Name _____ Index No _____

Adm No _____ Class _____

233/2
CHEMISTRY
PAPER 2
TIME 2 HOURS

ALLIANCE HIGH SCHOOL
PRE -TRIAL EXAM
PAPER 233/2
MAY 2015

INSTRUCTIONS TO CANDIDATE

- *Answer All Questions in the space provided*
- *Mathematical tables and electronic calculator may be used*
- *All working must be clearly shown where necessary*

FOR EXAMINERS USE ONLY

Question	Maximum mark	Student's score
1	13	
2	11	
3	11	
4	12	
5	11	
6	12	
7	10	
TOTAL	**80**	

Ensure you have 12 printed pages.

1. (A) The grid below represents part of a periodic table. The letters are not actual symbols of the elements. Study the grid and answer the questions that follow :

K								K	A
							C	D	
E	F				G				
								M	

(a) (i) Explain why element K can be placed in the two positions of the periodic table (2 marks)

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(ii) How does the atomic radii of E and F compare? Explain (2 marks)

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(b) Explain why element G has a higher M.P and B.P than all other elements in the same period. (2 marks)

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(c) (i) State with reason the type of structure expected in : (2 marks)

(ii) Oxide of F .....

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(iii) Chloride of G .....

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(d) (i) Draw a dot(.) and cross (x) diagram to show bonding in the compound formed by element in the compound formed by element C and F (2 marks)

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(B) The table below gives some properties of three elements in group (VII) of the periodic table. Study it and answer the questions that follow:

Element	Atomic No.	Melting Point (°C)	Boiling Point (°C)
Chlorine	17	-101	-34.7
Bromine	35	-7	58.8
Iodine	53	SOLID	SUBLIMES

(a) Which element is in liquid form at room temperature? Give a reason. (1 mar

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(b) Explain why the boiling point of Br_2 is much higher than that of chlorine. (2 mark

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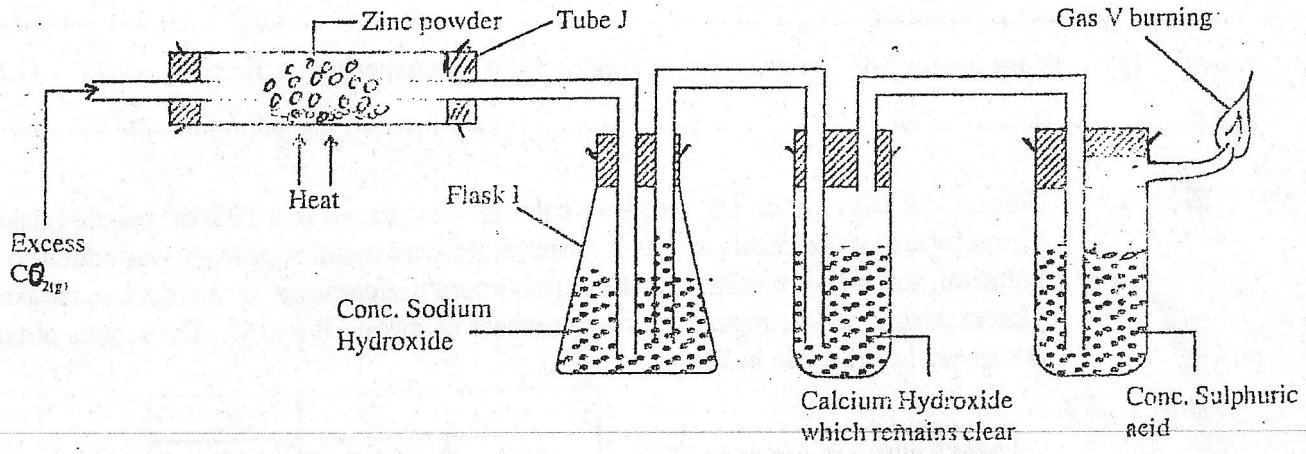
2. Study the diagram below and answer the questions that follow:



