} = \sqrt{\frac{R.M.MSO_2}{R.M.MO_2}}$

R.M.M of SO_2 =64

R.M.M of SO_2 = 32

$\frac{\text{Time for } SO_2}{50} = \sqrt{\frac{64}{32}}$

Time for SO_2 = 70.7 seconds (3marks)

4 a) $37 + 0 \rightarrow 37$
$18^A - 1^e \quad 17^B$

b) i) Studding rate of absorption of phosphorus from a fertilizer (1mk)

ii) May result to babies with deformities
May cause cancer (1mk)

5 a) In solid state - Does not conduct
Ions are fixed (1 ½ mks)

b) Aquous solution - Conducts
Ions are mobile (1 ½ mks)

6. a) $C_{(s)} + 2H_2SO_4(g) + 2H_2O\ (l) + 2SO_{2(g)}$ (1mk)

b) Carbon changes from 0 to +4 .. Oxidation has taken place
Sulphur changes from +6to +4.. Reduction has occurred (2mks)

7. a) Refrigeration (1mk)

b)
- They deplete the ozone layer.
- They cause green house effect. (2mks)

8. Mass of water 94.5 – 51.3 = 43.2
R.M.M. of Ba(OH)2 = 171
R.M.M of H2O = 18

$\frac{51.3}{171} \quad \frac{43.2}{18} = 8$

$0.3 = 1 \quad \frac{2.4}{0.3} \quad 8$

9. a) Mass
- Pale yellow intensifies.
- Forward reaction is exothermic
- Lowering temperature shifts the equilibrium to the right. (1 ½ mks)

b)
- Pale yellow intensified
- Reducing the volume of syringe.
- Increases the pressure
- The equilibrium shifts to the rights.

10. a) sublimation (1 mk)

b) Bleaching. (1mk)

c) Polymerisation (1mk)

11 a)
- Acidify water with nitric acid.

- Add aqueous lead nitrate.
- Formation of white PPt shows presence of CT

b) provides essential minerals e.g Ca2+ (1mk)

12. 62.93 x 69.09 +64.93 x 30.91
100
= 43.4783 + 20.0698
= 63.548 (3mks)

13. a) It is a drying agent. (1mk)
b) $Fe_{(s)} + 2HCL_{(g)} \longrightarrow FeCl_{2(s)} + H2(s) + H_{2(g)}$ (1mk)
c) Picking of metals (1mk)

14. a) N_2O
b) K_2O (1mk)
c) Al_2O_3 (1mk)

15. a) N (1mk)
b) Eø =0.80 +0.76
= 1.56 volts (1mk)

16 a) The solution changed from brown/yellow to light/pale green. (1mk)
b) $2FeCl_{3(aq)} + H_2S_{(g)} \longrightarrow FeCl_{2(aq)}\ 2 + 2HCl_{(aq)} + S_{(s)}$ (1mk)
c) Oxidation. (1mk)

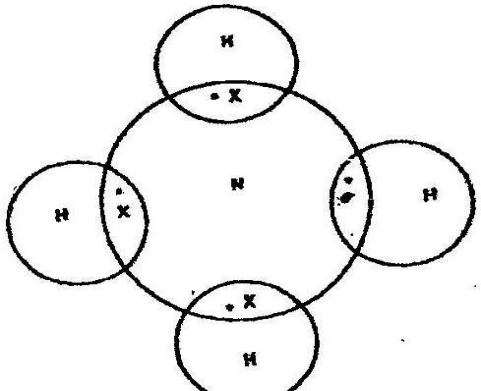
17. a)Platinum
Platinum- Rhodium (1mk)
b) $4\ NH_{3(g)} + 5O_{2(g)}$ $4\ NO_{(g)} + H_2O$ (1mk)
c) Fertilizers
Explosives (1mk)

18. add anhydrous copper(II) Sulphate to substance S. It changes from white to blye
OR
Dip cobalt chloride paper into Substance s. It changes from blue to pink. (2mks)

19. a) To M_gO and excess HCl or H_2SO_4. Add NaOH or KOH to the mixture. Filter and dry the residue. (2mks)
b) Anti-acid (treatment of acid indigestion) (1mk)

20 a) Covalent bond is formed by equal contribution of the shared electrons by the atoms. Co-ordinate bond is where the shared electrons are contributed by one (2mks)

b)



21. a) They have delocalized valency electrons (1mk)
b) Aluminium has three delocalized electrons.
It is resistant to corrosion (2mks)

22. a) Oxalic acid and Conc. H_2SO_4 (1mk)
b) $2\ KOH_{(aq)} + CO_{2(g)} \longrightarrow K_2CO_{3(aq)} + H_2O_{(l)}$ (1mk)
c) CO is odourless
Co is colourless (1mrk)

23. In addition to van der waals forces, strong hydrogen bonds exist in ethanol.
These bonds require more energy to break (2mks)

24. a)

Acidic	Basic
Orange	Pink

(1mk)
b) The PH of 0.1 M KOH is higher then that 0.1 M aqueous ammonia.
KOH is strongly dissociated in solution (1mk)

25. a) V_1 and V_3 (1mk)
b) Add petrol to the mixture. Filter. V_2 is the residue. Filtrate is V_4 (2mks)
Distill the filtrate.

26. a) They gain energy and move faster. The intermolecular distance increases. (1mk)
b) XY (1mk)
c) The energy supplied changes molecules of water from liquid to Gaseous state.
(1mk)

27. a) Conc. H_2SO_4 (1mk)
b) Heat the solution to concentrate it. Allow for crystal for form. Filter.
C) Anhydrous copper(II) Sulphate (1mk)

28. a) $\triangle H_1$ = Lattice energy
$\triangle H_2$ =Hydration energy (2mks)
b) $\triangle H_3 = \triangle H_2$ (1mk)

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K.C.S.E 2007 MARKING SCHEME

1. (a) Carbon (IV) oxide
   (b) Blue flame, carbon (II) oxide is burning

2. Mass in $500cm^3$ = 15 x 1.05 = 15.75g
   Mass in $100cm^3$ = 15.75 x 2 = 31.5
   Molarity = $\frac{315}{60}$ = 0.103

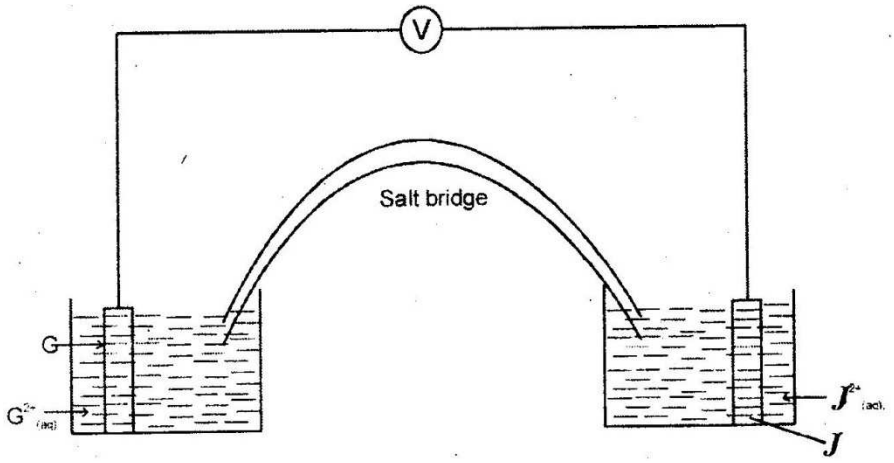
3. (a) Group (VIII) elements
   (b) Chlorine molecule is smaller and the strength of vanderwaals forces between molecules of chlorine is weak as compared to iodine.

4. C- unburnt gas D- Luminous yellow flame

5. The product from nettle plant is acidic aqueous ammonia solution being basic neutralize the acidic product.

6. a) Colour change from green to brown.
   b) fe^{3+} 3OH → Fe $(OH)_3$
   (aq) (aq) (s)

7. a)



   b) E^{θ} cell = E^{θ}reduced = E^{θ} oxidized
   = -0.14V - - 0.74V = +0.6V>

8. Across the period there is a gradual increase in number of proteins in the nucleus. This increases the force as attracted between the nucleus and the electrons.

9. a) Dilute Nitric acid

b) Silver metal
c) oxygen

10. i) $H_2O_2(g) \rightarrow H_2O_2$ $\Delta H^{cc}_f = -133 kjmol^{-3}$
ii) $H_2O(l) \rightarrow H2_{(g)} + O2_{(g)}$ $\Delta H_f = +188 kmol^{-1}$
iii) $H_2O(l) \rightarrow H2O_{(g)}$ $\Delta H_f = +55 kjmol^{-1}$

11. It is denser than air>
It will react calcium oxide since CO_2 is acidic and CaO is basic.

12. a) The volume of a fixed mass of gas is directly proportional to its temperature is kevin.
b) $\frac{V1}{T1} = \frac{V2}{T2}$

$$T2 = \frac{291 \times (1.0 \times 10^5) \times 2.8 \times 10^{-2}}{(1.0 \times 10^5) \times 3.5 \times 10^{-2})}$$

2328 K

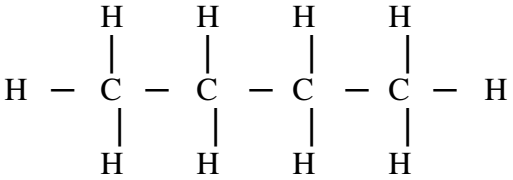
13. (a) (i) Deliquscency
(ii) Esterification
(iii) Thermal crucking

14. (a) Nuclear fusion is where two light nuclei combine to give a heavy release of energy while nuclear fusion is where a large nuclear splits into smaller nuclei with the release of enormous amount of energy.
(b) Wrap with aluminium or lead foil and bury them deep underground

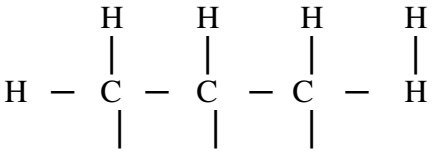
15. (a) The calcium and magnesium compounds in this water can not be decomposed by heating i.e. $CaCl_2$, $CaSO_4$, $MgSO_4$ and $MgCl_2$
(b) Ionic exchange
Uses sodium carbonate (washing soda)

16. (a) O^0
(b) $[Zn(OH)_4]^2$

17.



Butane



H CH_3 H

Methyl Propane

18. React sodium with water to get sodium hydroxide
Bubble into this solution excess carbon (iv) oxide to get sodium hydrogen carbonate.

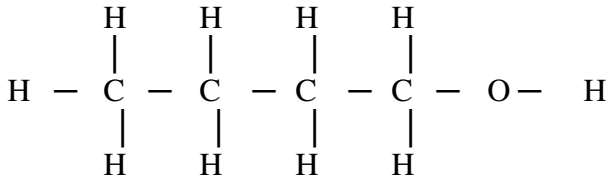
19. (a) Froth Floatation
(b) $ZnCO_3(g) \rightarrow ZnO_{(s)} + CO_2(g)$
(c) Manufacture of dry cells. Zinc casing forms the anode of dry cells

20. (a)

Element	C	H	O
%	$\frac{64.9}{12}$	$\frac{21.6}{16}$	$\frac{13.5}{1}$
Moles	5.41	1.35	13.5
Ration	4	1	10

[E.F.= C_4H_9OH]

(b)



21. (a) Chlorine ions in Brime are high concentration compared to oxide ions in solutions
(b) Hydrogen gas

22. $Al_2(SO_4)_3 \rightarrow 3SO_{4-2} + 2Al^{3+}$

Moles a^2 $Al_2(SO_4)_3 = \frac{6.84}{342} = 0.02$

Moles $a^2SO_4^{-2} = 0.02 \times 3 = 0.06$

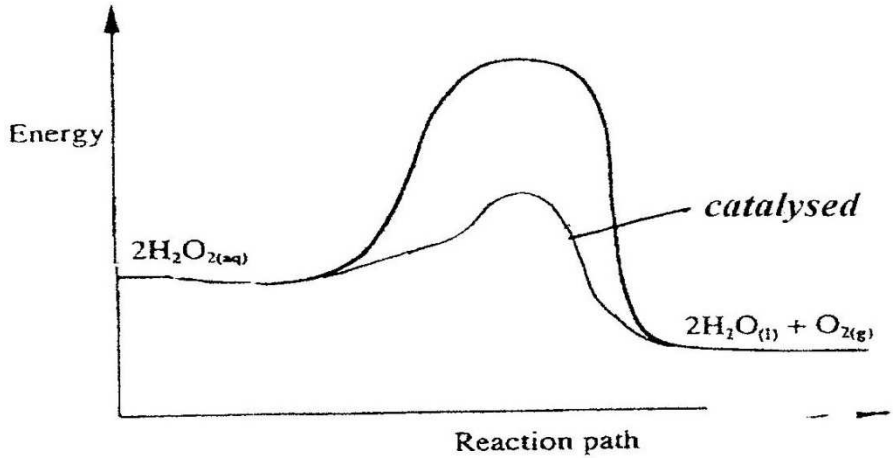
23. Pentene -1Al is polar. There are two forces, Vanderwaals and hydrogen bonds holding its molecules together. Pentene is non- polar.

24. White flames produced, Ammonia react with chlorine producing hydrogen chloride gas which react with excess ammonia to give ammonium chloride

25. (a) No change in volume since the number of moles of acid is equal in both cases.
(b) It is less dense and does not burn like hydrogen

26. (a) They are both metals and need to lose electrons to be stable
(b) $RCO_3(s) \rightarrow RO(s) + CO_2(g)$
(c) Q^{-3}

27.



