MAKUENI COUNTY CLUSTER PREPARATORY EXAMINATION 2016

233/2
CHEMISTRY
PAPER 2
(THEORY)
JULY/AUGUST 2016
TIME: 2 HOURS.

1. (a) The grid below is part of the periodic table. Letters are not actual symbols. Study it and answer the questions that follow.

G									
				I		K	L		
H			J				M	N	

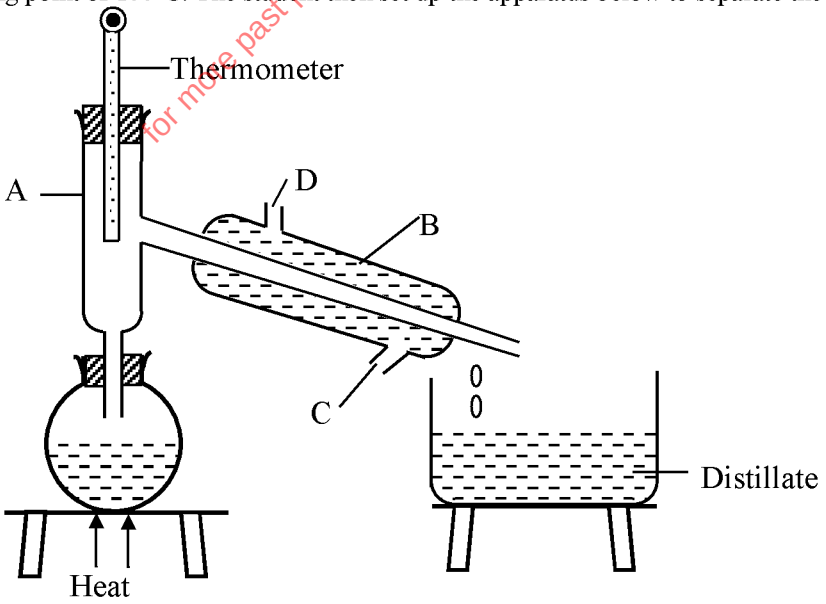
(i) Give the letters representing atoms that can form a singly-charged anion. (1 mark)
(ii) Identify the most electromagnetic element in the grid. Explain. (1 mark)
(iii) Identify the strongest reducing agent. (1 mark)
(iv) Write the formula of the most stable compound formed when **J** and **K** react (1 mark)
(v) Give the name of the type of bond in the compound formed in (iv) above. (½ mark)
(vi) Give the chemical family name of **L** and **M**. (½ mark)
(viii) Write the ionic equation for the reaction in which gas **L** is bubbled through a solution with ions of M. (1mark)
(ix) Element P is alkaline earth metal and belongs to period 2. Indicate its position on the grid. (1 mark)

(b) Use the information in the table below to answer the questions that follow.

Element	Atomic number	Melting point ^{0}C
Q	11	98
R	12	650
S	14	1410
T	17	-102
U	18	-189
V	19	64

Give a reason why the melting point of:
(i) Q is higher than of V. (1 mark)
(ii) R is higher than of Q. (1 mark)
(iii) S is the highest. (1 mark)

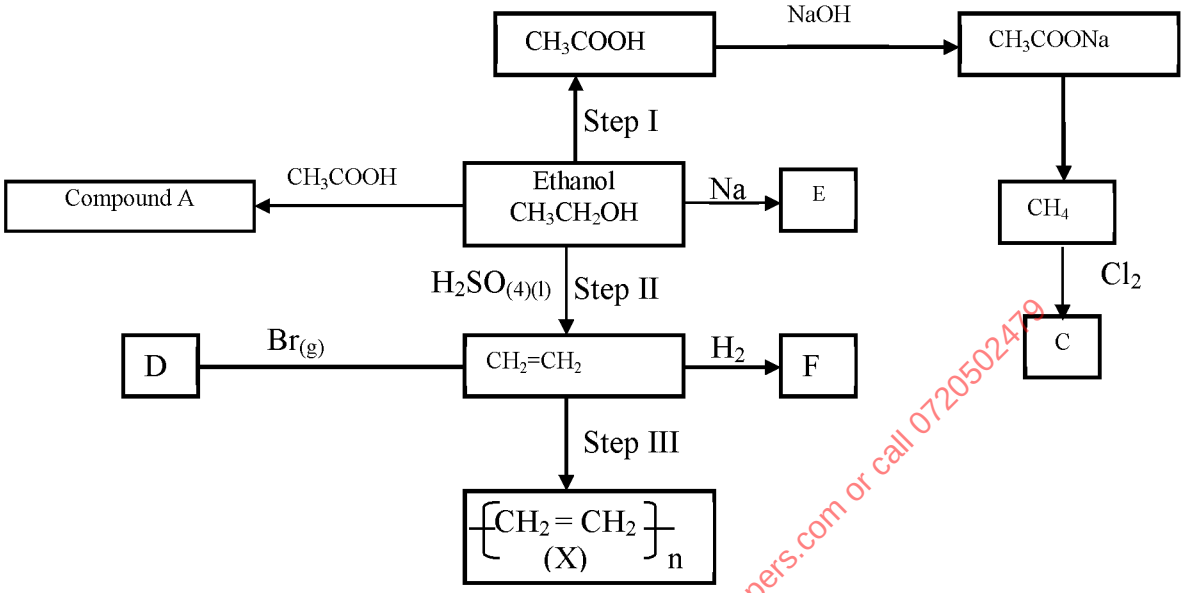
2. (a) A form one student crushed banana leaves with water and left the mixture for some days. He found that the mixture had fermented. He suspected that the mixture had been contaminated with ethanol which has a boiling point of 78^{0}C while water has a boiling point of 100^{0}C. The student then set up the apparatus below to separate the mixture.



