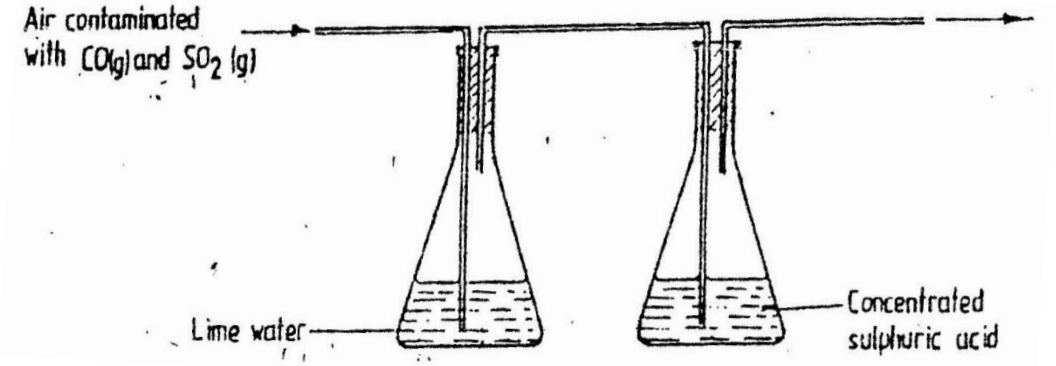
FORM FOUR LAINAKU I 2015 CHEM PAPER 1 MARKING SCHEME

1.Complete the table below for the characteristics of the sub atomic particles(2marks)

sub atomic particle	Relative mass	Electrical charge
Proton	1	***1 √1***
neutral	1	***0 √1***

2. A sample of air contaminated with carbon monoxide and sulphur (IV)oxide was passed through the apparatus shown in the diagram below.



Which contaminant was removed by passing the contaminated air through the apparatus Explain .

Sulphur (IV) oxide √1, it reacts with limewater being an acidic gas √1

3 Explain how you would obtain solid lead carbonate from a mixture of lead carbonate and sodium carbonate powders.

Add water √1, filter to remove lead carbonate as a residue √1, wash and dry the residue √1

4. (a) Write an equation for the reaction that takes place when carbon (II) oxide gas is passed over heated lead(II)oxide.

$CO(g) + PbO_{(s)} \longrightarrow Pb(s) + CO_2(g)$ √1

(b) State **one** other use of carbon (II) oxide gas .

As a fuel √1 // as a reducing agent in extraction of metals

5. Describe how the following reagents can be used to prepare copper (II) hydroxide , solid copper (II) sulphate, solid sodium hydroxide and distilled water.

Add distilled water to solid copper (II) sulphate and solid sodium hydroxide in separate beakers to obtain their solutions. √1 mix the solutions to obtain copper (II) hydroxide precipitate √1 filter , wash and dry the residue √1

6. Aluminium metal is a good conductor and is used for overhead cables. State any other two properties that make aluminium suitable for this use .

Has low density// it is light √1

Forms a protective oxide coating on its surface √1

7. A given volume of ozone, (O_3) diffused from a certain apparatus in 96 seconds.
Calculate the time taken by an equal volume of carbon (IV) oxide (CO_2) to diffuse under the same conditions (O = 16.0, C = 12.0)

R.M.M. of O_3 =48 ***R.M.M CO_2 =44 √1***

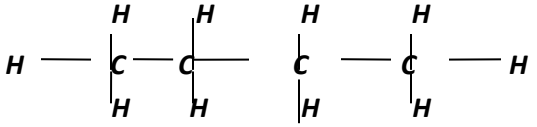
$\frac{TO3}{TCO2}$ = $\sqrt{MO3/MCO2}$

$\frac{96}{TCO2}$ = $\sqrt{48/44}$ ***√1 =91.9 SECS √1***

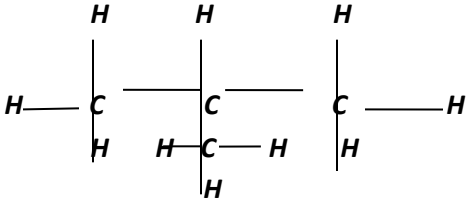
8. (a) What is meant by isomerism?

compounds that have same molecular formula but different structural formula √1

(b) Draw and name two isomers of butane.



BUTANE √1 half each



2-METHYLPROPANE √1 half each

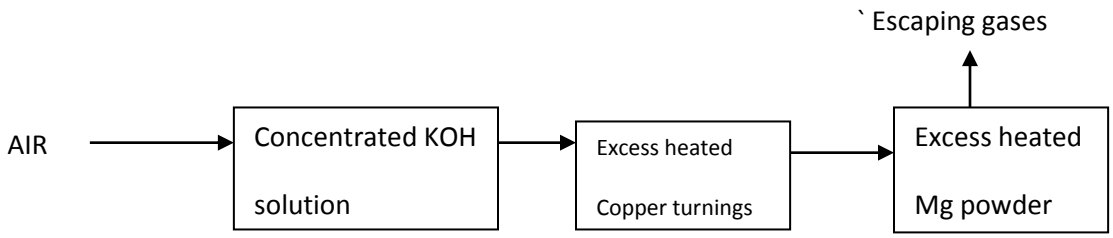
9 The table below shows the relative molecular masses and the boiling points of methane and water

	Relative molecular mass	Boiling point(^oC)
Methane	16	-161
Water	18	100

Explain why the boiling point of water is higher than that of methane.