(a) Describe the changes that occur in tube J during the experiment and after the tube has cooled. (2 marks)

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(b) Explain how the pH of the solution in flask I changes during the experiment. (2 marks)

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(c) Why is a precipitate not formed in flask I? (1 mark)

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(d) What evidence is there in the above set up which proves that the burning gas is not contaminated with carbon(II) oxide gas? (1 marks)

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(e) Write three chemical equations showing the reactions that occur in the above experiment. (3 marks)

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(f) What is the colour of the flame in the experiment (1 mark)

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(g) What precaution is necessary in carrying out this experiment. Explain (1 mark)

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3. (a) 50 cm^3 of 1M copper (II) sulphate solution was placed in a 100cm^3 plastic beaker. The temperature of the solution was measured. Excess metal A powder was added to the solution, the mixture stirred, and the maximum temperature of the mixture measured. The experiment was repeated using powders of metals **B** and **C**. The results obtained are given in the table below:

	A	B	C
Maximum temperature (°C)	26.3	31.7	22.0
Initial temperature (°C)	22.0	22.0	22.0

(i) Arrange the metals **A**,**B**,**C** and copper in order of reactivity starting with the least reactive. Give reasons for the order. (2 marks)

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(ii) Other than temperature change, state one other observation that was made when the most reactive metal was added to the copper (II) sulphate solution. (1 mark)

(b) The standard enthalpy change of formation of methanol is $-239\ kJmol^{-1}$.

(i) Write the thermo chemical equation for the standard enthalpy change of formation of methanol. (1 mark)

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(ii) Methanol is manufactured by reacting carbon (II) oxide with hydrogen at 300°C and a pressure of 250 atmospheres.
The equation for the reaction is

$$CO_{(g)} + 2H_{2(g)} \rightleftharpoons CH_3OH_{(g)}$$

(I) How would the yield of methanol be affected if the manufacturing process above is carried out at, 300°C and a pressure of 400 atmospheres? Explain. (2 marks)

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(II) Use the following data to calculate the enthalpy change for the manufacture of methanol from carbon (II) oxide and hydrogen. (2 marks)

$$CO(g) + \frac{1}{2}O_2(g) \longrightarrow CO_2(g);\ \Delta H^{\ominus} = -283\ kJmol^{-1}$$

$$H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(l);\ \Delta H^{\ominus} = -286\ kJmol^{-1}$$

$$CH_3OH(l) + \frac{3}{2}O_2(g) \longrightarrow CO_2(g) + 2H_2O(l);\ \Delta H^{\ominus} = -715\ kJmol^{-1}$$

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(iii) The calculated enthalpy change in part b (ii) (II) above differs from the standard enthalpy change of formation of methanol. Give a reason. (1 mark)

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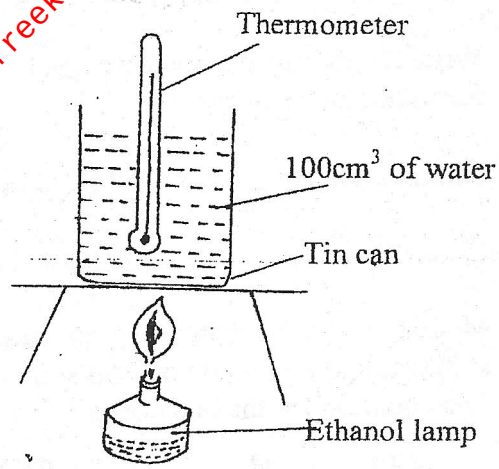
c . In an experiment to determine the molar heat of combustion of ethanol, a student set up the following apparatus and obtained the results below.