28. (a) $Ag(a) + e^-$ AG(s)

(b) Ce = 1t = 5.0 x 3 x 60 = 54000c

Mass of silver deposited

$$= \frac{108 \times 54000}{96500}$$

$$= 60.44g$$

29. (a) Metallic bonding

(b) Group 1 Each atom contains one electron in its outer most energy level

30. The molecules which were inform of a ring open up to give chained molecules (S_8). This entangles each other reducing the flow of molten sulphur and increases its viscosity

CHEMISTRY PAPER 233/1
K.C.S.E 2008 MARKING SCHEME

1. Crystal dissolves
Purple colour spreads in the water
The crystal break into smaller particles of potassium manganate (VII) which moves in all directions.
Crystals dissolves through diffusion
Purple colour of Km spread uniformly throughout the water KmNO4 diffused from the area of high con.

2. Mass of hydrated salt = (33.111 – 30.296)= 2.815g
Mass of anhydrous salt = 32.781 – 30.296) = 2.485g
E.F = $CaSo_4$ 33. 111g
32 781g = 0.330
Mass of water = (2.815 – 2.485) = 0.330g
Accept any correct method

$CaSO_4$	x H_20
Mass 2.485	0.320
Moles 2. 485 = 0.0183	$^{0.330}/_{18}$ = 0.0183

Ration $^{0.0183}/_{0.0183}$ = $^{0.0183}/_{0.0183}$

Or; $CaSo_4. XH_2O \rightarrow CaSo_4 + XH_2O$
$\frac{2.815g}{CaSo_4 \times H_2O} = \frac{2.485g}{136}$
$Y = \frac{2.815}{2.485} \times 136 = 154$
$CaSo_4 \times H_2O = 154$
$136 + 18x = 154$
$18x = 154 - 136 = 18$
$X = {}^{18}/_{18} = 1$

3.

No	Gas	Test	Observation
I	Chlorine		The red litmus pare turn white/ the litmus paper bleached
II	Acidified must be th	Put a filter paper dipped in acidified potassium dichro (VI) into the gas	

III			The bromine water is decolorized

4. (a) $C_{13}H_{27}COONa^+$ Regardless of charges i.e. $C_{13}H_{27}COONa$
   (b) Soapy detergent/ soaps
   (c) $(C_{13}H_{27}COO\text{-})_2$ Ca or $CI3H27COO)_2Mg^{2+}$

5. RFM of $Ca_3(PO_4)_2$ Ca=40 x 3 = 120
   P = 31 x 2 = 62
   O= 16 x 8 = 128
   310

   H_3PO4 H=1 x 3 = 3
   P = 31 x 1 = 31 1 mole $Co_3(PO_4)2$ gives moles of H_3PO_4
   O = 16 x 4 = 64/98 310g $Co_3 (PO_4) 2$ gives 2.98 g
   155 x 100g $Co_3 (PO_4)$ gives $\frac{2.98 \times 155 \times 100}{310}$
   = 98000g
   = 98kg

6. Propanol Propan - I – ol
   Butanoic acid
   Are elements with the same atomic number but different masses
   Are different elements with the same atomic no but different masses

7. (a) Atoms of the same element having different masses or atoms of the Same element having different number of neutrons.
   (b) 18- 8 = 10 neutrons

8. (a) A black solid
   (b) Fes (s) + 2 HCL(aq) → $FeCL_2$ (aq) + H_{2S}(g)
   (c) The powder has a larger surface area than the iron fillings hence the Reaction is faster

9. $Zn(s) + H_2SO_4 (aq) \rightarrow ZnSO_4(aq) + H_2(g)$
   $Zn(s) + 2H_2SO_{4\,(I)} \rightarrow ZnSO_4(aq) + SO_2 (g) + 2H_20_{(l)}$

10. Magnesium burns in air to form Mgo and Mg_3N_2, Mg_2N_2 reacts with water to Liberate ammonia gas
    $Mg_3N_2(s) + 6\ H_2O\ (I) \rightarrow 2NH_3\ (g) + Mg\ (OH)_2(ag)$

11. (a) Ionic/ electrovalent
    (b) Has 7 electrons in its outermost energy level and hence easily gains an

electron to complete the octet or it is most electronegative.

12. (a) Oxygen; O_2
(b) The Ph decreases
HoCL decomposes to give more HCL in the mixture
$2\ HOCL_{(ag)} \rightarrow 2\ HCL_{(ag)} + O_{2\ (g)}$

13. Pass product ever anhydrous copper (II) sulphate (I) which turns from white to blue (I) turns to blue or anhydrous copper (II) sulphate or use Cobalt Chloride (anhydrous which turns from blue to pink.

14. (a) A (I)
(b) A_1 (l) using baseline

15. J- the solubility of the substance decreases with increase with temperature it dissolves more in cold water than in hot water.

16. Heat the metal in air to form the oxide CUO
Add excess dilute HCL to the oxide to get $CUCL_2$
Concentrate the filtrate and leave to crystallize Filter and dry the crystals at room temperature between pieces of filter paper Add excess Cu to nitric acid (dilute concentrate)
K_2CO_3/ NH_4 (Co_3)
Filter to remove unreacted copper. Add $Na_2\ Co_3$ to the filtrate to pp $CuCO_3$ filter and add dilute HCL to residue to obtain $CUCL_2$
Add nitric to obtain Cu (No3)2. Filter to remove excess CU. Add NaOH

17. (a) Amphoteric
(b) Lead (II), Zinc and Aluminium (any two)

18. (a) Position for silicon
(b) U
(c) $Q(s) + T_2\ (g) \rightarrow QT_2(s)$

$Mg(s) + CL_2\ (g) \rightarrow MgCl_2(s)$

19. (a) $Zn(s)\ /\ Zn^{2+}(aq)\ //\ Ag^+\ /\ Ag\ (s)$
$Zn/Zn^{2+}\ //\ Ag^+/Ag(s)$

(b) The solution changes to blue because Cu metal is corroded dissolves to form Cu
(c) Metal silver is deposited on the sides of beaker BCO3 silver is deposited on the sides of beaker
$Cu(s) + Ag^+(aq) \rightarrow Cu_2(aq) + 2\ Ag(s)$

20. (a) At constant temperature and pressure, the rate of diffusion of a gas is

inversely proportional to the square root of its density.

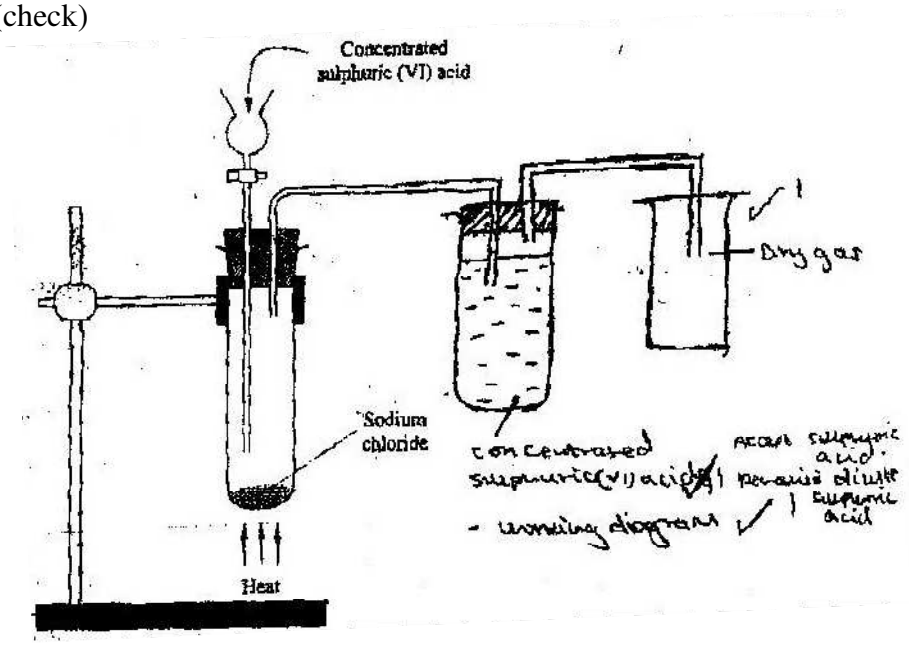
(b) $\sqrt{\frac{RW}{RX}} = \sqrt{\frac{RMMX}{MMWE}} \sqrt{\frac{44}{16}}$

$\frac{12.0}{RX} = \frac{44}{4}$; $\frac{12.0 \times 4}{44} = \frac{48}{6.63}$

=7.24 cm

21. a) Cu^{2+} moving towards the cathode
    b) $4OH^-(aq) - 4e^- \rightarrow 2H_2O(l) + 0_2(g)$
    $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$

22. Diagram (check)



23. The brown colour of the mixture intensifies / increases and the green colour of the mixture fades/ decreases or the yellow deposit/ sulphur decreases Iron (II) is converted to Fe^{3+} Sulphur is converted to H_2S OR Equilibrium shift to the left.

24. (a) $^{4}_{2}He$ reject>, He, $^{4}_{2}He^{+}$
    (b) (i) $Z_1 = 235$ $Z_2 = 54$
    (ii) Nuclear fission
    Accept fission

25. (a) Cooling
    (b) Latent heat of fusion

26. (a) I Pb^{2+}

II $Co3^{2-}$

(b) $PbO(s) + 2H^+(aq) \rightarrow Pb^{2+}(aq) + H_2O(l)$

27. (a) $Mg(OH)_2(aq) + 2\ HCL\ (aq) \rightarrow Mg\ Cl_2\ (aq) + H_2O_{(l)}$

Mole ration (1:2)

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

No of moles of $Mg(OH)_2 = \frac{½ \times 0/1 \times 23}{1000} = 0.00115$

Mass of $Mg(OH)_w$ in antacid = 0.00115 x 58 = 0.067g

(b) % of $Mg(OH)_2$ in anti- acid

$Mg(OH)_2 = \frac{0.67}{0.50} \times 100 = 13.34\%$

28. (a) (i) Cryolite

(ii) Electrolysis

(b) Good conductor does not rust

Malleable

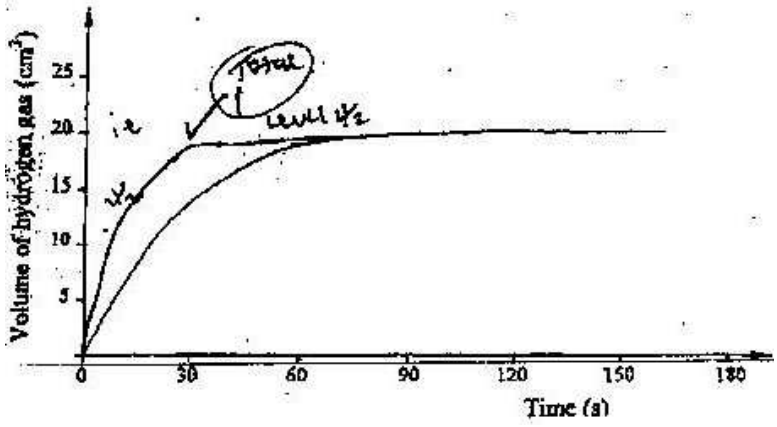
Light

High m.p

Does not corrode easily

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

(b) (i)



(ii) The molecules of the reactants have higher energy marking points

The reaction is faster/ are more effective collusions

30. It burns to form SO_2SO_3 which is a pollutant

Accept any other effect e.g. – Acid rain

- Corrosion of buildings
- Irritation of respiratory systems

- Yellowing of leaves of plants

31. (a) Neutralization
(b) (i) Calcium hydrogen carbonate
(ii) Drying agent
Extraction of sodium metal

CHEMISTRY PAPER 233/1

K.C.S.E 2009 MARKING SCHEME

1. (a) Energy required to remove 1 mole of electrons from 1 mole of gaseous atoms (1 mk)
(b) B (1) 418???

It loses electrons most readily (l)
Reject lowest i.e. $M_g (HCO_3) 2_{aq} \rightarrow M_gC_S O_3 + H_2O + CO_2 (_g)$

2. (a) $Ca (HCO_3)_2 (aq) \rightarrow CaCO_3(S) + H_2O(l) + CO_2 (g)$
(b) Sodium carbonate (l) Soda ash/ washing soda
Calcium hydroxide (l) / Lime water $_2$ Ammonia Sol;
Sol; Sodium per mutito/ Sodium Duminium Silicate.

3. (i) 2.8.8
(ii) 2.8.2

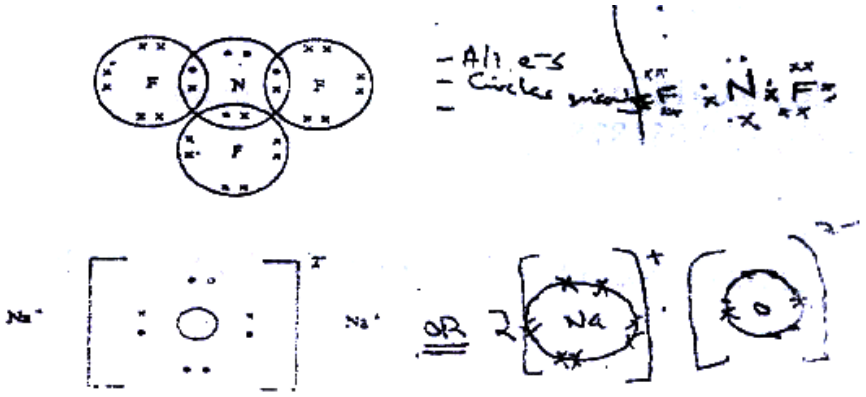
4. (a) Water (l)
(b) The second / other product of burning candle is carbon (IV) oxide (l). It can be prevented from getting into the environment by passing it though a hydroxide solution/ alkaline solution e.g. K.O.H NaOH or aqueous ammonia (l).
(2 mks)
To form K_2CO_3

5. Oxygen exists as diatomic molecules (½) / Simple Molecular
The forces of attraction between the molecules are very weak (½) therefore less energy is required to separate them. (½)
Atoms are sodium are held by strong metallic bonds (l). These require a lot of energy to break them (½)

6. 60
30^{E+21} wrong/ correct change (- ½)

7. (a) $Al^{3+} + (l) + 3e^{-} \rightarrow AL\ (s)\ (l)$
(b) 27 g require 3 faradays (l)
1800 x 1000g requires $\frac{3 \times 1800 \times 1000}{27}$
$= 2 \times 10^5$ Faradays (½) = 200, 000 F (3 mks)

8.