The molecules of water interact through strong hydrogen bonding √1 while molecules of methane have weak van der waals forces √1

10. Air was passed through several reagents as shown in the flow chart below



(a) Write an equation for the reaction, which takes place in chamber with magnesium powder

$3Mg\ (s) + N_2\ (g) \longrightarrow Mg_3N_2(s)$ √1

(b) Name one gas, which escapes from the chamber containing magnesium powder. Give a reason for your answer.

b) Argon // Neon (name of a noble gas) √1

Because they are inert and not likely to have reacted with any of the reagents. √1

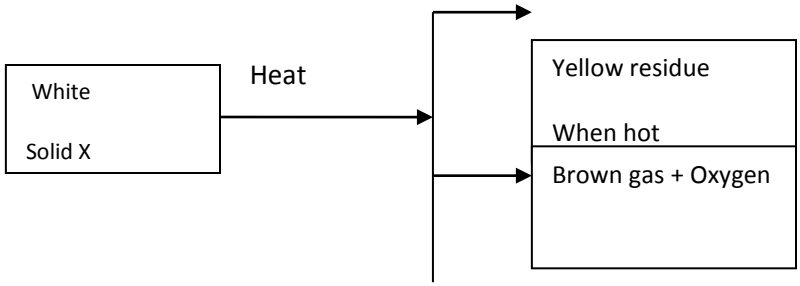
11. (a) Other than the enthalpy of combustion, state **one** factor which should be considered when choosing a fuel.

Ease of transportation//availability//cost//environmental effects//ease of storage √1

(b) The molar enthalpies of neutralization for dilute hydrochloric acid and dilute nitric (V) acid are -57.2KJ/mol while that of ethanoic acid is -55.2kJ/mol. Explain this observation.

The molar enthalpy of neutralization of ethanoic acid is <u>lower</u> √1 because it ionizes partially so some <u>heat energy</u> √1is used to ionize it.

12. a) Study the scheme below and answer the questions that follow.



(a) Name (i) Solid X ***Zinc nitrate √1***

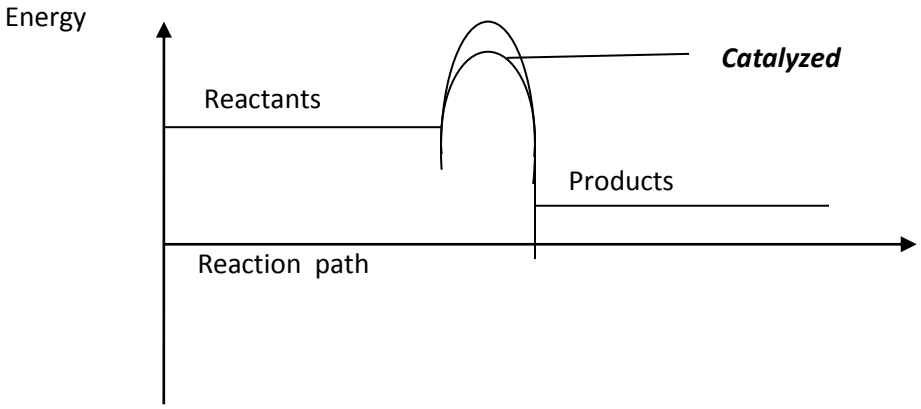
(ii) The yellow residue ***Zinc (II) oxide √1***

(b) Write an equation for the decomposition of the yellow solid

$2Zn(NO_3)_{2(S)} \longrightarrow 2ZnO_{(S)} + 4NO_{2(g)} + O_{2(g)}$ ***√1***

13. Ammonia can be converted to nitrogen (II) oxide as shown in the equation below

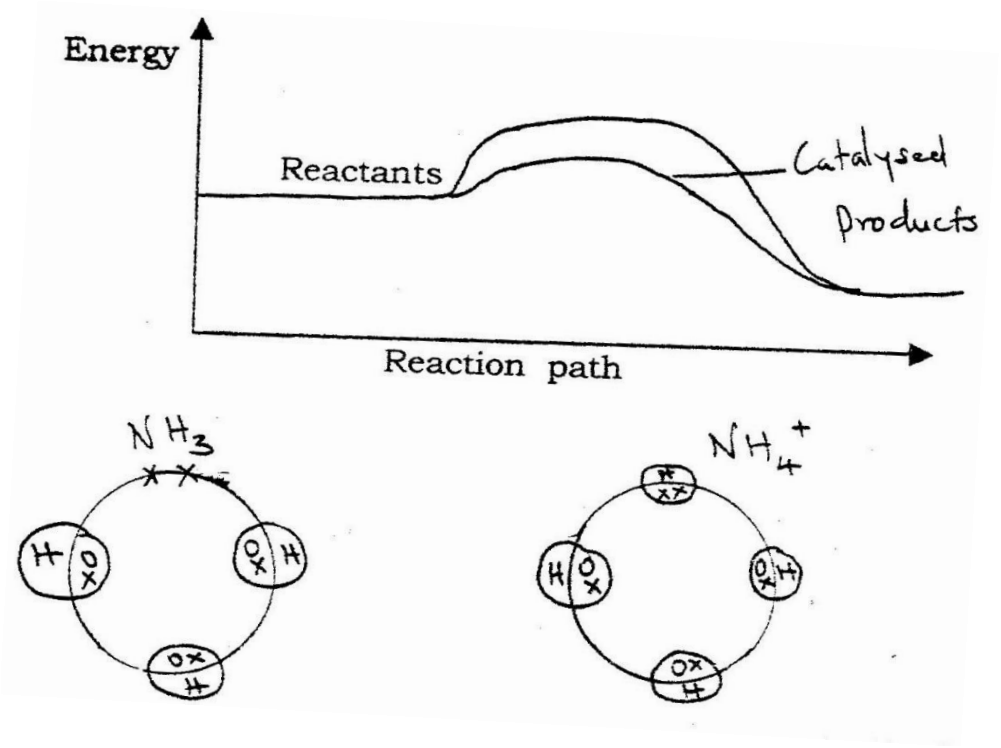
$4NH_{3(g)} + 5O_{2(g)} \rightleftharpoons 4NO_{(g)} + 6H_2O_{(l)}$ ***√1***



(a) Explain how an increase in temperature would affect the yield of nitrogen (II)oxide

increase in temperature would lower the yield of Nitrogen √1, this is because the reaction is exothermic and equilibrium shift to the left. √1

b) On the energy level diagram above sketch, the energy level diagram that would be obtained if the reaction is carried out in the presence of platinum catalyst.