Results

Volume of water heated	=	$100cm^3$
Initial mass of lamp + ethanol	=	4.9g
Final mass of lamp + ethanol	=	4.4g
Initial temperature of water	=	25^0C
Final temperature of water	=	45^0C
Specific heat capacity of water	=	4.2J/g/k

Use the results above to calculate the molar heat of combustion of ethanol.
(C = 12, H = 1, O = 16) density of water = $1g/cm^3$

(2 mks)

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4 (I) Study the information in the table below and answer the questions that follow:

Salt	Solubility (g/100g water)	
	at 40°C	at 60°C
$CuSO_4$	28	38
$Pb(NO_3)_2$	79	98

A mixture containing 35g of $CuSO_4$ and 78g of $Pb(NO_3)_2$ in 100g of water at 60°C was cooled to 40°C.

(a) Which salt crystallised out? Give a reason

(2 marks)

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(b) Calculate the mass of the salt that crystallised out.

(1 mark)

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(II) (a) At 25°C, 50g of potassium nitrate was added to 100g of water to make a saturated solution. What is meant by a saturated solution? (1 mark)

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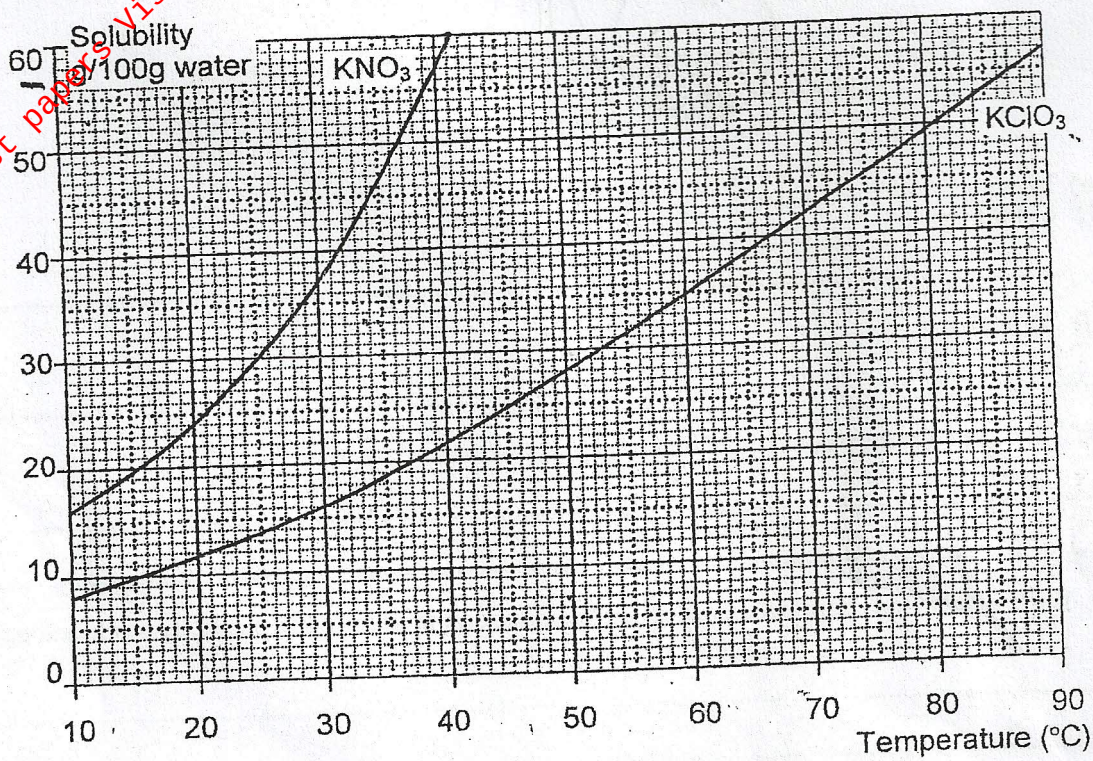
(b) Study the solubility curves below and answer the questions that follow.