(i) Name the piece of apparatus labelled B. (1 mark)
(ii) What is the purpose of the thermometer in the set up? (1 mark)
(iii) At what point of apparatus B should the tap water be connected. Explain. (2 marks)

(iv) Name the part labelled A and state its function (2 marks)
(v) Which liquid was collected first? Explain (1 mark)
(vi) What is the name given to the above method of separating mixtures? (1 mark)
(vii) What property of the components of the mixture makes it possible for the components to be separated by the method? (1mark)
(viii) State two applications of the above method of separation. (2 marks)
(b) A form two student was supplied with a liquid suspected to be water.
(i) Describe one chemical test that would be carried out to show that the liquid was water.
(ii) How would it have been proved that the liquid is pure water? (1 mark)

3. The flow chart shows some chemical reactions.



(a) Draw the structural formula and names of the following compounds. (3 marks)

Compound	Name	Structure formula
A		
C		
D		

(b) Write the name of the processes that leads to the formation of substances A and F. (1marks)

Substance	Process
A	
F	

(c) Name the type of reaction and conditions required for the formation Step 1 (1 mark)
(d) If the relative molecular mass of compound X is 84000 units, determine the value of n (C = 12, H = 1) (1 mark)
(e) Write an equation that leads to the formation of substance E. (1 mark)
(f) State and explain the observation made when substances F and $CH_2=CH_2$ are burnt in excess air. (2 marks)
(g) Given the thermochemical equations for combustion of ethanol, hydrogen and graphite (carbon)

$C_2H_5OH_{(aq)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{4(l)}$ $\Delta H = -1368kJ/mol$
$H_{2(g)} + -O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta H = -286\ kJ/mol$
$C_{(s)} + O_{2(g)} \longrightarrow CO2(g)$ $\Delta H = -393\ kJ/mol$

(i) Draw an energy cycle diagram to represent the above information linking the formation of ethanol with its enthalpy of combustion and its constituents. (2 marks)
(ii) Calculate the enthalpy of formation of ethanol (2 marks)

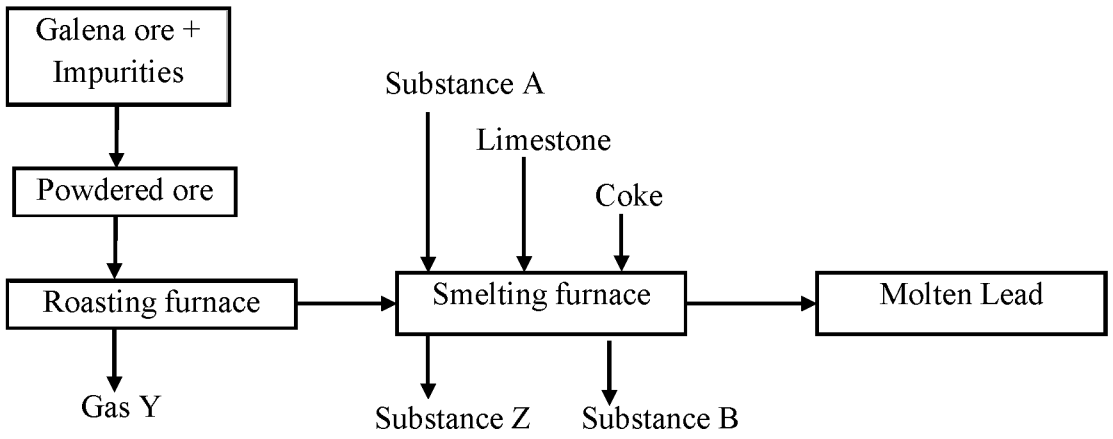
4. In an experiment to study the rate of reaction between duralumin (an alloy of aluminium, magnesium and copper) and hydrochloric acid, 0.5g of the alloy were reacted with excess 4M hydrochloric acid. The data in the table below was recorded. Use it to answer the questions that follow.