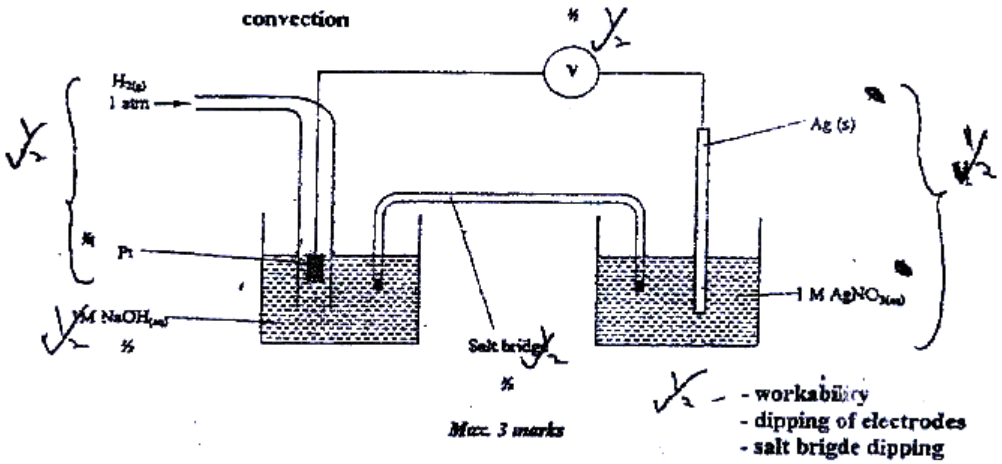
9. (a) Heat change when one mole of a solute dissolve in excess of the solvent (l)
(i) ΔH_1 = + 733 kj Mol -1 Until no further Δ in temperature

ΔH_2 = 406 kJ mol -1 / Infinitely dilute solution
ΔH_3= 335 kJ mol -1
(ii) Molar heat of solution
Must be correct (733 – (+ 406 + 335 = 733 – 406 - 335)
= -8 kJ Mol -1 (3 mks)

10. At anode $40H\ (aq) \rightarrow 2H_2O_{(l)} + O_2\ (g) + 4e$
At cathode $2H^+\ (aq) + 2e \rightarrow H_2\ (g)$ / $4N^+\ (aq) + 4e^+ \rightarrow 2\ Hg$
Or $4OH^-(aq) + 4\ H(aq) \rightarrow 2\ H_2O(l) + O_2 + (g) + 2\ H_2\ (g)\ (l)$

11. To 50 cm^3 of 2.8 M NaOH, add 25 cm^3 of 2.8 M $H_2\ SO_4$ or 50 cm^3 of 1.4 M/ 100m^3 of 0.7 m
- Heat mixture to concentrate (½)
- Cool it for crystals to form (½)
- Filter and dry the residue (3 mks)

12.



13.

Moles of oxygen = 0.83 = 0.026 (½) / 0.0259375

Moles of $NaNO_3$ = 2 x 0.026 / 0.051875

0.05 (½) / 0.051875

R. M .M $NaCO_3$ = 85 (½)

Mass of $NaNO_3$ = converted $\frac{0.052 \times 85}{4.41}$ / 4.4094 (½)

4.41

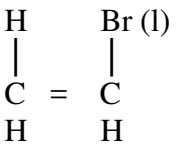
8.53

51. 693%5

Or 183

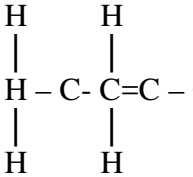
51.7% (3 mks)

14. (a)



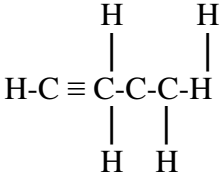
Bromoethane (l) / 1 bromoethane (2 mks)

(b)



(1 mk)

(c)



(½) (1 mk)

15. (a) The gas burns with a blue flame (1)
(b) (i) The iron isles reactive than magnesium (1)
(ii) Heat the iron powder (1) (3 mks)

16. (a) To be read from graph (x) = 79g/ 100g water 78 + 1 g / 100g H_2O

(77, 78, 79)

(b) R.F.M of KNO_3 = 101

Molar concentration = $\frac{79\ ½}{101} \times \frac{1000/}{100}$

= 7.82 m

17. 10 electrons (l)
3 single bonds constitutes 6 electrons – There are 5 covalent bonds
Double bond – 4 electrons (l) – 3 single bonds 1 double bond

18.

Bottle	Correct label
1	Sodium chloride
2	Sugar
3	Sodium carbonate

(3 mks)

19. (a) Catalyst (l) or words to that effect
(b) Add bromine water or acidified potassium magnate (VII) (1) if they decolorize (½) then gas is either an alkene or an alkynes (½) (3 mks)

20. (a) Chemical change
(b) Physical change
(c) Chemical change

21. Magnesium phosphate (reject formula)

22. Tests 2 (½) and 3 (½) for test 2 iron is above hydrogen in the reactivity series hence it displaces hydrogen (i) for test 3. Dilute sulphuric acid is not an oxidizing agent (1).

23. (a) Pale green solution turns yellow (i)
(b) Sodium hydroxide (l) Potassium hydroxide
(c) Water (l)

24. (a) S_1H_4 it has a higher boiling point (l)

(b) No hydrogen bonding in CH_4 and S_1H_4 (l) while the hydrogen bond in H_2O is stronger than that in H_2S_1 (l)

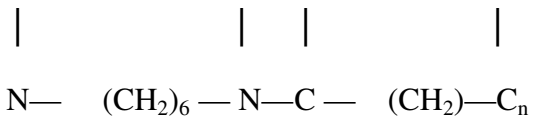
25. (a) Colourless solution becomes brown/ black
L_2 (aq)/S
(b) Blue PPt dissolving to form a deep blue solution (l) $Cu(NH_3)_4^{2+}$ (3 mks)

26. (a) Temperature and pressure are directly proportional (l) IR words towards that ofeal
(b) With increase in temperature, the gas particles gain more Kinetic energy (l)
They move faster and collide with the walls of the container more frequently hence increasing pressure.

27. The amount of hydrogen would reduce (l) increase in pressure shifts the reaction to the side with fewer molecules or Equation shifts to the left. Less Volume

28. (a) Energy of the activated energy (1) Therefore more molecules will take part in effective collision. (3 mks)

29. (a)



(b) Making synthetic fibres such as for

- Ropes
- Blouses
- Stockings
- Undergarments
- Trousers

30. (a) Crush the roses with a suitable solvent (½) Filter/ decant/ Scape wilt, droper to obtain pigment/ e.g. ethanol – Methanol – Propanus - Aocome
(b) Add pigment to an acid or base
It shows different colours in each

CHEMISTRY PAPER 233/1

K.C.S.E 2010 MARKING SCHEME

1 a) Deliquescent – A substance that absorbs water from the atmosphere and changes into a solution

Hygroscopic – substance that absorbs water from the atmosphere but just becomes wet.

b) drying agent/used to test for water.

2 a) i) - Substance that cannot be split into simpler substance by chemical means *(must be named)*

- Substance that consists of one type of atoms
- A pure form a substance with unique atomic No.

ii) No of protons in an atom

Deny no. of electrons

b) $Ti_2(so_4)3$

$T_2(so_4)3$

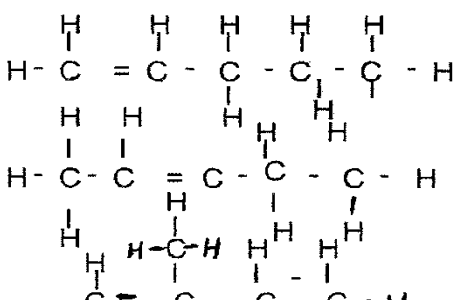
3 a) Ductility / Ductile

b) Activation energy

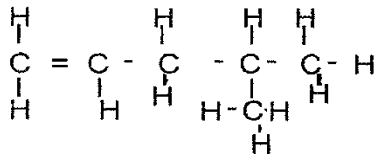
c) Vander waals force

Don't accept intermolecular forces

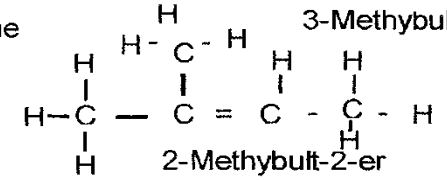
4



Pent - 1 - ene



Pent - 2 - ene



3-Methybult-l-er

2-Methybult-2-er

6 a) $Al2O3\ (s) + 6\ Hcl\ (aq) \longrightarrow 2\ AlCl3\ (aq) + 3H20\ (i)$ pen** ½ mk for wrong states

b) $Al2O3 = 2(27) + 3\ (16) = 102$ moles of $Al_2O_3 = \frac{153}{102} = 1.5$ moles

Moles of Hcl = $\frac{153}{102} \times 6 = 9$ moles

$1.5 \times 6 = 9$ moles

7.

Oxygen	Hydrogen
Copper ions	Copper metal

8. a) $\frac{P_1V_1}{T_2} = \frac{P_2V_2}{77} - \frac{1.0 \times 10^8 \times 1}{298} = \frac{1.0 \times 10^5 \times V_2}{298}$

$V_2 = \frac{1.0 \times 107 \times 298}{1.0 \times 10^5 \times 77}$ $V_2 = 387.0\ dm^3$

b) No of moles $N_2 = \frac{387.0}{24.0}$ = 16.1 moles (No mark)
or 16.12: 16.125

Therefore Mass of N2 = 16.1 x 28 = 451.50g (Ans. to 2 d.p)

Accept 451.5g

(4.s.f)

Or 455.51g

9a) $^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

b) i) 5.6×10^3 yrs | $5.6 - 5.7) \times 10^3$ yrs range

ii) 78% | 78 – 78.4%

+ 0.4 accept

10 a) Enthalpy of formation of hydrogen peroxide or Enthalpy of formation

b) $\Delta H1 + \Delta H3 = \Delta H2 \longrightarrow \Delta h3 = \Delta H2 - \Delta H1$

$= -285.8 - (-187.8) = 187.8 - 285.8 = -98KJmol$

11. a) Fes | Hcl (accept formulas)

Iron (II) sulphide or Zinc sulphide / copper sulphide

Hydrochloric acid Lead (II) sulphide / HNO_3

b) Hydrogen sulphide

The sulphur changes from -2 to zero

(it reduces SO_2 to S) i.e +4 to 0 /

Sulphur lost e's in the H_2S to form sulphur

c) - Vulcanization of rubber | hard on rubber

- Manufacture of sulphur drugs

- Manufacture gun powder / match sticks / explosives / fungicides

12. a) CU^{2+} aqs + Fe (s) ⟶ CU (s) + Fe^{2+} (aq)

b) $\Delta H = MC\Delta T$; = 75.0 x 4.2 x 5.6 = -17645

moles of CU = $\frac{5.83}{63.5}$ = 0.0918

ΔH/mol = $\frac{1764\ h}{0.0918}$ = -19,215J (must have –ve sign)

= -19.2 KJ mol-12

Or -19.22kJmol^{-1}

13 a) Reagents - Hydrogen | H2

Condition – High temp 150 – 250^{0}C (range must be given)

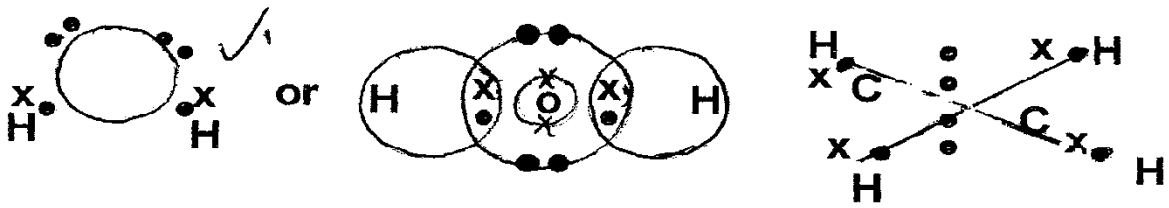
- High pressure not necessary
- Catalyst vol | pd | va

b) Reagent – sodium hydrochloride | NaoH

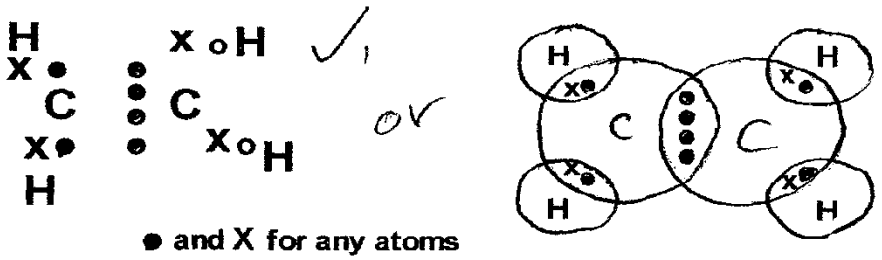
- Potassium "

Condition – Heating (don't accept warning to temp e.g 50^{0}C

14 i)



ii)



● and X for any atoms

b) Dative covalent bond | | Dative | co-ordinate

15 a) Gas has no colour and smell | odorless

b) Carbon (II) oxide has high affinity for iron in the hemoglobin in the blood / or displaces oxygen from hemoglobin therefore the body tissue are deprived of oxygen. Combines to form carboxyhaemoglobin - give one mk only

16 a) Add a few drops of NaoH to an aqueous solution of fertilizer. It forms white ppt insoluble in excess portion of aqueous solution or soluble sulphate of fertilizer. Forms a flame test. Take a solid and heat it. It burns with a red flame (1mk only)

b) Heat the sample fertilizer in a test tube, and test gas evolved with dump red litmus paper, it turns blue

or add NaOH to the sample fertilizer and heat the mixture, test gas evolved using damp red litmus paper turns blue or introduce a glass rod dipped in conc Hcl; white fumes observed.