14. Use the information below to answer the questions that follow:

$Zn^{2+}(aq) + 2e^- \rightleftharpoons zn(s)$ -0.76 V

$Al^{3+}(aq) + 3e^- \rightleftharpoons Al(s)$ -1.66 V

$Fe^{2+}(aq) + 2e^- \rightleftharpoons Fe(s)$ -0.44 V

a). Calculate the E value for the electrochemical cell below

Al(s) | Al^{3+} (aq) || Fe2+(aq) | Fe(s)

…(a) Al(s) $Al^{3+}(aq)$ $Fe^{2+}(aq)$ Fe(s)

EMF $= E^{\theta}_{Red} - E^{\theta}Ox$

$= (-0.44) - (-1.66)$ ***√1***

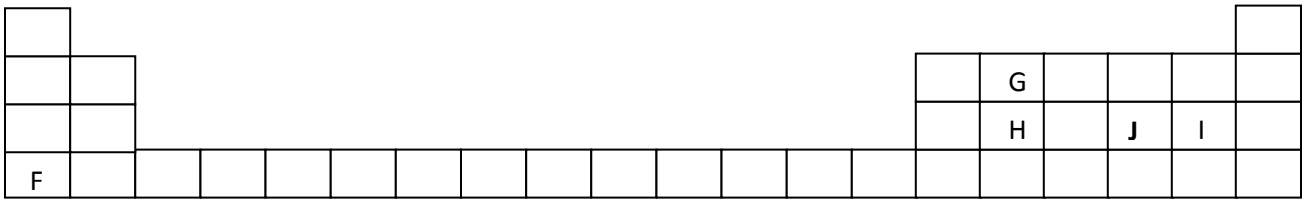
$= 1.22V$ ***√1***

(b) Give a reason why aluminium metal would protect iron from rusting better than zinc metal.

- Has less negative E value ***√1***

- It is on the left cell rep// aluminium is more reactive than iron

15. The grid below shows part of a periodic table. The letters do not represent the actual symbols of the elements



(i) element which has the largest atomic radius.

F ***√1***

(ii) Most reactive non-metal .

I ***√1***

b) Show on the grid the position of the element J which forms J^{2-} ions with electronic configuration 2, 8, 8. (1mk)

16. A hydrocarbon slowly decolorizes bromine gas in the presence of sunlight but does not decolourise acidified potassium manganate (VII).

(i) Name the homologous series to which the hydrocarbon belongs .

alkane ***√1***

(ii) Give an example of a member of the homologous series named in (i) above.

Methane/Ethane/Propane/ Butane /Pentane √1 //any alkane

17. Atoms of element X exists as $^{14}_{6}X$ and $^{12}_{6}X$

(a) What name is given to the two types of atoms.

Isotope √1

(b) Use dot (·) and cross (x) diagrams to illustrate the atomic structure of $^{14}_{6}X$

Nucleus composition ***√1***

E c 2.4 √1

18. When dilute nitric acid was added to a sample of solid C, a colourless gas that formed a white a white precipitate with limewater was produced. When another sample of solid C was heated strongly in a dry test – tube, there was no observable change.

(a) identify the cation and anion in solid C

CATION ***Na^+ // sodium √1***

ANION ***CO_3^{2-} // Carbonate √1***

19 Complete the table below by inserting the missing information in the space provided.

Name of polymer	Name of monomer	One use of the polymer
Polyethene √1	ethene	***Squeeze- bottles // √1 buckets//bowls// piping//coating for cables//plastic bags***

20. In an experiment, soap solution was added to three separate samples of water. The table below shows the volumes of soap solution required to form lather with 100cm^3 of each sample of water before and after boiling.

	Sample I	**Sample II**	**Sample III**
Volume of soap before water is boiled (cm^3)	27.0	3.0	10.6
Volume of soap after water is boiled cm^3)	27.0	3.0	3.0

(a) Which water sample is likely to be soft? Explain.

Sample II √1 it lather with a small amount of soap √1

(b) Name the type of water hardness in sample III

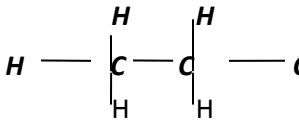
Temporary hardness √1

21. The reaction of ethane with chlorine gas gave a compound of formula C_2H_5Cl.

a) What condition is necessary for the above reaction to take place?

u. v radiation // sunlight √1

b) Draw the structural formulae of the compound C_2H_5Cl. and name it.



√1 chloroethane √1

22 .Soot is one of the environmental pollutants .

(i) Explain the term pollutant.

Harmful substance released into the environment √1

(ii) State how soot is formed from hydrocarbons.

Soot is formed when hydrocarbons burns in a limited supply of oxygen √1 // incomplete combustion

23. In an experiment, sulphur (Iv) oxide gas was bubbled into water followed by chlorine gas. The resulting colorless solution gave a white precipitate when mixed with a acidified barium chloride solution. Explain these observations.

