CLUSTER CHEMISTRY PP2

1. (a) Define an electrolyte. **(1mark)**

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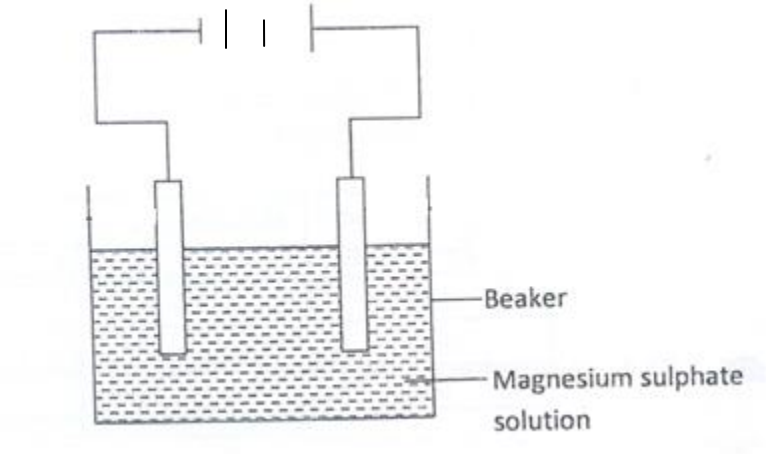
(b)The set-up below was used to carry out electrolysis of an aqueous solution of magnesium sulphate using carbon electrodes.



i) State and explain the observation made at the cathode. **(1 mark)**

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(ii) Write down an equation for the reaction that occurs at the anode. **(1mark)**

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(iii)What change occurred to the concentration of magnesium sulphate solution during the experiment? Explain. **(3 marks)**

……

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……

(c)During the electrolysis of dilute copper (II) chloride, the mass of the platinum cathode increased by 3.2g. If a current of 2.5 amperes was passed through the solution for some time, calculate the time taken. (Cu= 64.0; 1 faraday = 96,500 Coulombs) **(3 marks)**

(d) Use the information below to answer the question that follows.

$Al^{3+}(aq) + 3e^- \rightleftharpoons Al(s)$ $E^\theta = -1.66v$

$Fe^{2+}(aq) + 2e^- \rightleftharpoons Fe(s)$ $E^\theta = -0.44v$

Why is it not advisable to keep a solution of iron (II) nitrate in a container made of aluminium? **(2 marks)**

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……

……

(e)Other than electroplating, give one application of electrolysis. **(1 mark)**

……

……

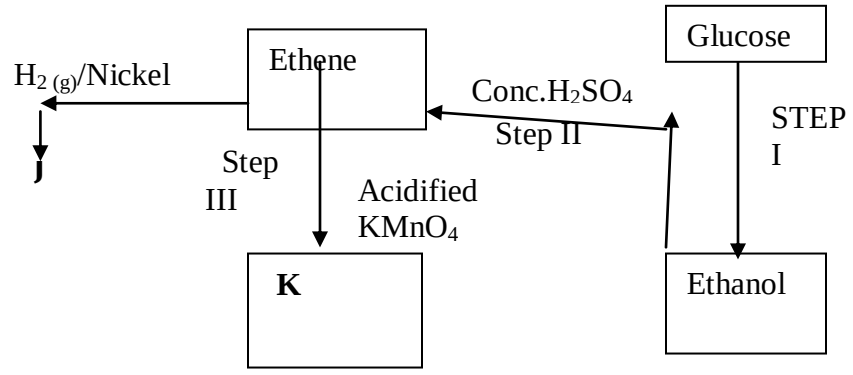
2. a) Draw the structural formula of . **(3 marks)**

(i) Propan-1-ol

(ii) Pent-2-yne

(iii) 2,3-dimethylbutane

(b)Study the reaction scheme below and answer the questions that follow.



(i)Name the process in step I **(1 mark)**

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(ii)Give the two conditions necessary in step II **(2 marks)**

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……

……

(iii)State the observation made in step III. **(1 mark)**

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……

(iv)Name compound J. **(1 mark)**

……

(v)Draw the structural formula of compound K. **(1 mark)**

(c) Water is added dropwise to calcium carbide in a conical flask.