17 a)

C	**H**	**O**
69.41	4.13	26.45
$\frac{69.42}{12} = 5.785$	$\frac{4.13}{1} = 4.13$	$\frac{26.45}{16} = 1.653$
$\frac{5.785}{1.653} = 3.5$	$\frac{4.13}{1.653} = 2.5$	$\frac{1.653}{1.653} = 1$
7	5	2

Empirical formula $C_7H_5O_2$

b) E.F.M = 7 (12) + 5 (1) + 2 (16) = 121

$(C_7H_5O_2)\ n = 242\ n = \frac{242}{121} - 2$

Molecular formula is $C_{14}H_{10}O_4$)

18a) Hydrogen gas | H_2

b) Increase surface area for faster reaction

c) - Pickling of metals
- Making of drugs
- Regulation of PH in the beer industry
- Treatment of sewage
- Making ion resins (don't accept manufacture of butter)

19 a) $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(l)$

Accept $\longrightarrow$

b) E.M.F = 0.40 - - 0.83 = 1.23 per cell

for ten cells = 10 x 1.23 = 12.3

c) Water formed can be used

water is not a pollutant

don't release harmful wastes

20a) NH_4NO_3 (s) N_20 (g) + $2H_2O$ (g) (accept gas)

b) Over warm water

Downward displacement of warm water because it is fairly soluble in cold water

c) Both red and blue litmus will not change colour

- both must be stated i.e. red and blue papers
- Don't award no observation made on papers
- Award no observable change on papers

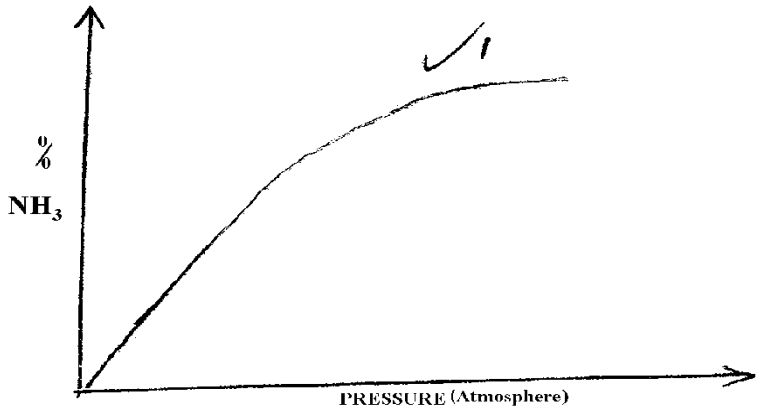
21 a) Chlorofluorocarbon

b) When ozone is depleted high energy UV radiation reach the earth which may cause skin cancer to human beings (if answer comes in b and has explained it in c then award)

c) Global warmings | or Green house effect

Don't accept acid

22a) Forward reaction is exothermic, therefore increase in temperature shifts position of equilibrium to the left direction in which heat is absorbed



23. Hcl is a strong acid // which is furry ionized in water while ethanoic acid is a weak acid // partially ionized in water.

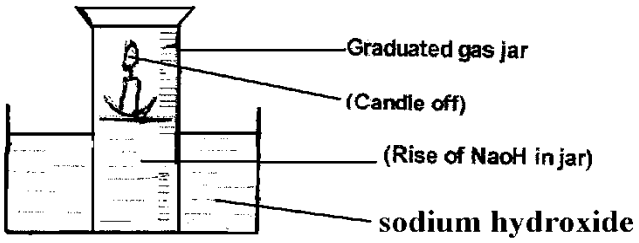
24. React iron metal with sulphuric acid to form iron (II) sulphate. React aqueous ammonia with sulphuric acid to form Ammonium sulphate mix the two solutions iron (II) sulphate and ammonium sulphate to form a solution of ammonium iron (II) sulphate evaporate, until crystallization starts then filter. Add excess H_2SO_4 the two salts in SO_2

react to form ammonium iron (II) sulphate evaporate until crystallization starts. Cool and filter to obtain ammonium iron (II) sulphate put iron metal in a beaker containing NH2 (aq). Add H_2SO_4 until efferveseen stops. Filter the solution obtained. Heat the filtrate to obtain ammonium iron (II) sulphate as a residue.

25.

Water hard containing Mg^{2+} | Ca^{2+} ions
Permanent hardness of water || Mg | Ca2+ $SO4^{2-}$ | Cl^{-1}
Na2CO3 removed the hardness || Hardness water was soft || Mg^{2+} | Ca^{2+} absent Mg^{2+} | Ca^{2+} are ppted out

26.



27 a) 2, 8, 8 | 2.8.8 ✓i

b) $K^{+} < S^{2-} < P^{3-}$

Potassium has 19 protons attracting 18 e's, sulphur has 16 protons attracting 18 e's, and phosporus has 15 protons attracting 18 e's. Therefore the electrons in potassium ions are attracted in potassium ions are attracted more strongly making it the smallest ion. ✓1

CHEMISTRY PAPER 233/1
K.C.S.E 2011 MARKING SCHEME

1. (a) Fermentation

   (b) Ethanol forms hydrogen bonds with water while Ethane does not / remains molecular / only weak Vanderwaals forces (intermolecular force. Ethane is non polar while Ethanol is polar.

2. (a) oe
   -1

   (b) $50g \xrightarrow{t½} 25g \xrightarrow{t½} 12.5g \xrightarrow{t½} 6.25g \xrightarrow{t½} 3.125g \xrightarrow{t½} 1.5625g$
   Or $NW = 0.4(½)^n$
   $NW = 50 \times (½)^5 = 1.5625g$

   (c) Instant / cause death
   Cause cancer
   Cause gene mutation

3. (i) Heat the mixture to sublime the NH_4Cl
   Add water to dissolve the NaCl or copper (II) oxide does not dissolve. Filter and evaporate the filtrate to obtain sodium chloride.

   (ii) Add water to the mixture to dissolve NH_4Cl and NaCl. Cuo does not dissolve. Filter and evaporate the filtrate to dryness. Heat to sublime NH_4Cl. NaCl remains behind.

   (iii) Add water to dissolve. Filter to obtain NaCl & NH_4Cl . Cuo does not undergo traditional crystallization i.e. concentrate and cool. NaCl crystallizes first.

4. (a) $NaNo_2$ reacts with NH_4Cl to form NH_4No_2. The NH_4No_2 decomposes to form N_2 gas.
   Or $NaNo_2 (s) + NH_4Cl \longrightarrow NaCl (s) + NH_4No_2(s)$
   $NH_4No_2(s) \longrightarrow N_2 (g) = 2H_2O (l)$

   (b) Provides inert atmosphere in certain industrial prcesses e.g. packaging / used in light bulbs.
   Storage of semen (for artificial insemination)
   Drilling of oil to provide inert atmosphere
   Dilute effect of O2 gas
   Fill aircraft tyres
   Fill empty oil tankers
   Provide inert atmosphere during welding

5. (a) 2;8 / 2.8 / 2,8 / 2:8 / 2 8 deny 2-8
   (b) $3v\ (s) + Q_2(g) \longrightarrow V_3Q_2\ (s)$
   Or $3Mg\ (s) + N_2\ (g) \longrightarrow Mg_3N_2(s)$ or N_2Mg_3

   (c) T has a lower ionization energy than M or M higher than T.
   T has an extra energy level and hence e's are less attracted by the positive nucleus M has higher e's are more attracted.

6. $\frac{P_1V_1}{T_1} + \frac{P_2V_2}{T_2} = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2} = \frac{98,648.5 \times 0.15 \times 273}{293 \times 101,3285}$

   $V_2 = 0.136dm^3$ (go to minimum of 2d.p)

7. (a) $2\ Pb\ (No_3)_2\ (s) \longrightarrow 2PbO\ (s) + 4\ No_2\ (g) + O_2\ (g)$

   (b) Moles of No2 gas = $\frac{0.29}{24} = 0.01208$

   Moles of $Pb\ (No_3)_2$ = ½ x 0.01208 = 0.006 or ½ x $\frac{0.29}{24}$ = 0.006

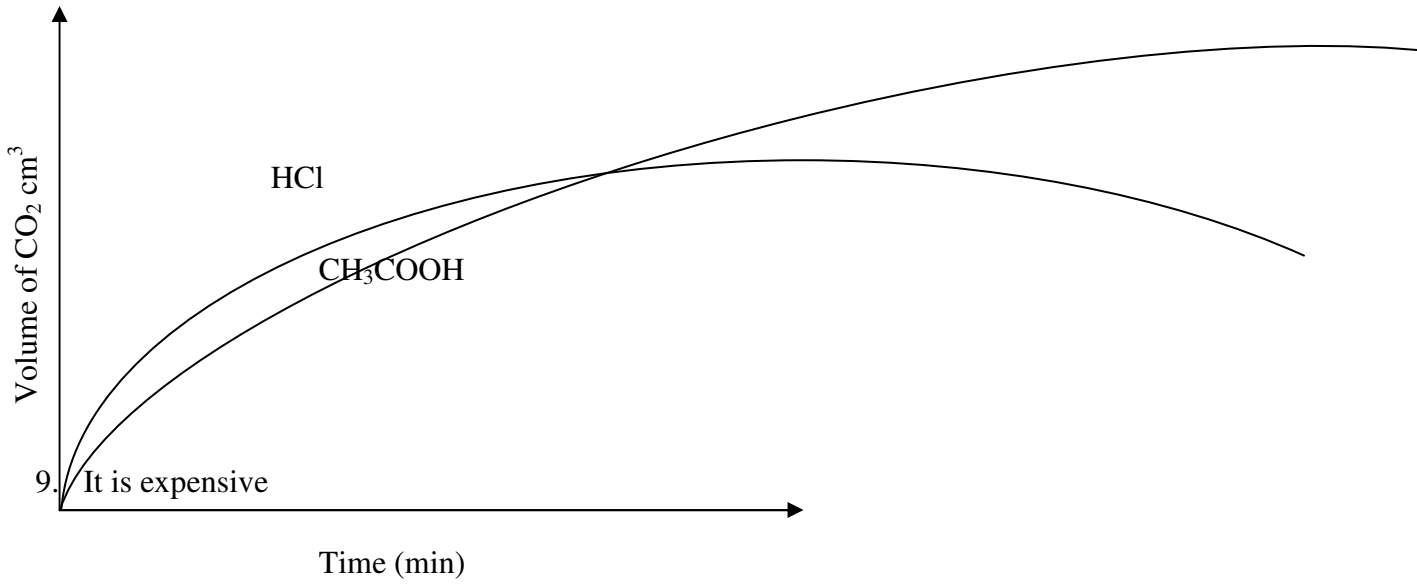
   Mass of $Pb\ (No_3)_2$ = 0.006 x 331 = 1.9998g / 1.986 g

   Or 2 moles $Pb\ (No_3)_2$ 4 x 24 dm^3 No_2 (g)

   $\frac{0.290 \times 2 \times 331}{4 \times 24} = 0.290\ dm^3 = 2g$

8. (a) An acid that ionizes fully / dissociates fully / completely gives all the H^+ ions

(b) Curves start at the same point. Curve of Hcl above ethanoic. Curve ethanoic below.
Joining at some point.



9. It is expensive

It is explosive
It is difficult to store

10. (a) Greenish yellow / pale green colour of Cl_2 disappears
Brown solution / black solid is deposited

(b) Cl_2 (g) + 2 I^- (aq) $\longrightarrow$ 2 Cl^- (aq) + I_2 (s)
Explanation; Iodine oxidation state changes from -1 to 0 hence oxidation while Cl_2 0.5 changes from 0 to -1 hence reduction / increase is ON and decrease is ON or movement of electrons Cl_2 gains e's where lose.

11. (a) Carbon (II) oxide is formed when fuel burns under limited oxygen / incomplete combustion of fuel.

(b) Carbon (IV) oxide / Co_2 – Sulphur (VI) oxide / So_3
Nitrogen (IV) oxide / NO_2
Sulphur (IV) oxide / So_2

12. (a) Small piece of sodium metal (pea size) with a lot of water
Perform the experiment wearing goggles.

(b) Electrolysis

(c) Manufacture of paper (soften)
Manufacture of soaps and detergents
Fractional distillation of liquid air
Extraction of aluminium metal
Manufacture of bleaching agents eg NaOCl paper, textiles, oil refinery
Making herbicides on weed killers
It is boiled with
Textile industry to soften

13. Deliquescent substance absorbs water from the atmosphere to form a solution / dissolve.
Efflorescent substance loses water of crystallization to the atmosphere.

14. P is an alkanol / alcohol
The alkanol reacts with sodium metal to produce the colourless gas / H_2 gas

15. (a) $Ca(st)_2$ or $Mg(st)_2$
$Ca(st)_2$ or $Mgst_2$
$Ca(C_{17}H_{35}COO)_2$ or Ca $(c_{17}H_{35}COO)_2$

(b) Ca^{2+} (aq) + CO_3^{2-} (aq) $\longrightarrow$ $CaCo_3$(s)
Or Mg^{2+} (aq) + Co_3^{2-} (aq) $\longrightarrow$ $MgCo_3$ (s)

16. By adding conc H_2So_4 as a catalyst / adding H_2So_4

17. (a) (i) Black solid is deposited. Lead (II) sulphide (Pbs) is formed
Bubbles are produced and seen. Gas is produced which is H_2S passes through the solution.