SO_2 reacts with water to form SO^{2-}_3/ sulphurous acid √1 which then is oxidized by chlorine to SO^{2-}_4/ sulphur ic (VI)acid (1). SO^{2-}_4 reacts with Ba^{2+} to form insoluble $BaSO_4$(I) √1

24. A compound has an empirical formula, C_3H_6O and a relative formula mass of 116. Determine its molecular formula (H = 1.0, C = 12.0, O = 16.0)

E F M = 12X3+ 1X6 +16X1 = 58

58 n = 116 √1

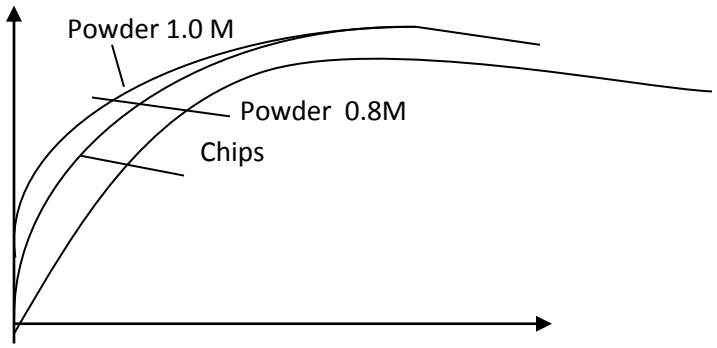
n = 2 MF is (C_3H_6O) X 2 √1

= $C_6H_{12}O_2$ √1

25. The table below gives three experiments on the reaction of excess hydrochloric acid and 0.5g of calcium carbonate done under different conditions. In each the volume of gas was recorded at different time intervals.

Experiment	Form of Zinc	Sulphuric acid solution
I	Powder	0.8m
II	Powder	1.0m
III	Chips	0.8m

On the axis below draw and label the three curves that could be obtained from such results. (3mks)



26. Crystals of sodium carbonate decahydrate ($Na_2CO_3 . 10H_2O$) were exposed to air for about four days.

(i) State what was observed.

A white powder was formed ***√1***

(ii) Name the process that took place.

Efflorescence ***√1***

(ii) Write an equation for the reaction that occurred.

$$Na_2CO_3.10H_2O_{(s)} \longrightarrow Na_2CO_3.H_2O_{(s)} + 9H_2O_{(l)} \quad \surd 1$$

27. Explain why molten calcium chloride conducts electricity while silicon (IV) oxide does not.

molten calcium chloride contains delocalized ions which carry charge √1 but silicon (IV) oxide does not √1

28. Calculate the mass of sodium oxide, Na_2O, formed when 3.45 g of sodium burns in air. (Na =23, O=16).

$$4Na_{(s)} + O_{2(g)} \longrightarrow 2Na_2O_{(s)} \quad \surd 1$$

92 g ***108 g***

3.45 g $\frac{3.45}{92}$ **x 108** ***√1***

= 4.05 g ***√1***

29. T he table below gives the first ionization energy of three elements.

Element	A	B	C
1st ionization energy(kJ/mol)	496	419	520

(i) define the term first ionization energy.

First ionization energy is the minimum amount of energy required to removed the first electron From a gaseous atom √1

(ii) select the element that is the most reactive. Explain.

B √1 it has the least ionization energy therefore loses electrons most readily √1

30. State the colour of the indicators in the solutions given in the table below:

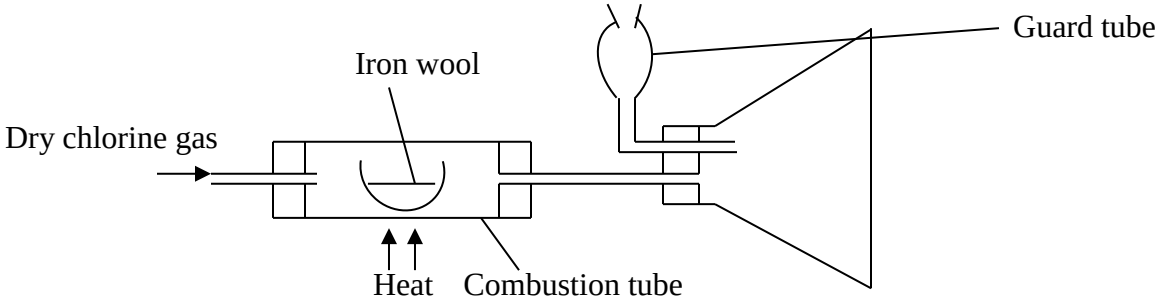
	Colour in	
Indicator	Acid	Base
Litmus	Red	***Blue*** $\surd$***1***
Methyl orange	***Orange*** $\surd$***1***	Yellow
Phenolphthalein	Colourless	**Pink** $\surd$***1***

LAINAKU JOINT MOCK EXAMINATION
CHEMISTRY PAPER 2
MARKING SCHEME
MARCH/ APRIL 2015

1. (a) Give the name of one reagent which when reacted with concentrated hydrochloric acid produces chlorine gas. (1mk)

-potassium manganate (VII), Manganese (IV) oxide, Lead oxide

(b) A student set out to prepare Iron (III) Chloride using apparatus shown in the diagram below.



(i) Explain why: it is necessary to pass chlorine gas through the apparatus before heating begins. (1mk)

-To displace/ remove the air present in the apparatus.

(ii) Calcium oxide would be preferred in the guard tube. Explain. (1mk)

-It reacts with excess chlorine gas./ It absorbs moisture.

(iii) What property of Iron (III) Chloride makes it possible to be collected as shown in the diagram above? (1mk)

-It sublimes

(iv) The total mass of Iron (III) Chloride formed was found to be 0.5g. Calculate the volume of chlorine gas that reacted with Iron. (Fe=56, Cl=35.5 and Molar gas volume at 298 = 24000cm^3). (3mks)

$2Fe_{(s)} + 3Cl_{2(g)} \rightarrow 2FeCl_{3(s)}$
Mass of $FeCl_3$= 56+71+35.5= 162.5
Moles of product=0.5/162.5=0.0031moles
Moles of Cl_2 used= $^3/_2 \times 0.0031 = 0.00461$

Volume of Cl_2= 2400×0.00461
=110.8cm^3

(c) When hydrogen sulphide gas was passed through a solution of Iron (III) Chloride, the following observations were made:-
- The colour of the solution changed from reddish brown to green.
- A yellow solid was deposited.