(i)Identify the gas produced. **(1 mark)**

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(ii)Write a chemical equation for the reaction that occurs. **(1 mark)**

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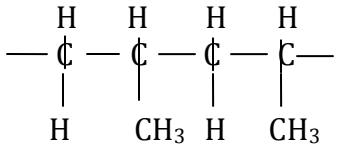
(d)Part of a polymer is required below.



(i) Draw the structural formula of the monomer of this polymer. **(1 mark)**

(ii) State one use of this polymer. **(1 mark)**

……

3. The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters are not the actual symbols of the elements.

Y	R					Q	**X**	
	V		**W**					U

(a)Select an element whose oxide is amphoteric.**(1 mark)**

……

(b)On the grid indicate with letter J the position of element J which is in period 3 and forms a stable ion J^{2-}**. (1 mark)**

(c)Draw a dot-cross diagram to show bonding in the compound consisting of elements V and X only. **(2 marks)**

(d)Write an equation to show the formation of an ion of R. **(1 mark)**

……

(e)Which is the least reactive element? Give a reason for your answer. **(2 marks)**

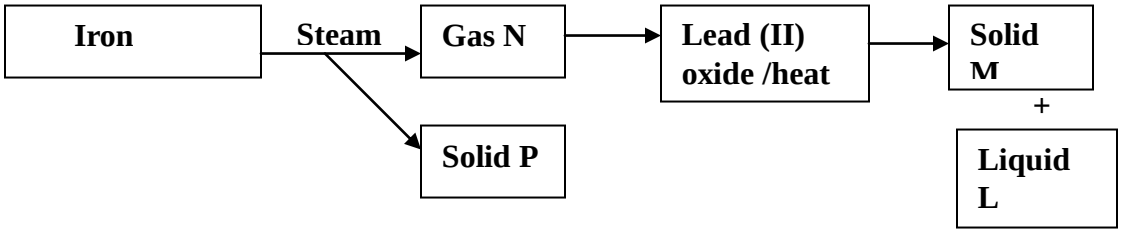
……

(f)Write an equation for the reaction that occurs when element Y is placed in water. **(1 mark)**

(g)How does the atomic radius of W compare with that of V? Explain. **(2 marks)**

(h)Name the chemical family to which elements R and V belong. **(1 mark)**

4. a) Use the chart below to answer the questions that follow.



Identify:

Gas **N** …….. **(½ mark)**

Solid **P** …….. **(½ mark)**

Solid M…….. **(½ mark)**

Liquid **L**…….. **(½ mark)**

b) Name the method that can be used to extract oil from castor oil seeds. **(1 mark)**

c) i) In the method named above, state the property of oil that enables the extraction to take place. **(1 mark)**

ii) Describe an experimental procedure that can be used to extract oil from the seeds. **(3 marks)**