Time (minutes)	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0
Vol of gas evolved, cm^3	0.0	220.0	410.0	540.0	620.0	640.0	640.0	640.0

(a) (i) Plot a graph of total volume of gas produced against time. (3 marks)
(ii) From the graph, determine the volume of the gas produced at the end of the 2 ½ minutes. (1 mark)
(b) Determine the rate of reaction between the 3rd and 4th minute. (1 mark)
(c) Give a reason why some solid remained at the end of the experiment. (2 mark)
(d) Given that 2.5cm3 of the total volume of gas was from the reaction between magnesium and

hydrochloric acid. Calculate the percentage by mass of aluminium present in 0.5g of the alloy.
(Al = 27, Molar gas volume = 24000cm^3) (3 marks)

5. The chart shows the extraction of lead from its ore.



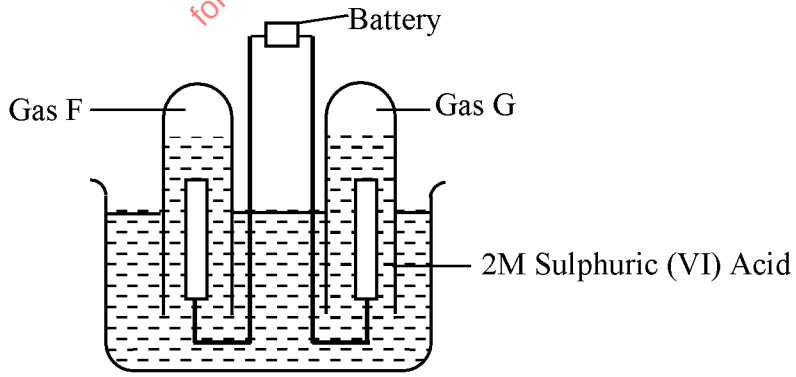
(a) Write the chemical formula of the chief ore. (1 mark)
(b) Name the possible impurities present in the ore. (2 marks)
(c) Why is it necessary for the ore to be converted into powder form? (1 mark)
(d) Identify process X and state it's significance (1 mark)
(e) Write equations for the reaction taking place in the
I. Roasting furnace (1 mark)
II. Formation of substance B (1 mark)
It is not advisable to use lead pipes in transporting drinking water. (1 mark)
(f) Identify one of the impurities present in molten lead obtained by the process. (1 mark)
(g) State one use of lead (1 mark)

6. (a) Study the standard electrode potentials below and answer the questions that follow. The letters do not represent the actual symbols of the elements.

	Eθ volts	
$E^{2+}_{(aq)} + 2e^-$	$E_{(s)}$	-0.44
$A+(aq) + e^-$	$A_{(s)}$	-2.92
$½D_{2(s)} + e^-$	$D^-_{(aq)}$	+1.36
$C^+_{(aq)} + e^-$	$½ C_{2(g)}$	0.00
$B^+_{(aq)} + e^-$	$B_{(s)}$	+0.52

(i) Identify the strongest reducing agent. Give a reason. (1 mark)
(ii) Select two half cells when combined produce the highest potential difference and determine the electromotive force. (2 marks)
(iii) Which element is likely to be hydrogen? Give a reason (2 marks)
(iv) Explain whether the reaction represented below can take place. (2 marks)
$2A^+_{(aq)} + E_{(s)} \rightarrow 2A_{(s)} + E^{2+}_{(aq)}$

(b) The apparatus below shows the set up that was used in the electrolysis of 2M Sulphuric (VI) acid.
Study it and answer the questions that follow.



(i) Write an equation for the reaction that produce gas F. (1 mark)
(ii) Describe how gas G can be identified (1 mark)
(iii) Why is the concentration of the acid expected to increase during electrolysis. (2 marks)

7. The following results were obtained in an experiment to determine the heat of neutralization of $50cm^3$ 2M hydrochloric acid and $50cm^3$ 2M sodium hydroxide.

Mass of plastic cup	=	45.1g
Initial temperature of acid	=	27.0^0C
Initial temperature of alkali	=	23.0^0C
Mass of plastic cup + HCl + NaOH	=	145.1g
Temperature of the mixture of acid and alkali	=	38.5^0C

(a) Define heat of neutralization (1 mark)

(b) Write an ionic equation for the neutralization of hydrochloric acid and sodium hydroxide. (1 mark)

(i) The amount of heat produced during the experiment (2 marks)
(Specific heat capacity of solution = $4.2jg^{-1}k^{-1}$, density of solution = $1gcm^3$)

(ii) Molar heat of neutralization for the reaction. (2½ marks)

(c) Explain why the molar heat of neutralization of NaOH and Ethanoic acid of equal volume and molarity would be less than the value obtained in C (ii) above. (1 mark)

(d) Write down the thermochemical equation for reaction between NaOH and dilute hydrochloric acid above (1 mark)

(e) Draw an energy level diagram for the neutralization reaction in (e) above. (2 marks)