(i) Using the graph:

I determine the mass of a solution of potassium nitrate formed by saturating 100g of water with the salt at 60°C. (1 mark)

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II determine the solubility of potassium nitrate at 15°C. (1 mark)

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III Determine the molar concentration of potassium nitrate at 15°C. (Assume there is no change in density of water at this temperature.) (K = 39·0, N = 14·0, O = 16·0) (3 marks)

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(ii) What happens when a solution containing 40g of potassium chlorate and 40g of potassium nitrate in 100g of water at 90°C is cooled to 40°C? Explain. (3)

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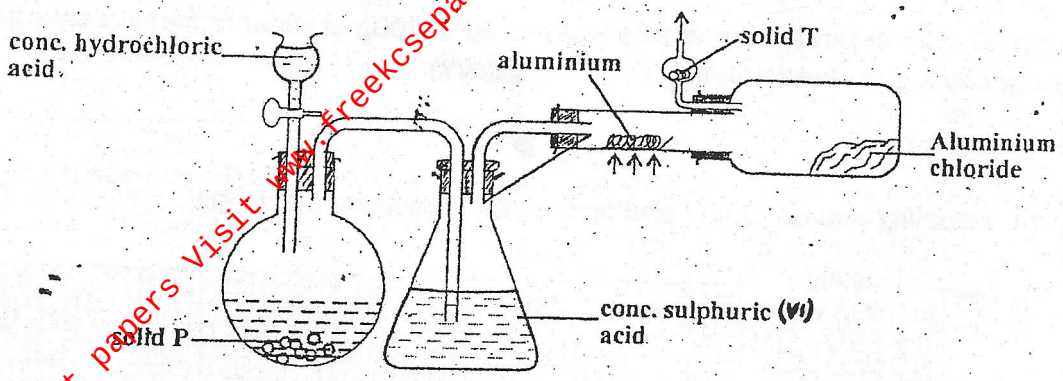
5. Study the set up below and answer the questions that follow.



a) Identify:
i) Solid P (2 marks)

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ii) Solid T

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b) State the necessary conditions for the above reaction. (1 mark)

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c) Write a balanced chemical equation for the reaction between concentrated hydrochloric acid and solid P (2 marks)

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d) Explain why the product is collected as shown in the above set up. (1 mark)

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e) A sample of the product formed was dissolved in water and sodium hydroxide solution added dropwise until in excess.
i) State the observations made (1 mark)

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ii) Write the ionic equations for the observations made above. (2 marks)

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f) When chlorine gas is bubbled through dilute sodium hydroxide solution the resulting solution act as a bleaching agent.
i) Write a chemical equation for the above reaction. (1 mark)

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ii) Explain how the resulting solution acts as a bleaching agent. (1 mark)

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6.(a) The information below gives the standard electrode potentials for a number of half reactions involving elements P,Q R, S and T. Letters are not the actual symbols for the element.

Half reaction	E^{θ} volts
$P^{2+}_{(aq)} + 2e^- \rightleftharpoons P_{(s)}$	+ 0.34
$Q^+_{(aq)} + e^- \rightleftharpoons Q_{(s)}$	-2.92
$2R^+_{(aq)} + 2e^- \rightleftharpoons R_{2(g)}$	0.00
$S_{2(g)} + 2e^- \rightleftharpoons 2S^-_{(aq)}$	+ 1.36
$T^{2+}_{(aq)} + 2e^- \rightleftharpoons T_{(s)}$	- 0.44

(i) What is element R likely to be? Explain (2marks)

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(ii) Elements T / T^{2+} ions half cell were connected to P/ P^{2+} ions half cell

I Write equations for the half cell reactions that occur at the electrodes:- T and P (2mark)

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II Calculate the E^{θ} value for the cell in a (ii) above (1mark)

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III Write down the cell representation for the cell in a (ii) above. (1mark)

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(iii)If metal P were taken as the reference electrode, work out the reduction potential for element S (1mark)

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b. In an experiment to electrolyse an aqueous solution of a sulphate of metal U using graphite electrodes, a current of 5A was passed through a cell for 48.25 minutes. The mass of U deposited was 1.35g. (F = 96,500 , U= 27, molar gas volume at r.t.p = $24dm^3$)

(i) Calculate the quantity of electricity in coulombs passed (1mark)