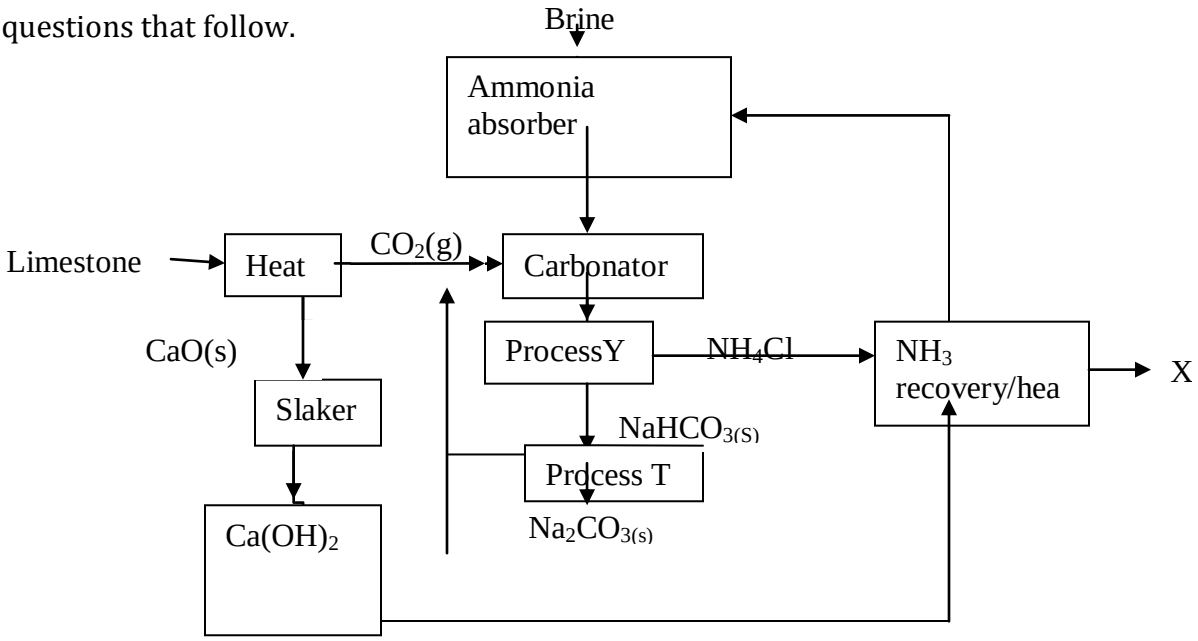
d) How is phosphorus stored in the laboratory? Explain your answer. **(1 mark)**

e) i) In the fractional distillation of liquid air water is removed, name two other substances that are removed. **(1 mark)**

ii) Why must water be removed? **(1 mark)**

iii) State the processes involved in fractional distillation of liquid air. **(2 marks)**

5. Study the flow chart below showing the Solvay process and use it to answer the questions that follow.



a) Write the equation for the reaction producing substance X. **(1 mark)**

……

b) Name processes Y and T. **(1 mark)**

Y……

T……

c) In the carbonator, two reactions take place. Write the two equations for the reactions.

(2 marks)

d) Explain why the Solvay process is said to be one of the most efficient industrial process.
(1 marks)

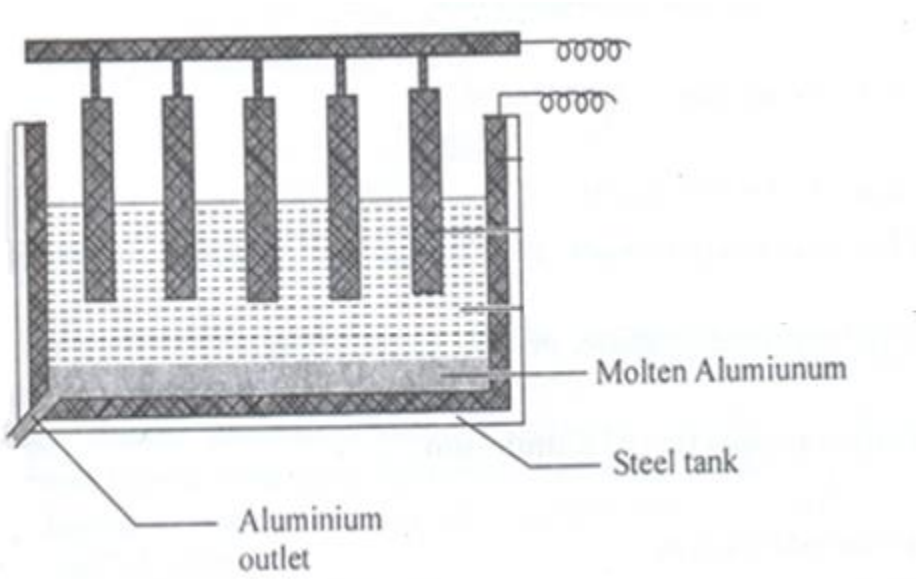
e) 16.8g of sodium hydrogen carbonate are completely decomposed by heating. Calculate;

i) the mass of the resulting solid produced. **(3 marks)**

ii) the volume in litres of the gas produced at s.t.p **(2 marks)** (Molar Gas Volume at s.t.p =22400 cm^3, Na=23.0, C=12.0, H= 1.0, O=16.0)

f) Give two industrial uses of sodium carbonate. **(1 mark)**

6. The diagram below shows the electrolysis process in the extraction of aluminium. Study it and answer the questions that follow.



a) i) Name the main ore from which aluminium is extracted from.**(1 mark)**

……

.ii) Explain how the impurities present in the ore are removed. **(3 marks)**

b) Label on the diagram the anode and the cathode. **(1 mark)**

c) The melting point of aluminium oxide is 2015^{o}C but the electrolysis is carried out at temperature of around 800^{o}C.