Explain these observations. (4mks)

-Hydrogen sulphide is a strong reducing agent (1mk),
thus reducing iron (III) to iron (II) (1mk)
-The hydrogen sulphide is itself oxidized to sulphur. (2mks)

(d) State and explain the observations that would be made if a moist blue litmus paper was placed in a gas jar full of chlorine gas. (2mks)
-The blue litmus paper turns to red due to the formation of an acidic solution. (1mk)
-The litmus paper gets bleached due to the presence of HOCl. (1mk)

2. The table below gives some elements of the periodic table and their atomic masses, atomic numbers and melting points. The letters are not the actual symbols of the elements.

Element	B	C	D	E	F	G	H	I	J	K
Atomic No	7	8	19	15	2	9	6	16	12	11
Atomic mass	14	16	39	31	4	19	12	32	40	23
Melting point (^{0}C)	-209	-218	63.7	44	-272	-223	Vary	113	669	98

a) Select **two** elements with oxidation states of -3

(1mk) **–E and B**

b) Which elements represent the most powerful reducing agent. Explain

(1mk) **–Element D. It is a group one metal which loses its electrons most easily due to**

the relatively low effective nuclear charge attraction to the outermost energy level electrons.

c) How does the atomic radius of D compare with that of K. Explain.

(1mk) **–K has a lager atomic radius than G because K has a higher number of occupied energy levels.**

d) How do you compare the electrical conductivity of element D and J. Give your reason

(1mk) **–J has a higher electrical conductivity than D because it has a higher number of delocalized electrons.**

e) Select **two** elements which when reacted form a compound that conducts electricity both in molten and aqueous state.

(1mk) **–G and J**

- G and D

- G and K

f) Select any two elements which when reacted form a compound that dissolves in water to form an acidic solution.

(1mk) **–C and H, I and C, E and C, B and C**

g) In which period and group do elements D and G belong?

(1mk)**- D= Period 4 group I**

G=Period 2 group VII

i) Explain why the melting point of element K is higher than that of element D (1mk)

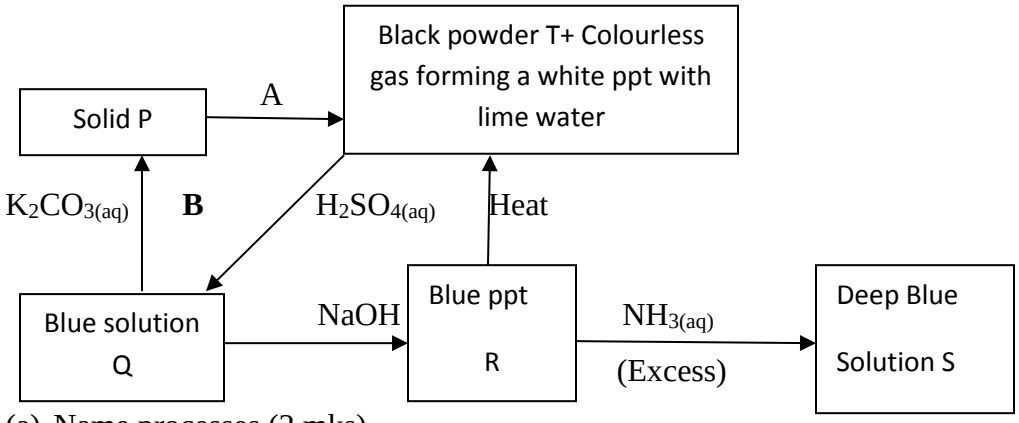
-Element K has stronger metallic bonds than element D due to its smaller atomic radius

j) How does the atomic radius of K and I compare. Explain

(2mks) **–I has a smaller atomic radius than K (1mk)**

- because it has a larger number of protons in its nucleus, resulting in a higher effective nuclear charge attraction which pulls the energy levels closer to the nucleus. (1mk)

3. Study the flow chart below and answer the questions that follow.



(a) Name processes (2 mks)

i) A –**Thermal decomposition/ Heat**

ii) B- **Precipitation/ Double decomposition**

b) Name substances: (2mks)

(i) Solid P- **Copper (II) carbonate**

(ii) Colourless gas- **Carbon (IV) oxide**

(b)Give balanced stoichiometric equations for the reactions:
(8mks)

(i) Producing solid P

$CuSO_{4(aq)}$+ $K_2CO_{3(aq)}$ → $CuCO_{3(s)}$ + $K_2SO_{4(aq)}$ ***√1***

(ii)Giving the blue precipitate R

$CuSO_{4(aq)}$ + 2 $NaOH_{(aq)}$ → $Cu(OH)_{2(s)}$ + $Na_2SO_{4(aq)}$ ***√2***

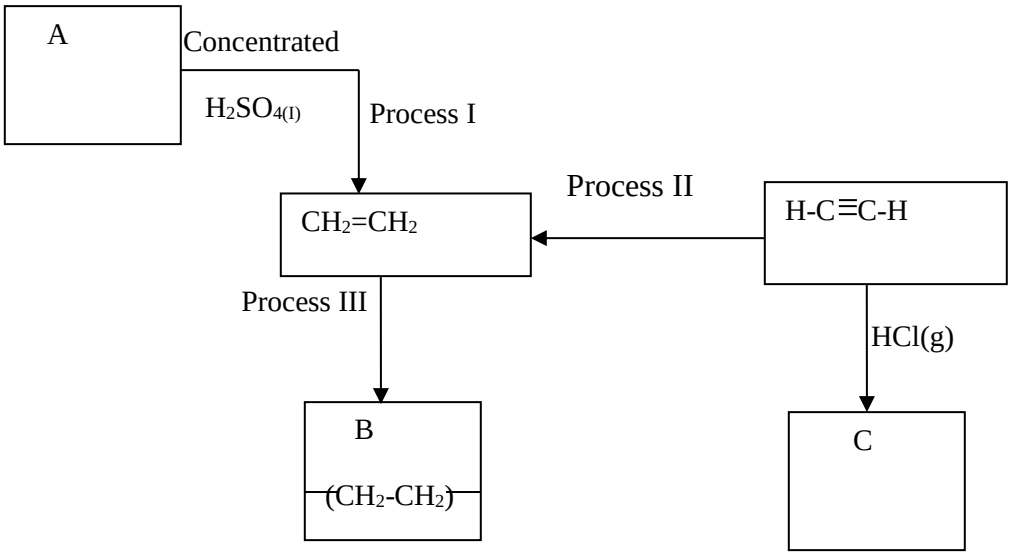
(iii)Thermal decomposition producing black powder T