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(ii) Calculate the volume of oxygen discharged at the anode at normal temperature and pressure (2marks)

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(iii)Find the charge on an ion of U (2marks)

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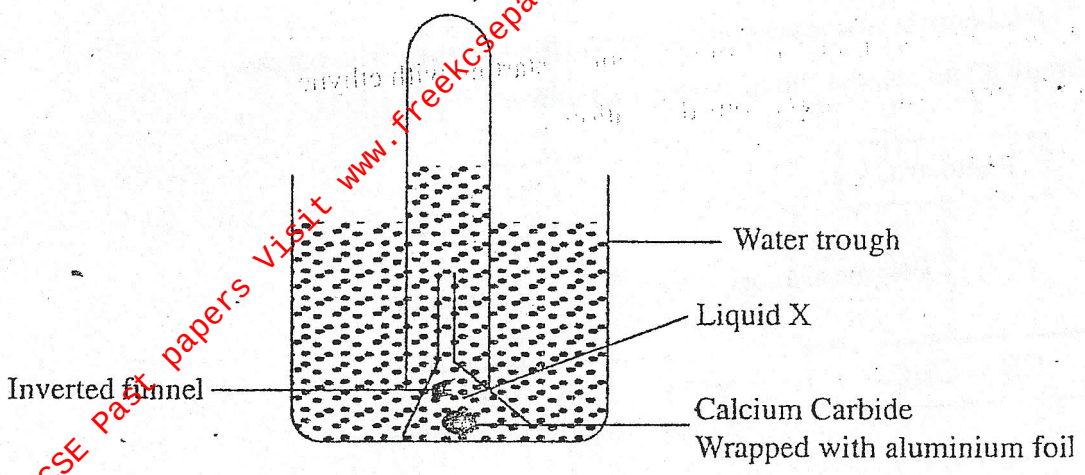
7. The set up below was used to prepare and collect ethyne.



(a) (i) Identify liquid X (1 mark)

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(ii) At the end of the experiment, the gas was collected in a test tube and burnt in air. Describe the flame observed. (1 mark)

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(iii) Write a well balanced equation for the reaction that produced ethyne (1 mark)

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(iv) Give one industrial use of ethyne (1 mark)

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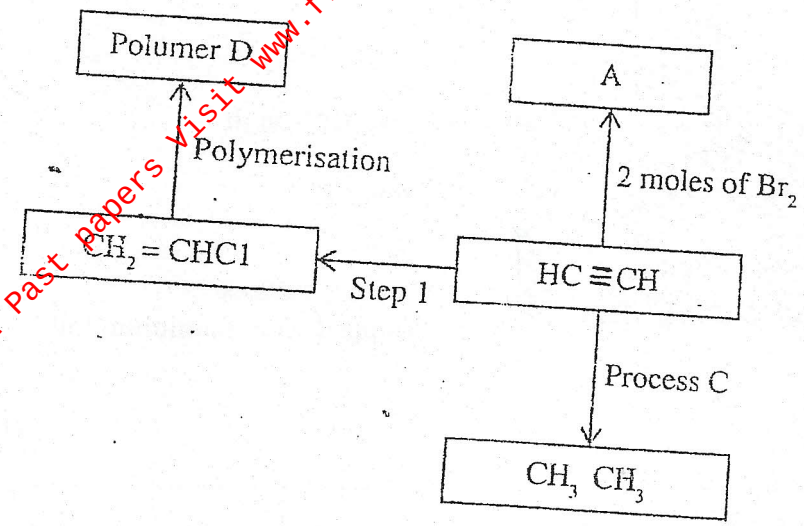
(b) The scheme below represents some reactions starting with ethyne. Study it and answer the questions that follow :



(i) Write down the structural formula of compound A and write its IUPAC name

(2 marks)

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(ii) Write the formula of the reagent used in :

(1 marks)

Process C _____

Step 1 _____

(iii) Write the formula of D and give its name.

(2 marks)

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(iv) What conditions are necessary for the polymerisation reaction to take place.

(1 mark)

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