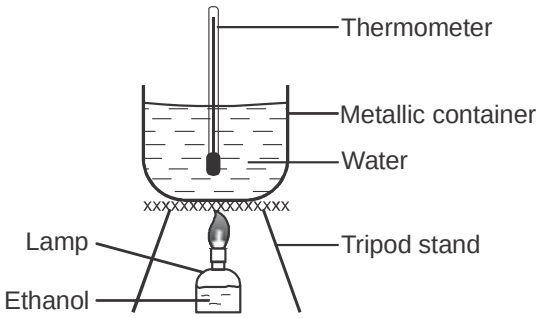
i) Why is the electrolysis not carried out at 2015^{o}C? **(1 mark)**

ii) How is the temperature lowered to about 800^{o}C? **(1 mark)**

d) Duralumin (an alloy of aluminium) is preferred to pure aluminium in the construction of aeroplane bodies. Give **two** properties that make it suitable for making the aeroplane bodies. **(2 marks)**

7.a)State two reasons why wood charcoal is not a suitable fuel for cooking. **(1 mark**)

b) The diagram below represents a set up that was used to determine the molar heat of combustion of ethanol.



During the experiment the data given below was recorded :
Volume of water = $450cm^3$
Initial temperature of water = 24.0^oC
Final temperature of water = 45.5^oC
Mass of ethanol + lamp before burning = 113.5g
Mass of ethanol + lamp after burning = 112.0g

I. Calculate the :
i)Heat evolved during the experiment (density of water = $1g/cm^3$, specific heat capacity of water = $4.2Jg^{-1}K^{-1}$) **(2 marks)**

ii)Molar heat of combustion of ethanol. (C = 12.0, O = 16.0, H = 1.0) **(1½ marks)**

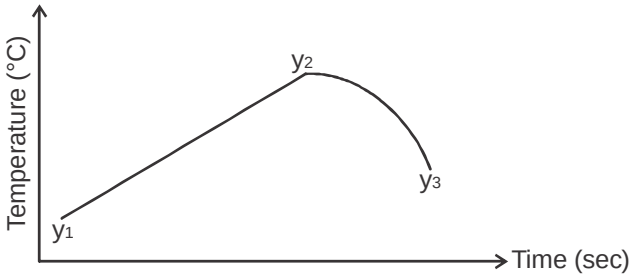
II. Write the thermochemical equation for the complete combustion of ethanol**. (1 mark)**

III. The value of the molar heat of combustion of ethanol obtained in b(ii) above is lower than the theoretical value. State two reasons which lead to this. **(2 marks)**

IV. On the axis below, draw an energy level diagram for combustion of ethanol. **(1½ marks)**

c) In order to determine the molar enthalpy of neutralization of sodium hydroxide, $50cm^3$ of 2M sodium hydroxide and $50cm^3$of 2M hydrochloric acid both at the same initial temperature were mixed and stirred continuously with a thermometer. The temperature of the resulting solution was recorded after every 15 seconds until the highest temperature of the solution was attained. Thereafter the temperature of the solution was recorded for a further two minutes.

The sketch below was obtained when the temperature of the mixture were plotted against time. Study and answer the questions that follow.



i)What is the significance of point y_2 **(1mark)**

……..

ii) Explain why there is a temperature change between points y_1 and $\mathbf{y_2}$ **(1 mark)**

iii) Explain how the value of temperature rise obtained in this experiment would compare with the one that would be obtained if the experiment was repeated using $50cm^3$ of 2M methanoic acid instead of hydrochloric acid. **(2 marks)**