$CuCO_{3(s)}$ $\xrightarrow{\text{heat}}$ $CuO_{(s)}$ + $CO_{2(g)}$ ***√1***

(iv) Producing deep blue solution S

$Cu(OH)_{2(s)} + 4NH_{3(aq)} \rightarrow [Cu(NH_3)_4]^{2+}_{(aq)} + 2OH^-_{(aq)}$ √2

4. Study the flow chart below and answer the questions that follow.



a)

i) Name process I (1mk)
-Dehydration

ii) Name process II (1mk)
-Hydrogenation

iii) Give the conditions necessary for process I to occur.(1mk)
-Conc. Sulphuric acid
-Heat (170^{o}C)

iv) Give the conditions necessary for process II to occur.(1mk)
-Catalyst (Nickel)
-Temp of 200^{o}C

v) Name compound C. (1mk)
Chloroethene

vi) Name the reagent A. (1mk)
-Ethanol

b) Complete combustion of one mole of a hydrocarbon produced four moles of Carbon (IV) Oxide and four moles of water only .

i) Write the formula of the hydrocarbon.

C_4H_8 (1mk)

ii) Write the equation for the combustion reaction.

$C_4H_{8(g)} + 6O_{2(g)} \rightarrow 4CO_{2(g)} + 4H_2O_{(l)}$ (1mk)

c) An organic compound T contains 50% Oxygen;12.5% Hydrogen and 37.5% Carbon. The organic compound has a relative molecular mass of 32. (C=12, 0=16, H=1)

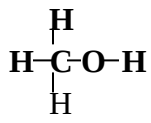
i) Determine the molecular formula of the compound T. (3mks)

C	**H**	**O**
$^{37.5}/_{12}$	$^{12.5}/_{1}$	$^{50}/_{16}$
$^{3.125}/_{3.125}$	$^{12.5}/_{3.125}$	$^{3.125}/_{3.125}$
1	**4**	**1**

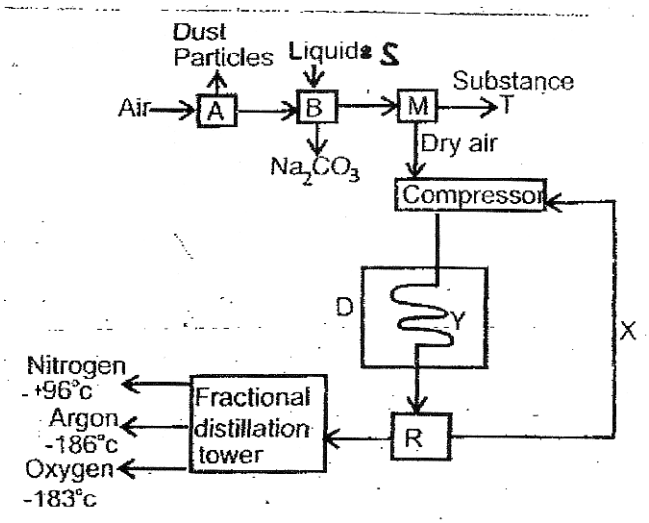
; CH_4O

ii) Draw the structural formula of the compound T. (1mk)

(CH_4O) n=32
(12+4+16)=32
n=1
Molecular formula= CH_4O
Structural formula;



5. Fractional distillation of liquid air is used to produce oxygen gas used in hospitals to patients with breathing problems. Study it and then answer the questions that follow.



(a) What processes takes place in chambers:- (4mks)

A: **-Filtration**

B: **-Removal of Carbon (IV) oxide**

M:**-Condensation/ Removal of water vapour.**

D:**-Heat exchange/ Cooling**

(b) Name: (2mks)

(i) Liquid S:
-Sodium hydroxide

(ii) Substance T:
-Water

(c) Explain why part Y in chamber D is curved.
-To increase the surface area for cooling/ heat exchange

(d) State **two** large scale use of oxygen gas other than the one mentioned.
-Used in the manufacture of steel
-Used in welding when mixed with a fuel such as ethyne/hydrogen.

-Used by deep sea divers and mountain climbers.(2mks)

6. In an experiment to determine heat of displacement of Copper by Iron, $50cm^3$ of 0.2M Copper (II) Suphate was reacted with excess iron fillings. The following results were obtained.