(ii) The indicator turns red/pink/orange. This is due to excess H_2S and/or SO_2 gas (formed are acidic)

(b) The experiment should be done in a fume chamber or in open air

18. (a) At room temperature cold and dilute sodium hydroxide

(b) Used in sterilizing of water / treatment of water / killing germs
Used as a bleaching agent
Antiseptic for mouth wash
Fungicide

19. Plot A (Urea)
% of N_2 in $(NH_4)_2 SO_4$ = $\frac{28}{132}$ x 100 = 21.2%. Amount in 50kg = $\frac{21.2}{100}$ x 50 = 10.6 kg
Plot B ($(NH_4)_2SO_4$
% of N_2 in urea = $\frac{28}{60}$ x 100 = 46.7%. Amount in 30kg = $\frac{46.7}{100}$ x 30 = 14.01kg
Plot B is more enriched with N_2 since it has a higher amount of N_2 than Plot A.

20. Add universal indicator to match the colour of solution with pH chart and read the value using a pH meter.
Add water to dissolve the anti-acid powder. Dip electrodes directly into solution and read the pH from the screen.

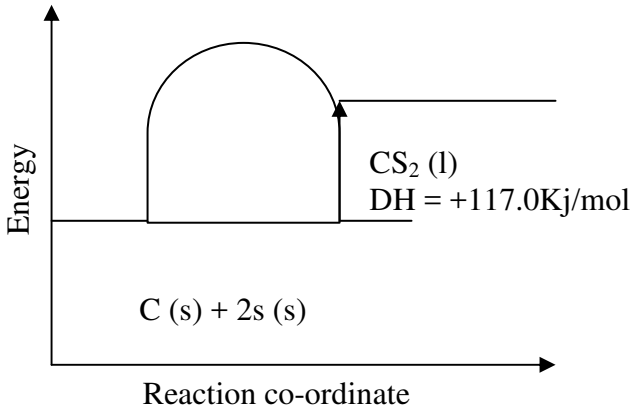
21. (a) Sulphur / Phosphorous / oxygen

(b) Carbon atoms in graphite are arranged in layers of hexagon which are held by weak van der waals forces. The layers slide over each other when force is applied.

22. (a) Bromite
At room temp (25°c) Bromite is liquid since its M.P and B.P is between -7°c and 59°c /58.8°c. Room temp is between M.P and B.P

(b) Atomic mass / molecular mass / molecule of iodine is higher than that of Cl_2.
Van der waals forces are stronger in I_2 than Cl_2 hence iodines b.p is highest than that of Cl_2

23.



24. (a) Y

(b) Y and Z. They have the same number of protons (8) but different atomic masses / mass

numbers / no of neutrons.

25. (a) When gases combine together at constant temp and pressure they do so in volumes which bear a simple ratio to each other, and to the volumes of the products if gaseous.

(b) $C_2Hx\ (s) + 3O_2\ (g) \longrightarrow 2CO_2\ (g) + 2H_2O\ (g)$

Vol	10	30	20	20
Mol Ratio	1	3	2	2

Therefore X = 4

26. (a) (i) 10.352 – 10.240 = 0.112g

(ii) 10.400 – 10.352 = 0.048g or (10.400 – 10.240) – 0.112 = 0.048g

(b)

Elements	M	O
Mole ratio	$\frac{0.112}{56}$	$\frac{0.048}{16}$
	0.0020	0.0030
Simplest Ratio	2	3
E.F	M_2O_3	

27. (a) Zinc blende or/ calamite

(b) $2\ ZnO\ (s) + C\ (s) \longrightarrow 2Zn\ (s) + CO_2\ (g)$

$ZnO\ (s) + C\ (s) \longrightarrow Zn\ (s) + CO\ (g)$

$3ZnO\ (s) + 2C\ (s) \longrightarrow 3Zn\ (l) + CO_2\ (g) + CO\ (g)$

$ZnO\ (s) + CO\ (s) \longrightarrow Zn\ (s) + CO\ (g)$

(c) Dry cells
Galvanizing iron sheets
As electrodes
Making of alloys e.g. brass

28. (a) Single covalent bonding / covalent
Dative / co-ordinate bonding

(b) 7 bonds x 2 = 14 electrons

29. (a) Mg metal has free/mobile delocalized electrons which may carry the current.

(b) It has (Mg^{2+} and Cl^{-}) ions which are free/mobile to move. Accept if ions only. Not necessarily free/mobile.

30. Add aqueous ammonia until in excess.
A formation of white ppt which dissolves in excess shows presence of zinc ions.
Add aqueous acidified $Ba(NO_3)_2$/$BaCl_2$/$Pb(NO_3)_2$.
Formation of a white ppt shows presence of SO_4^{2-} ions

31. Alkaline earth metals

CHEMISTRY PAPER 233/1
K.C.S.E 2012 MARKING SCHEME

1. a) Carbon (iv) oxide /CO_2/ carbon dioxide
Carbon (II) oxide/ CO/ carbon monoxide

b) - Fire extinguisher/ photosynthesis
- Refrigeration
- Solvay process
- Fizzy drinks
- Food preservation
- Extraction of metals
- Manufacture of methanol
- Manufacture of fuel (water, gas)

2. Add water to dissolve $CUSO_4$, Fe_2O_3 doesn't dissolve
- Filter out the undissolved Fe_2O_3
- Wash the residue with plenty of water ro remove traces of the filtrate.
- Dry the residue between the filter papers

3. Grey solid deposited, PbO has been reduced to lead metal; colourless liquid condenses hydrogen has been oxidized to water

Or

$H_{2(g)} + PbO_{(s)} \rightarrow Pb_{(s)} + H_2O_{(l)}$

Or

$H_{2(g)} + PbO \rightarrow Pb_{(s)} + H_2O_{(l)}$

Yellow /grey/

4. a) BDAC; Across the period the atomic radius decreases/ no. of protons/ nuclear charge increases.CADB; from right to left size increases.

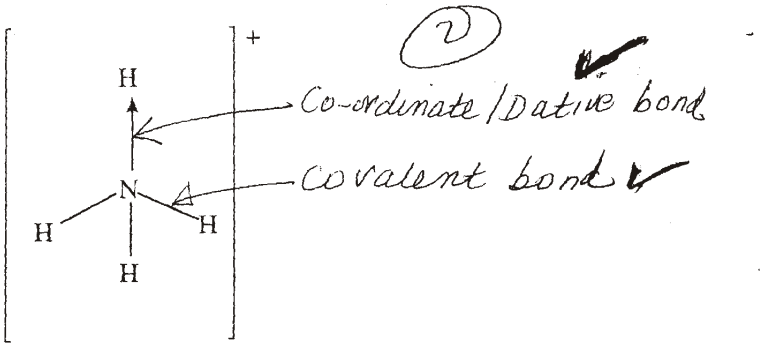
b) D
Across the period the conductivity increase due to increase in delocalized electrons/ mobile/ free/ valency electrons

5. Water contains impurities; impurities increases/ raise/
Water contains ions

6. a) CUSO4; at 40°C only 28g is soluble leaving undissolved $CUSO^4$ while all $Pb(NO^3)^2$ dissolves.

b) 35 – 28 = 7g

7.



a) Or N – H

b) Or N→ H

8. $H_2SO_{4(aq)} + 2NaOH(aq) \rightarrow Na_2SO_{4(aq)} + H_2O_{(l)}$
Or
Moles of NaOH = $\frac{36 \times 0.1}{1000}$ = 0.0036moles
Moles of acid ratio 1:2

$\frac{0.0036}{2}$ = 0.0018moles
Mass H_2SO_4 = (2 x 1) + 32 + (4 x 32) = 98

Moles of acid = $\frac{0.0018 \times 100}{10}$ = 0.018moles

98 x 0.018 = 1.764g

Or
$H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + H_2O_{(l)}$
1 : 2

Moles of NaOH $= \frac{36 \times 0.1}{1000} = \frac{3.6 \times 10^{-3}}{2}$ moles $= 1.8 \times 10^{-3}$ moles

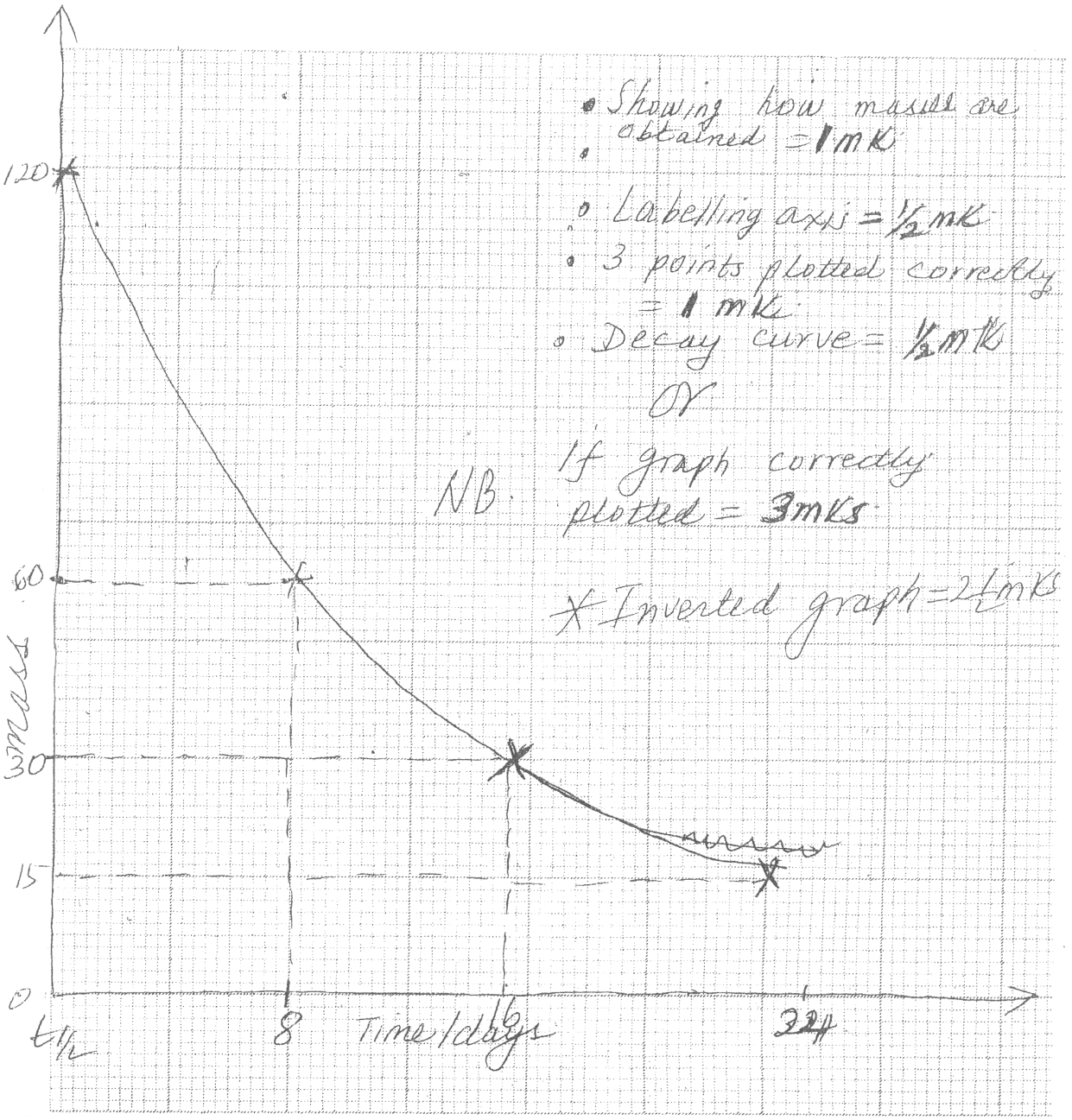
$$\frac{1.8 \times 10^{-3} \times 100}{10} = 0.018 \text{moles}$$

$H^2SO_4 = 2 + 32 + 64 = 98$

$98 \times 0.018 = 1.764$g

9.

Mass	120	60	30	15
Time	0	8	16	24



10. a) Ca^{2+}, Mg^{2+} ion Or magnesium ion
Calcium ion

Rej Magnesium or calcium

b) Ca^{2+}/ Mg^{2+} are exchanged with Na^{+} ion in charge resin/ ions in hard water are exchanged with Na+ ion in the resin.

11. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ or $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$V_2 = \frac{56 \times 1 \times 273}{548}$

$= 28cm^3$

$\frac{0.47 \times 22400}{28} = 376$

R.F.M of $CH_2Br = 94$

$94n = 376$

$\therefore n = 4$

$MF = (CH_2Br)_4$

$= C_4H_8Br_4$

NB if $56cm^3$ is used

$n = 2$

mfc, H_4Br_2

12. a) CaO/ Calcium oxide/ quick lime

b) 1. Expose $NH_3(g)$ to HCL(g), dense white fumes form or use of equation.
2. Dump red litmus paper turns blue when exposed to ammonia.
3. Use of indicators or
4. Pass the gas in Ca2+ ions a pale blue ppt which dissolves to give a deep blue solution is seen

c) X – steam/ water vapour/ water

13. - Catalyst has no effect on position of equilibrium
- A catalyst will increase the rate of forward and backward rxn by equal amount
- A catalyst reduces time for establishment of equilibrium

NB marks are tied

Or

Equilib shifts to the right – because iron reacts with steam

14. Ionisation energy – is the energy required to remove an electron from an atom in gaseous state.

Electron affinity – is the energy change that results in the formation of an ion when an atom gains an electron.