   Initial temperature of Copper (II) Sulphate solution = 25.0^oC

   Final temperature of the solution = 31.0^0C

   Mass of iron = 1.0g

   (Assume density of solution = $1.0g/cm^3$, specific heat capacity = $4.2Jg^{-1}K^{-1}$)

   a) Calculate;

      i) Heat evolved during the reaction. (2 marks)

      Heat evolved= 50×4.2×6= 1260 J

      ii) Molar heat of displacement. (2 marks)

      $^{1260}/_{0.01}$= 126,000 OR 126kJ

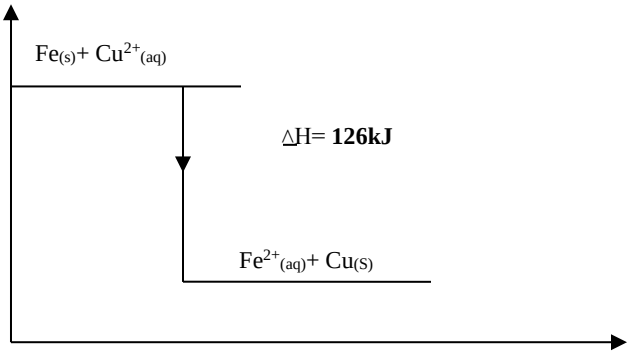
      iii) Write a thermochemical equation for the reaction above. (2 marks)

      $Fe_{(s)} + Cu^{2+}_{(aq)} \rightarrow Fe^{2+}_{(aq)} + Cu_{(s)}$; ∧H=-126kJ

      iv) Why were ion fillings used in excess? (1 mark)

      To ensure that all thew copper ions are displaced

   b) Draw an energy level diagram for the reaction. (3 marks)



   c) What is a fuel? (1 mark)

   d) **A substance that produces useful energy when it undergoes a chemical or nuclear reaction**

7. Butane is a gas at room temperature and pressure, it is used to melt bitumen to apply on roads.

(a) Write an equation for complete combustion of butane.

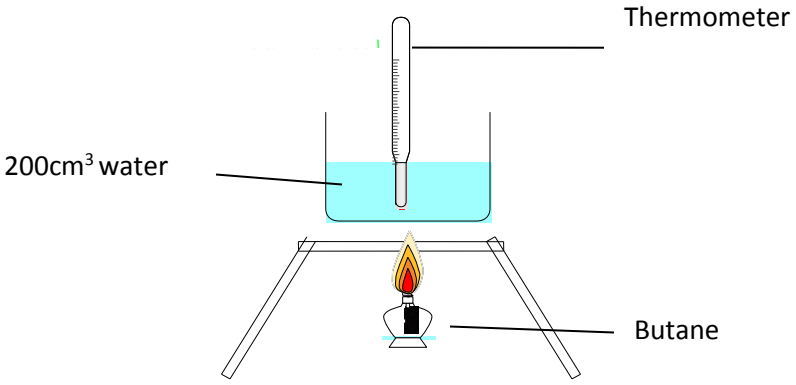
(1mk)

$2\ C_4H_{10(g)} + 13\ O_{2\ (g)} \longrightarrow 8\ CO_{2(g)} + 10H_2O_{\ (g)}$ ✓1

(b) Define the term standard enthalpy of combustion. (1mk)

This is the energy change that occurs when one mole of a substance/fuel burns completely in excess oxygen. ✓1

(c) The set up below was used to determine the enthalpy change for combustion of butane.



The temperature rose from 22^0C to 70^0C when 1g of butane was burnt

Calculate the energy change and hence molar enthalpy. (s.h.c 4.2 $KJKg^{-1}K^{-1}$, density 1 gcm^{-3}) (2mks)

$\Delta H = MC\Delta\theta$

$= \frac{200}{1000} \times 4.2 \times (70 - 22)$

$= 0.2 \times 4.2 \times 48$

$= 40.32\ KJ$

RFM of C_4H_{10}

$= (12 \times 4) + (1 \times 10)$

58

$1g \rightarrow 40.32\ KJ$

$58 \rightarrow ?$

$\frac{58 \times 40.32}{1}$

$= 2338.56\ KJmol^{-1}$

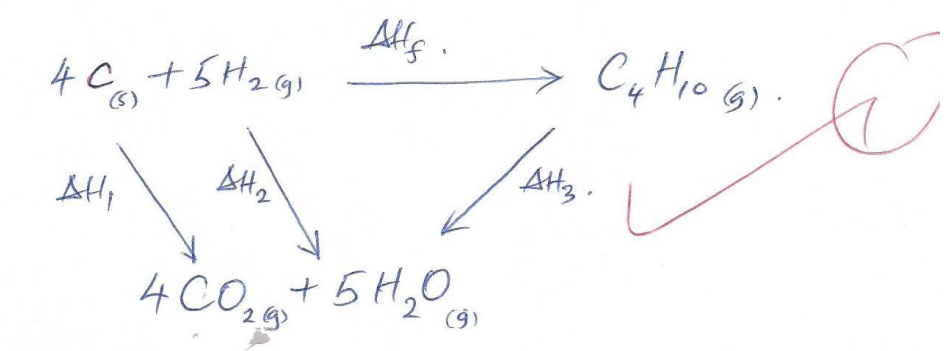
(d) Given the following enthalpies of combustion data:

Carbon $\Delta H = -393\ KJmol^{-1}$

Hydrogen $\Delta H = -286 KJmol^{-1}$

Butane $\Delta H = -232\ KJmol^{-1}$

Draw an energy cycle diagram and use it to calculate the enthalpy of formation of butane (2mks)



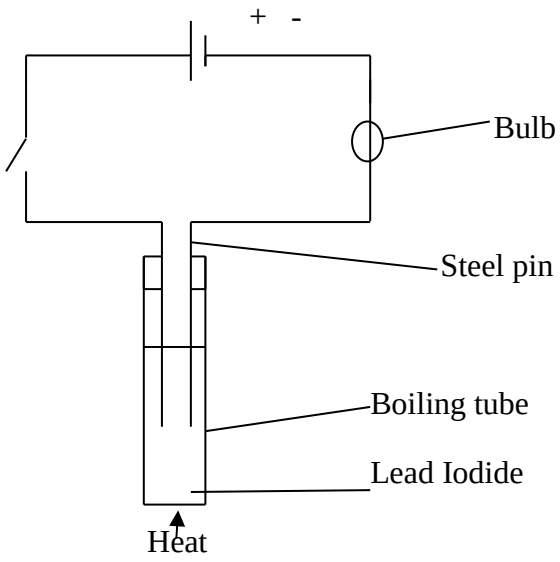
$\Delta H_f = \Delta H_1 + \Delta H_2 + \Delta H_3$