15. a) Salt bridge

b) Emf = Eϑ reduced - Eϑ oxidized
= - 0.80 – (-0.13) or 0.13 – 0.8
= - 0.670

Or
Emf = E ϑ reduced – E ϑ oxidized
= - 0.13 – (-0.8) or -13 + 0.8
= +0.67V

Or
Emf = +0.80 – (-0.13)
or 0.80 + 0.13
= + 0.93V

16. a) S.H.V.T = 2mks if TVHS – student must show the direction of reactivity
NB if SVHT – award 1mk; if any letters missing award 0

b) $T_{(s)} + V^{2+}_{(aq)} \rightarrow T^{2+}_{(aq)} + V_{(s)}$

17. a) Heat or rxn/ Heat change or rxn/ enthalpy of rxn or molar heat of rxn

b) - Using a catalyst
- A catalyst lowers/ reduces the activation energy.

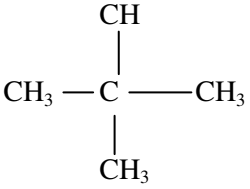
18. a) SO_2/ sulphur (IV) oxide
- Oxidation number of S increases from +4 to +6.

b) - Food preservation
- Bleaching agent
- fumigant
- disinfectant

19. - Level of water in glass tube goes down
- $H_{2(g)}$ gas being less dense than air diffusing or faster than air into the porous pot

20. - $CH_3 – CH_2 – CH_2CH_3$ pentane

$CH_3 – CH(CH_3) – CH_2 – CH_3$ 2-methly/butane



21. Plastic bottles, tooth brush handles
Packaging materials, making crates, cups, plates.
Building materials, models ceiling boards.

22. a) i) Can be hammered into sheets.

ii) Can be drawn into wires.

b) i) Making of sufurias/ motor vehicle parts/ aeroplane parts
window / door flames, cups, plates, packaging materials, pans, making sheets/ roof.

ii) electricity cables/ wires.

23. 1 Weigh $CUCO_3$
2. Heat $CUCO_3$ to a constant mass/ add acid
3. Reduce CUO using H_2NH_3 or CO
4. Weigh the copper
5. % CU = $\frac{\text{Mass of CU}}{\text{Mass of } CUCO_3} \times 100$

Weigh $CUCO_3$ heat$\rightarrow CUCO_3 \rightarrow$Reduce CUO $\rightarrow$weigh CU $\rightarrow$% CU

24. a) There is (No air (no O_2) due to boiling.

b) 1 Al forms a protective AL2O3 layer
2. Al being more reactive than non rusts fast/sacrificial or cathodic protection

25. Vol of 2KOH = 100cm3 (or mols = $\frac{0.4}{2}$ = 0.2

- Mix the $KOH_{(aq)}$ and H_2SO_4 acid
- Concentrate the mixture/ heat the mixture
- Crystalise the solution (or heating the solution to dryness)
- Dry crystals

26. - Add Na_2CO_3/ $NaHCO_3$ to each with ethanoic these is efferscence no rxn with ethanol.
- Add acidified $KMnO_4$ or $K_2Cr_2O_7$, ethanol decolourine $KMnO_4$ or change K_2CrO_7 from orange to green, no change with ethanoic acid.
- Using indicator or litmus papers, no effect with ethanol, while ethanoic acid affect litmus or indicator (phenolphthalein reject)

27. a) Group - 5 (or V) (or five)

Period – 3/ III/ or three

b)i) Noble gases/ inert gases/ rare gases

ii) In balloons (helium)
- Fluorescence lamps/ light bulb
- Disco lights
- Arc welding
- X-ray tubes
- In diluting O_2 in gas cylinder, deep sea diving.

28. a) $2CL^-_{(aq)} \rightarrow CL_{2(g)} + 2e^-$
Or $2CL^-_{(aq)} - 2e \rightarrow CL_{2(g)}$
NB Penalise state symbols/ balance.

b) - O_2/ oxygen
- OH^- ions will be in higher concentration
- OH^- ion being higher in the electro motive series/ or are easier to discharge or lower in the electrochemical series than the chlorine ions hence preferentially discharged or OH- has a higher –ve potential.

29. a) - No effect / change HOCL = chloride (I) acid ion
- Presence of water is necessary to form (H+ or OCL-) or HCL or HOCL bolds) That can affect litmus paper.

b) - Add dil HCL acid to each
- $BaSO_{3(s)}$ give effervescence and dissolves no rxn with $BaSO_4$/ gives a ppt or doesn't dissolves. (or alternatives)
$BaSO^4$ dissolves in dil HCL while $BaSO_4$ doesn't dissolve

or $BaSO_3$ gives effervescence with HCL while $BaSO_4$ doesn't
or $BaSO_4$ forms a white ppt while BaSO3 doesn't

CHEMISTRY PAPER 233/1
K.C.S.E 2013 MARKING SCHEME

1. (a) X is water. √ (1) or H_2O
   (b) It is slightly soluble in water. √ (1) and denser than air.

   (c) • Used in hospitals to resuscitate patients. √ (½)
   • Used in welding when mixed with acetylene in the ocy-acetylene flame. √ (½)
   • Used by divers and mountaineers.
   • Rocket fuel, hospitals for breathing, steel making.

2.

(a) $2NaHCO_{3(s)} \xrightarrow{heat} Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$ √(1)

(b) $2AgNO_{3(s)} \rightarrow Ag_{(s)} + 2NO_{2(g)} + O_{2(g)}$ √(1)

(c) $2FeSO_{4(s)} \rightarrow Fe_2O_{3(s)} + SO_{2(g)} + SO_{3(g)}$ √(1)

3. • Crush the seeds in a mortar √ (½) using a pestle.
   • Add a suitable solvent (acetone / propanone √ (½)
   • Filter out the solid matter. √ (½)
   • Evaporate the filterate to obtain oil. √ (½)

4. (a) Aluminium has a stronger metallic √ (½) bond because it has more delocalised Electrons than sodium. √ (½)
   (b) Sulphur has a ringed structure of S_8 √ (½) molecules whiles chlorine is diatomic. The forces in sulphur are stronger than chlorine. √ (½)

5. (a) It does not sublime. √ (½)
   (b) Cut a piece of Sodium √ (½) metal, place it on a deflagrating spoon, heat it briefly √ (½) then lower it √ (½) into a gas jar of chlorine . It will continue burning forming Sodium Chloride. √ (½)

6. (a) $Cu^{2+}(aq) + 2e \longrightarrow Cu(s)$

(b) 63.5 g require 2 x 96500 C

$$1.184g = \frac{2 \times 96500 \times 1.184}{63.5}$$

3598.6 coulombs $\surd(1)$

$Q = It$

$3586.5 = 2 \times t$

$\frac{3586.5}{2} = t$

$1799.3\ s = t$ $\surd(1_2)$

$\frac{1799.2}{60}$

$= 29.988$

$\simeq$ 30 minutes $\surd(1_2)$

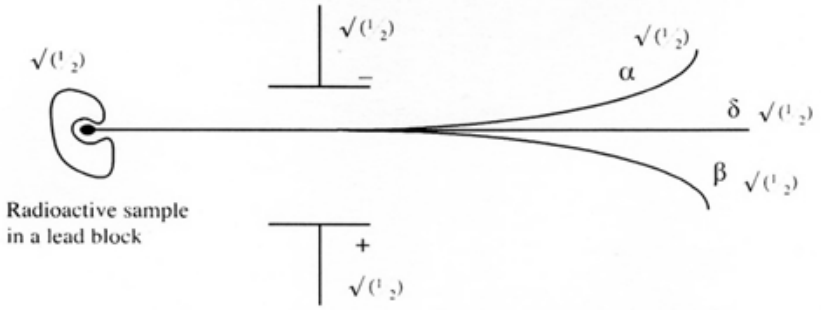
7. (a) (i) X - Calcium carbide √(1) or CaC_2

(ii) Y - $CH_2 = CHCl$ Chloroethene √(1) or vinylchloride

(b)
- Floor tiles √(½)
- Rain coats √(½)
- Plastic bags √(½)

} Any 2

8.



Working diagram, α should be deflected less than β because of its heavier mass.

(Accept any other working diagram)

9. In water, HCl is ionised √(½) into H^+ and Cl^- the Chloride ions are oxidised to chlorine gas by potassium permanganete. √(½)

In methylbenzene, HCl remains in molecular √(½) form i.e HCl. The Chloride is not available for oxidation hence no reaction. √(½)

10. (a) T(1)

(b) 15 g √(1)

(c) Fractional crystallization √(1)

11. (a) $N_2H_{4(g)} + O_{2(g)} \rightarrow N_{2(g)} + 2H_2O_{(g)}$ √(1)

(b) Bond breaking energy

163 + 4 (388) + 496

= 2211 kJ √(½)

Bond making energy

944 + 4 (463)

= -2796 kJ √(½)

Ethalpy change = Bond breaking + Bond making energies.

$2211 + (-2796)$ √(1)

$= -585$ kJ/mol √(1)

12. (a) The acidified permanganete will be decolourised √(1/2). (purple to colourless)

The permanganate (VII) is reduced to manganese (II) ion. √(1/2)

(b) (i) A white precipitate forms. √(1)

(ii) $Ba^{2+}_{(aq)} + SO_3^{2-}{}_{(aq)} \rightarrow BaSO_{3(s)}$ √(1)

13. (a) $[Zn(NH_3)]^{2+}_4$ √(1)

(b) $Zn^{2+}_{(aq)} + Mg_{(s)} \rightarrow Zn(s) + Mg^{2+}_{(aq)}$ √(1) $ZnCl_{(2(aq)} + Mg_{(s)} \rightarrow Zn_{(s)} + MgCl_{2(aq)}$

14. (a) Charles Law

At constant pressure, the volume of a fixed mass of gas is directly proportional to its absolute temperature. √(1)

(b)

$P_1 = 98.39$ kPa
$V_1 = 146$ dμ³
$T_1 = 18 + 273 = 361$ K

$P_2 = 101$ kPa
$V_2 = 133$
$T_2 = ?$

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

$$T_2 = \frac{P_2V_2T_1}{P_1V_1}$$

$$T_2 = \frac{100 \times 133 \times 361}{98.39 \times 146}$$ √(1)

$$T_2 = \frac{4849313}{14364.94}$$ √(1)

$T_2 = 273.22$ K

15. (a) R and T √(1)

(b) T √(1)

16. X - Zinc granules √(1)
The gradient of the graph is less steep √(1) because there is less surface area. √(1)

17. (a) $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$ √(1)

(b) Because nitrogen is inert. √(1)

(c) Nitrogen (II) oxide is oxidised to Nitrogen (IV) oxide which is a pollutant. √(1)

18. (a) Water √(1)

(b) Bubbles of gas √(½) and a white ppt √(½)
CO_2. √(½) reacts to give $CaCO_3$ √(½)

19. (a) These are different forms carbon in the same physical state. √(1)

(b) The hexagonal graphite rings have weak Van der Waals forces between the layers that allow the layers to slide over each other √(1) while in diamond the atoms are held by strong Covalent bonds. √(1)

20. (a) The atomic radii increase with increase in atomic number. This is due to increase in energy levels. √(1)

(b) The group II elements have more protons than group I elements √(1) hence this increases the nuclear attraction for the outer electrons. √(1)

21. (a) Cu^{2+} √(1) or copper ions

(b) Cl^- √(1) and OH^- √(1)

22. (a) Copper pyrites √(1) chalcocite, malachite

(b) To concentrate the ore √(1)

(c) - Brass √(½)
- Batteries √(½)

23. (a) 100 - 25 = 75 cm^3 √(1)

(b) $C_xH_y + O_2 \rightarrow CO_2 + H_2O$

15 cm^3 75 cm^3 45 cm^3 √(1)

1 5 3

$C_xH_y + 5O_2 \rightarrow 3CO_2 + 4H_2O$

x = 3 H = 8

C_3H_8 √(1)

24. $Ca(NO_3)_2 \rightarrow Ca^{2+} + 2NO_3^-$ √(1)

RMM of $Ca(NO)_2$ = 164 √(½)

Concentration of $Ca(NO_3)_2$ = 4.1 g/l √(½)

Molarity $= \frac{Conc.\ in\ g/l}{RMM}$

$= \frac{4.1}{164}$

$= 0.025M$ $\surd(1/2)$

1 mole $Ca(NO3)2$ $\equiv$ 2 moles Nitrate
0.025 m $\equiv$ 2×0.025
0.05M $\surd(1/2)$

25. It would remain unchanged $\surd(1)$
There is no water to form hypochlorous acid $\surd(1)$

26. When aqueous sodium chloride is added to Ca^{2+}. There is no ppt $\surd(1)$ while a white ppt is formed when aqueous sodium chloride is added to a solution containing Pb^{2+}. $\surd(1)$

27. (a) N. $\surd(1)$ being a weak acid provides few H^+ to be neutralised by OH^- hence there is a slight increase in temperature. $\surd(1)$

(b) $CH_3COOH_{(aq)} + KOH_{(aq)} \rightarrow CH_3COOK_{(aq)} + H_2O_{(l)}$ $\surd(1)$

28. (a) Experiments 1 and 3. $\surd(1)$

(b) In experiment 1, the ions in K_2CO_3 are tightly held in position and cannot move $\surd(1)$ while sugar solution does not have ions that can carry a current in solution. $\surd(1)$

29. $^{1}_{1}H$ mass 18 $\surd(1)$

$^{2}_{1}H$ mass 20 $\surd(1)$

CHEMISTRY PAPER 233/1
K.C.S.E 2014 MARKING SCHEME

1. Explain how the hotness of a Bunsen burner flame can be increased 1mk
By opening the air hole / by letting in more air (1)