$= 4(-393) + 5(-286) + (+232)$

$= (-1572) + (-1430) + 232$

$= -2770\ KJmol^{-1}$

8. The diagram below shows a setup that was used by a student to investigate the effect of an electric current on molten lead (II) iodide.



a) Explain what happens to lead iodide during the electrolysis. (2 marks)

-It decomposes/ Is broken down to the elements lead and iodine.

b) Give two reasons why solid lead (II) iodide does not conduct electricity? (2mks)
-Does not contain free/ delocalized electrons
-Does not have free ions

c) Write equations to show the reaction taking place; (4 marks)
i) At the cathode

$$Pb^{2+}_{(l)} + 2e^- \rightarrow Pb_{(l)}$$

ii) At the anode

$$2I^-_{(l)} \rightarrow I_{2(l)} + 2e^-$$

LAINAKU CHEMISTRY MARKING SCHEEM F4

MARCH/ APRIL PAPER 3 2015

TITRATION TABLE (5mks)

Complete table----------1mk

Decimals----------1mk tied only to first and second rows only-i.e one decimal place throughout or if to two decimal places, the last digit must be zero or .5 throughout otherwise zero mark

Accuracy----------1mk tied to titre value , if any + or- 0.1 of school value award 1mk, if non of this check if any value within + or -0.2 award ½mk otherwise 0mk

Principle of ave.----------1mk

Final answer----------1mk I.e the candidate answer (use conditions for accuracy to award marks

(b) $M_2CO_{3(aq)}$ +2 $HCl_{(aq)}$ ----------> 2$MCl_{(aq)}$ +$H_2O(l)$ +$CO_{2(g)}$ ✓

(c) Moles of R used = average(titre × 0.3) ÷1000✓½ = correct ans. ✓½

(d) (i) moles of M_2CO_3 = ans. In (c) above ÷ 2✓½ = correct ans✓½.

(ii) Molarity of Q = (ans. In (d) ii ×1000) ÷ 25✓½ = correct ans. ✓½

(e) RFM = Conc. Of Q in g/L÷ Molarity =10.8 ÷ ans, in d (ii) =**ans**

Ans. = 12+48+2M

M=(**ans.-** 60) ÷ 2**✓½** =CORRECT ANS**✓½**.

Question 2

table = 4mks awarded as follows;

complete table = 1mks (penalize half mark for each blank space **to a maximum of half mark)**

Accuracy = 1/$_2$mk (**tied to the first temperature** ± 2 ^{0}C of teachers value)

Decimal = 1/$_2$mk (**all** temp. to one decimal place I.e .0 or .5 **through ou**t/or whole numbers used **through out**, otherwise zero mk)

Trend of temp = 1mk (the temp. must rise **continuously from** 90 sec✓½. then a fall /or constant then fall✓½

Shape of the graph = 1mk a straight Line for the rise in temp. ✓½ then another straight for the second trend✓½**, both extrapolated above any plotted point and meet on the graph) Otherwise zero mk**

(b) Delta t shown on the graph and read correctly = 1mk

(c) Heat evolved = (0.5 × 4.2×Δt) ÷ 1000✓½ =**ans. kJ**✓½

(e) molar heat of displacement = **ans.kJ** ÷ ans. In (c) above✓½ = CORRECT ANS. ✓½

QUESTION 3.

(a) (i)

observations	***inferences***
-Colorless liquid formed at the cooler part of the test tube✓½ -white residue✓½	Hydrated salt-/water of crystallization✓**tied to colourless liquid formed**

(ii)

observations	inferences
Colourless solution fomed✓	$Cu^{2+,}$ Fe^{2+} ,Fe^{3+} absent/or inwords✓ **NB all 3 ions=3mks if two half mk, one zero mk**

(iii)

observations	inferences
-White ppt✓½ -soluble in excess✓½	Zn^{2+} ,Pb^{2+} ,Zn^{2+} present✓**NB all 3ions = 1mk,if two half mk, if one zero mk**

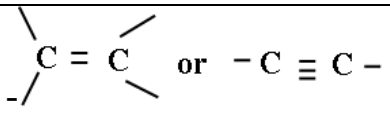
(iv)

observations	***inferences***
-White ppt✓½ Insoluble in excess✓½	Pb^{2+} ,Zn^{2+} present/ Zn^{2+} absent✓

(v)

observations	***inferences***
-White ppt ✓	$SO4^{2-,}$ Cl- ,$SO3^{2-,}$ $CO3^{2-}$ present✓ **NB 3-4 ions=1mk,if 2 ions half mk,if1-2ions 0mk**

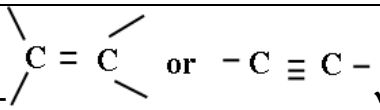
3 (b) (I)

observations	Inferences
- -burn with smoky/yellow flame✓	 ✓ for each✓½ **NB: tied to smoky/sooty flame**

(ii)

observations	Inferences
- -forms two layers/immiscible liquids✓½	- Non polar compound✓½

(iii)

observations	Inferences
- Potassium manganate vii changes from purple to colourless OR Potassium manganate vii is decolourised✓ **Reject**: **It** is decolourised	-  ✓ for each✓½ **NB: tied to correct observations otherwise zero mk,** **-unsaturated organic compound for half mk**

NB; 1. Inferences are tied to correct observations otherwise 0mk

2.Penalise half mark for each in the inference for contradditory ions or functional groups given

3.Accept ions written in words e.g Fe^{3+} as iron (iii) ions but no iron

4. If the observation is wrong do not accept the inference or not complete

5. Charges on the ions be **MUST written correctly**

6. If the observations not correct ignore the inferences