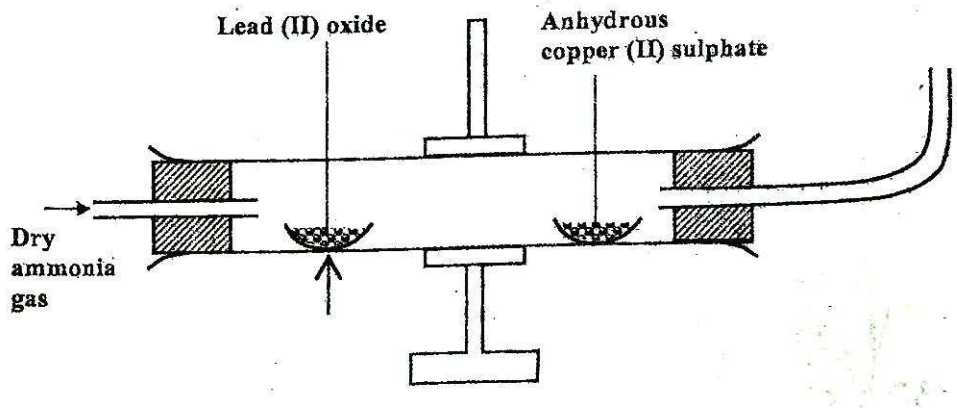
2. When dilute hydrochloric acid was reacted with solid B, a colourless gas which extinguished a burning splint was produced. When an aqueous solution of solid B was tested with a blue litmus paper, the paper turned red / pink

a) Identify the anion present in solid B 1mk
HSO_3^- (l)

b) Write an ionic equation for the reaction between solid B and dilute hydrochloric acid 1mk

$$HSO^{3-}_{(aq)} + H^+_{(aq)} \longrightarrow H_20_{(l)} + SO_{2\,(g)}$$

3. Dry ammonia gas was passed over heated lead (II) oxide and the product passed over anhydrous Copper (II) suphate as shown in the diagram below



a)Two observations made in the combustion tube. 2mks
- **Grey beads**
- **Blue crystals /solid**
- **Droplets of a colourless liquid on the cooler parts**

b) The property of ammonia gas shown in this experiment 1 mk
Reducing agent

4. Starting with zinc sulphate solution, describe how a sample of zinc oxide can be obtained 3 marks
- **Add soluble carbonate (e.g. Na_2CO_3) / nitrate**
- **Filter off sodium sulphate**

- **Heat the residue (zinc carbonate)**

- **Heat zinc sulpahte . To evaporate the water continue heating to get zinc oxide**
- **Heat of the sulphate strongly (680^0C to get zinc oxide)**

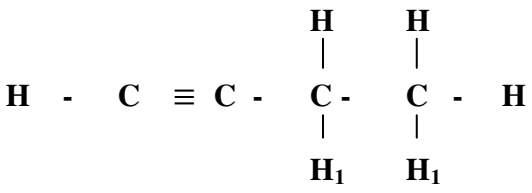
5. Explain how condition of electricity takes place in the following.
   a) Iron metal 1 mk
   By delocalized electrons (in the solid/ molten (liquid) state)

   b) Molten lead (II) iodide
   By mobile ions (in the molten (liquid) state

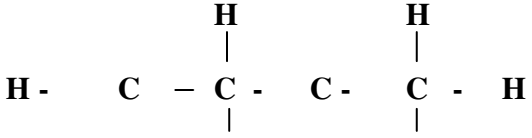
6.100cm^3 of a sample of ethane gas diffuses through a porous pot in 100 seconds. What is the molecular mass of gas Q if 1000 cm^3 of the gas diffuses through the same porous not in 121 seconds under the same conditions? (C-12.0, H=1.0)

$\frac{TE}{TQ} = \sqrt{\frac{ME}{MQ}}$ 61H6= 30 (YZ) $\frac{100}{121} = \sqrt{\frac{30}{Q}}$ $\frac{100^2}{121^2} = \frac{30}{Q}$	$\frac{10000}{14641} = \frac{30}{Q}$ 10000Q = 30 (14641) Q=$\frac{439230}{10000}$ Q= 43.92g	OR RE = $\frac{\sqrt{MQ}}{ME}$ $\frac{\frac{100}{100}}{\frac{100}{121}} = \sqrt{\frac{MQ}{ME}}$ $\frac{100(121)}{100\,(100)}\sqrt{\frac{MQ}{ME}}$ $\frac{121}{100}\sqrt{\frac{MQ}{30}}$	$\left(\frac{121}{100}\right)^2 = \frac{MQ}{30}$ $\frac{14641}{10000} = \frac{Q}{30}$ Q= 43.92 g

7a (Draw and name the isomers of butyne 2mks



But –1- yne



H_1 H_1

But –2- yne

b) State one use of polystyrene 1mk

- **Plastic made kits (low density)**
- **Making insulation materials (poor heat conductor)**
- **Packaging foam for electronics**
- **Ceiling tiles**

8. Complete the nuclear reaction below

a) $\frac{226}{88}Q$ $\frac{226}{88}Q + \frac{4}{2}He\ /\ \frac{4}{2}He^{2+}$ **1mk**

b)State two uses of radioisotopes in health 2mks

- **Treatment of malignant tumors and cancer (ϒ)**
- **Studying the working of the thyroid gland (iodine 131)**
- **Sterilizing surgical instruments (syringes)**

9. The table below shows the relative molecular masses and boiling points of pentane and ethanoic acid

	Relative molecular mass	Boiling point (^{o}c)
Pentane	72	36
Ethanoic acid	60	118

Explain the large difference in boiling point between ethanoic acid and pentane 2mks

Pentane molecules are only joined by weak van der Waals forces which are easily broken while ethanoic acid molecules are joined by van der waals forces and hydrogen bonds making them difficult to break (hence the high boiling point)

10. One of the ores of copper has formula, $CuFeS_2$

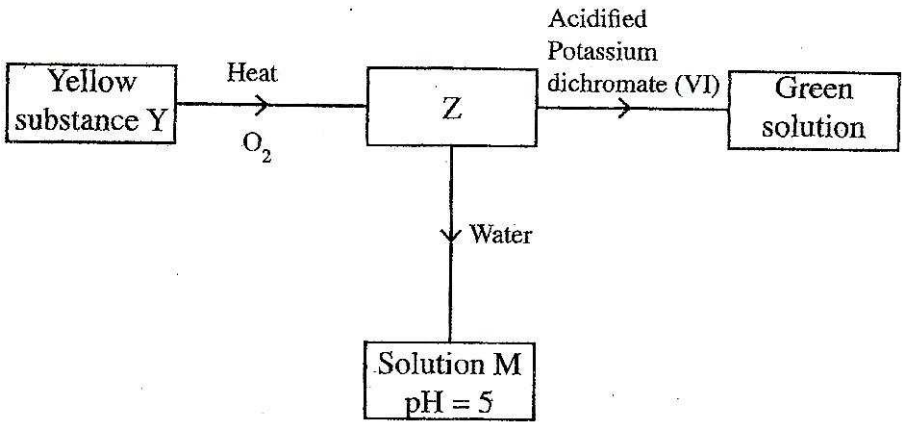
a) Describe how iron in the ore is removed during concentration of copper metal 1mks

Roasting the ore

b) State two environmental problems association with extraction of copper metal. 2mks

- **Sulphur (IV) Oxide causes acid rain which corrodes buildings**
- **Sulphur (IV) oxide causes respiratory problems**
- **Harmful smoke fumes and dust (can cause visibility problems especially at night causing accidents)**

11.Study the flow chart below and answer the questions t hat follow.



Identify Z and M. 2mks

Z **Sulphur (iv) oxide**

M **Sulphhric (IV) acid / sulphurous acid.**

12. The table below shows the pH values of solutions A, B,C and D

Solution	A	B	C	D
pH	2	7	11	14

Select solutions in which a sample of lead (II) hydroxide is likely to dissolve. Give reasons for each solution selected 3mks

A **Its acidic and reacts with hydroxides to form salt and water**

D **React with lead (II) hydroxide which is amphoteric to form a complex sat**

13.100cm^3 of 0.005 M sulphuric (VI) acid were placed in a flask and a small quantity of anhydrous sodium carbonate added. The mixture was boiled to expel all the carbon (IV) oxide.25cm^3 of the resulting solution required 18cm^3 of 0.1 M sodium hydroxide solution to neutralize it. Calculate the mass of sodium carbonate added.
(Na = 23.0; O=16.0; C=12.0)

$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_20$	**$NaCO_3 + H_2SO_4 \rightarrow Na_2CO_4 + H_2O + Co(s)$**
Moles of NaoH=$^{18}/_{1000}$(0.1) = 0.0018	**Mass of N_2Co_3, 0.0041 x 1= 0.0041**
Moles of H_2SO_4 = ½ (0.0018) = 0.0009	**Molar mass of Na_2CO_3= 106**
original moles of H_2SO_4	**Mass of Na_2CO_3 that reacted**
$^{100}/_{1000}$(0.05) = 0.005	**106(0.0041)**
Moles reached with $NaS0_3$ = 0.005-0.009	**0.4346 g**

= 0.0041	

14. When $20cm^3$ of 1 M sodium hydroxide was mixed with $20cm^3$ of 1 M hydrochloric acid, the temperature rose by 6.70C Assuming the density of the solution is 1 g/cm^3 and the specific heat capacity of the solution is $4.2Jg^{-1}k^{-1}$.

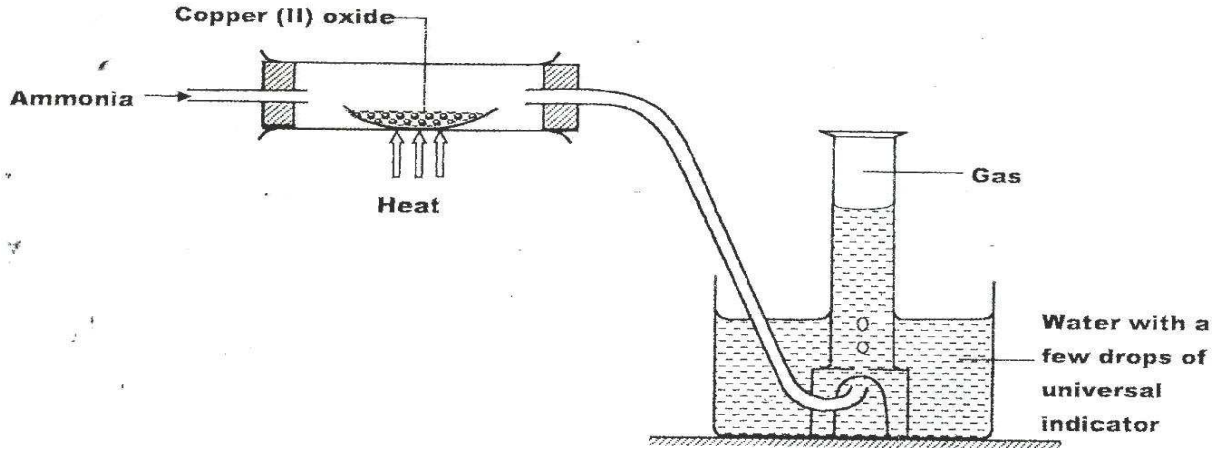
a) Calculate the molar heat of neutralization 2mks

(20+20)g ($4.25g^{-1}k^{-1}$) 6.7k **= 40(4.2J) 6.7** **= 1125.6J**	**Moles of acid = moles of water** **$^{20}/_{1000}$ (1) = 0.02** **0.02 ⟶ 11256J** **1 Mole ⟶ $^{1125.6}$ / $_{0.02}$** **= 5628J** **= 56.28J**

b) When the experiment was repeated with 1 M ethanoic acid, the temperature changes was found to be lower than that with 1 M hydrochloric acid. Explain 1mk

Ethanoic acid being a weak acid, some of the energy was use in ionizing the remaining acid

15. Study the set up below and answer the questions that follow



a)Write an equation for the reaction between ammonia and copper (III) oxide

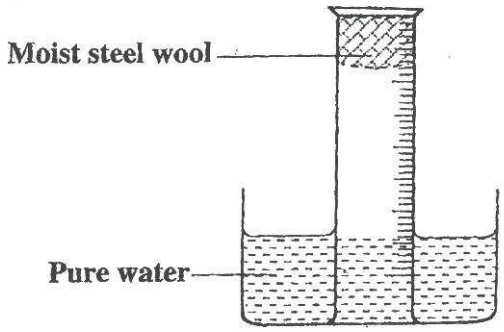
$3CUO_{(s)} + 2NH_{3(g)} \rightarrow 3Cu_{(s)} + 3H_20_{(1)} + N_2(g)$

b) During the experiment, the colour of the contents in the water trough changed. State the colour change observed and give an explanation

Purple

Due to the excess ammonia which is basic

16. A measuring cylinder fitted with moist steel wool was inverted in a trough of water as shown in the diagram below



a)State and explain the observations made on the;

i) Moist steel wool after four days 1mk

Turned brown

Had formed hydrated iron (III) oxide / rust

ii) Water level in the measuring cylinder after four days 1mk

Had risen

To occupy the vacuum left by the oxygen that was used during rusting

b) What would be the effect of using steel wool moistened with salty water? (1mk)

Would have turned brown faster

Would have rusted faster

17. In an experiment on rates of reaction, potassium carbonate was reacted with dilute sulphuric (Vi) acid

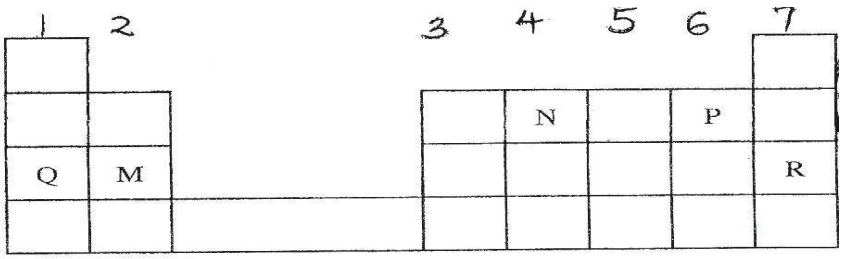
a)What would be the effect of an increase in the concentration of the acid on the rate of the reaction? 1 mk

Would increase / reaction would be faster

b) Explain why the rate of reaction is found to increase with temperature 2mks

Increase in temperature leads to increase in kinetic energy which increases collision of reacting particles

18. Use the part of the periodic table given below to answer the questions that follow (Letters are not the actual symbols of the elements



a) Identify the element that forms giant covalent structures (1 mark)

N

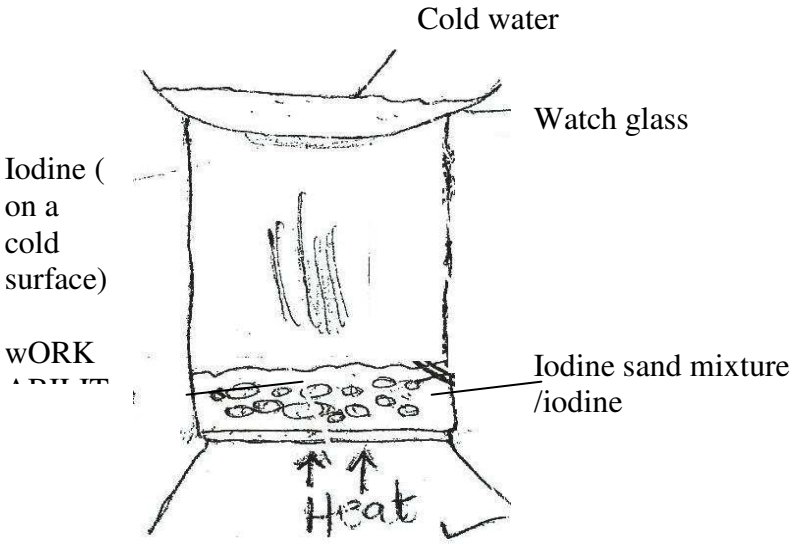
b) Identify one element that does not form compounds (1 mark)

NONE/R (assuming the missing is 7)

c) Write the formula for the nitride of M (1 mark)

M_3N_2

19 Draw a set up that can be used to separate a mixture of sand and iodine (3 marks)



20. In the contact process, during the production of sulphur (IV) oxide, a catalyst is used. Give **two** reasons why vanadium (V) oxide is preferred to platinum. (2 marks)

- **Not easily poisoned by impurities.**
- **cheap**

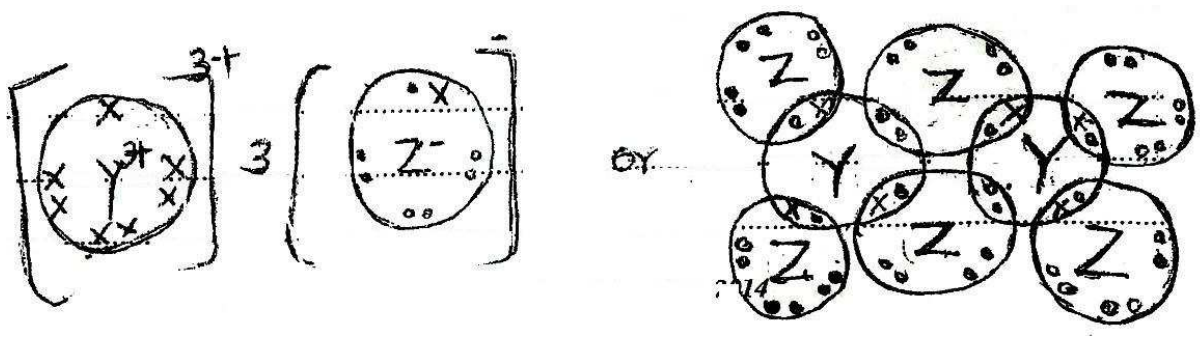
21 given that the atomic number of Y is 13 and that of Z is 9:

a)Write the electronic arrangement of Y and Z; (1 mark)

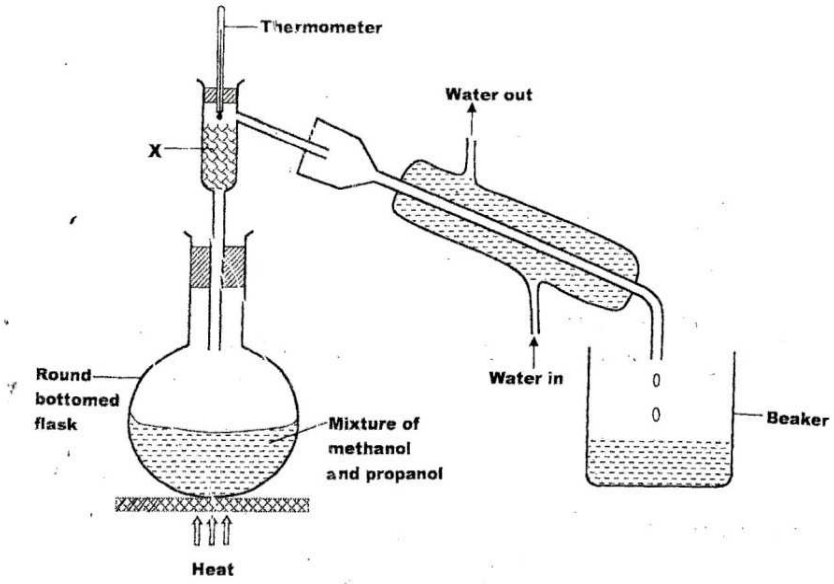
Y 2:8:3

Z 2:7

b) Draw the dot (.) and cross(x) diagram for the compound formed by Y and Z (1 mark)



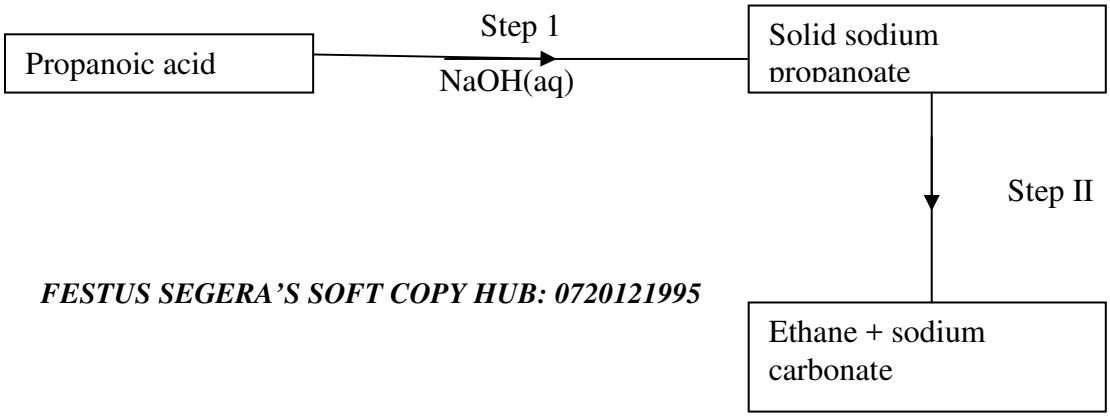
22. The set up below was used to separate a mixture of methanol and propanol. Study it and answer the question that follow.



a) state the function of X (1 mark)
to increase surface area for condensation of the liquid with higher boiling point

b) which liquid will collect first in the beaker? give a reason. (2 marks)
- **methanol**
- **has lower b.p due to its smaller molecular mass**

23 study the flow chart below and answer the question the follow.



a) Name the process in step I. (1 mark)
Neutralization

b) Identify the reagent in step II. (1 mark)
soda lime/ sodium hydroxide + calcium oxide

c) Give one use of ethane (1 mark)
Fuel

24 a) a student electrolyzed dilute sodium chloride solution using inert carbon electrodes. Name the products at:
i)Anode : **Oxygen**
ii)Cathode: **Hydrogen** 2mks

b)If the experiment was repeated using concentrated sodium chloride instead of dilute sodium chloride solution, write the half equation at the anode 1mk

$$Cu_{(s)} \longrightarrow Cu^{2+}_{(aq)} + 2e^-$$

25. An organic compound had the following composition 37.21% carbon, 7.75% hydrogen and the rest chlorine. Determine the molecular formula of the compound, given that the molecular mass of the compound is 65. (C=12.0; H=1.0; CL=35.5) 3mks

100-(37.21 + 7.75) = 55.04

C	**H**	**Cl**
37.21	**7.75**	**55.04**
12	**1**	**35.5**
3.1008	**7.75**	**1.5504**
3.1008	**7.75**	**1.5504**
1.5504	**1.5504**	**1.5504**
2.00002	**49987**	**1**

EF C_2H_5Cl

Empirical mass 2(2) + 5(1) + 35.5 = 64.5

N = Molecular mass = 65 = 1.0078
Empirical mass 64.5
≈

MF(C_2H5C1) n = (C_2H_5Cl)

= C_2H_5Cl

26.Cotton is a natural polymer. State one advantage and one disadvantage of this polymer. 2mks

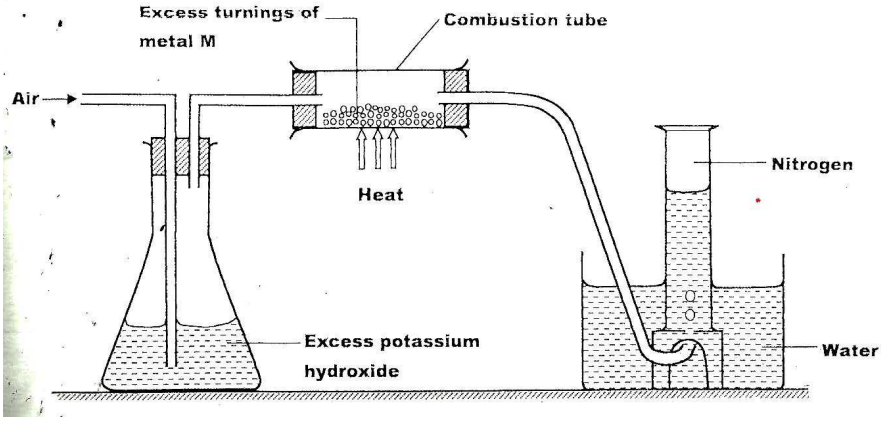
Advantage: **Biodegradable (easily disposed)**
Disadvantage: **Expensive**
Reacts easily with acid, alkalis

27a) Name a suitable solvent for extracting an indicator form flowers: 1mk

b) Give a reason why the solvent named in (a) above is used 1mk

Being a non polar solvent) it dissolves organic matter in the flower.

28. A student sued the set up below to prepare a sample of nitrogen gas.



a) State the function of potassium hydroxide in the set up 1mk

To absorb carbon (iv) oxide

b) Give a suitable metal M for use in the combustion tube 1 mark

Copper

c) Give a reason why the nitrogen gas obtained is not pure. 1mk

It has traces of noble gases (especially organ)

29. a)What is meant by the term radical? 1mk

A group of atoms that react as a unit and has a net charge

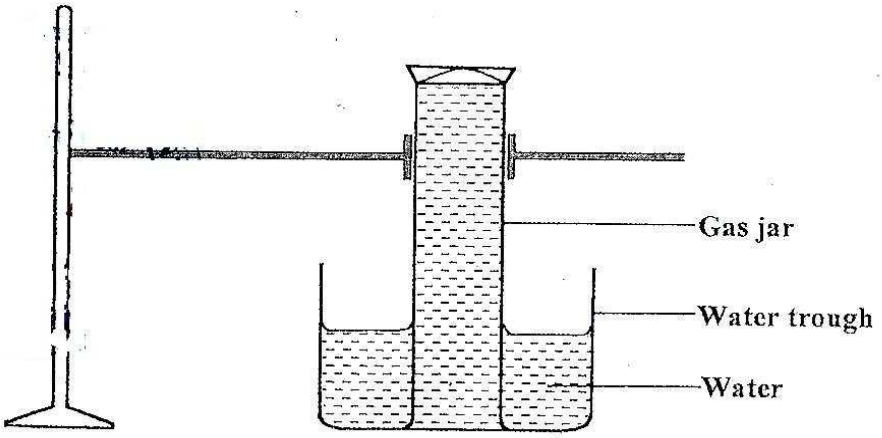
b) The table below contains atoms that form common radicals. Complete the table to show radicals formed from various atoms 2mks

Element	N	S
H	NH	
O	NO^{2-} NO^{3-}	$S04^{2-}$ $SO3^{2}$

$S_2O_3^{2-}$ as in $Na_2S_2O_3$

$S_2O_7^{2-}$ As in $H_2OS_2O_7$ (Oleum)

30A gas jar full of chlorine water was inverted over water and allowed to stand for sometime



a)State and explain two observations made in the gas jar after some time 2mks

yellow, green solution (in the gas jar) turns colourless

Colourless

Chlorine water (HOCL) is decomposed by sunlight to form hydrochloric acid and oxygen or $2HOCL_{(aq)} \longrightarrow 2HCL_{(aq)} + O_{2\,(g)}$

c) Write the equation for the reaction between chlorine and hot concentrated potassium hydroxide 1mk

$6K\,OH_{(aq)} + 3Cl_{2\,(g)} \longrightarrow KCLO_{3\,(aq)} + 5KCl_{(aq)} + 3H_2O_{(1)}$