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233/2  
CHEMISTRY  
Theory  
Paper 2  
July/August, 2018  
Time: 2 Hours

**FORM FOUR MID-YEAREVALUATION EXAMINATION**  
**Kenya Certificate of Secondary Education (KCSE)**  
**Chemistry (Paper 2)**

**INSTRUCTIONS TO CANDIDATES**

- Write your name, admission number, index number, date and sign in the spaces provided.
- Answer *all* the questions in the spaces provided.
- All working must be clearly shown where necessary.
- Scientific calculators may be used.
- All answers must be written in English

**FOR EXAMINERS' USE ONLY**

Questions	Maximum Score	Candidate's Score
1	12	
2	11	
3	10	
4	10	
5	11	
6	13	
7	12	
<b>TOTAL</b>	<b>80</b>	

This paper consists of 11 printed pages. Candidates are advised to check and to make sure all pages are as indicated and no question is missing.

1. Below is a grid representing part of the periodic table. The letters do not represent the actual chemical symbols of the elements. Study it and answer the questions that follow.

F			G			H	I	J
	K		L	M		N	Y	
P								

- (a) Using dots (•) and crosses (×) to represent electrons, show bonding in;
- I. Molecule of I (1 mark)
- II. Compound formed between K and Y. (1 mark)
- III. Name the types of bonds formed in (a) above. (1 mark)
- I -
- II -
- (b) A chloride of M was dissolved in water and the resultant solution tested using litmus papers. State and explain the observations made. (2 marks)
- Observations:
- Explanation:
- (c) Compare the atomic radius of K and N. Explain. (2 marks)

(d) Explain why element L is used in overhead electric cables whereas K is not. (1 mark)

(e) What is the name of the chemical family to which J belongs? (1 mark)

(f) A burning piece of element K was lowered in a gas jar containing carbon (IV) oxide gas.

(i) State and explain the observations made. (2 marks)

(ii) Write an equation for the reaction that took place in the gas jar. (1 mark)

2. Study the information below given about elements A, B, C, D, E, F, G and H which form part of the Periodic Table. Letters are not actual symbols of the elements.

- i. Element A is in period 2 group VI. D has atomic number 15.
- ii. Element F forms a cation having an oxidation state of +1. The ion of F has three occupied energy levels.
- iii. B and G belong to the same chemical family but G has one more energy level than B. B loses two electrons to form an ion with electronic configuration 2.8
- iv. Element C belongs to the same period as B and has one more proton than B.
- v. E and H belong to the same group and react by gaining one electron. H has a larger atomic radius than E.

Use the information above to answer the questions that follow.

a) Which element forms ions with a charge of 2-? Explain. (2 marks)

b) What is the nature of the oxide formed by element C? (1 mark)

c) How does the reactivity of H compare with that of E? Explain. (2 marks)

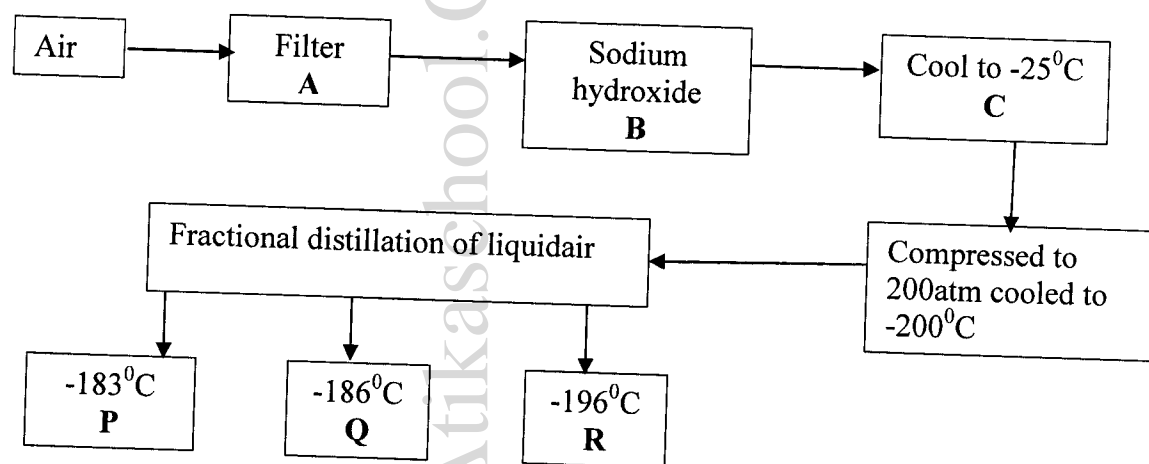
d) Write down a balanced chemical equation for the reaction between B and chlorine.  
(1 mark)

e) Compare the atomic radii of elements F and G. Compare.  
(2 marks)

f) If the oxides of F and D are separately dissolved in water, state and explain the effects of their aqueous solutions on litmus.  
(3 marks)

3. (a) Liquid A has a boiling of  $56^{\circ}\text{C}$  while liquid B has a boiling point of  $110^{\circ}\text{C}$ . State the method used to separate the two liquids. Give a reason.  
(2 marks)

(b) Study the flow chart below showing the main stages involved in fractional distillation of liquid air.



(i) Name substances removed through A, B and C.  
(1 ½ mark)

A -

B -

C -

(ii) What is the role of the compressor?  
(1 mark)

(i) Name **one** other substance that can be used in place of sodium hydroxide. (1 mark)

(ii) Name the gases P, Q, R. (1 ½ mark)

P -

Q -

R -

(v) What colour is liquid air? (1 mark)

(c) Magnesium ribbon is burnt in air. Write two equations for the products formed. (2 marks)

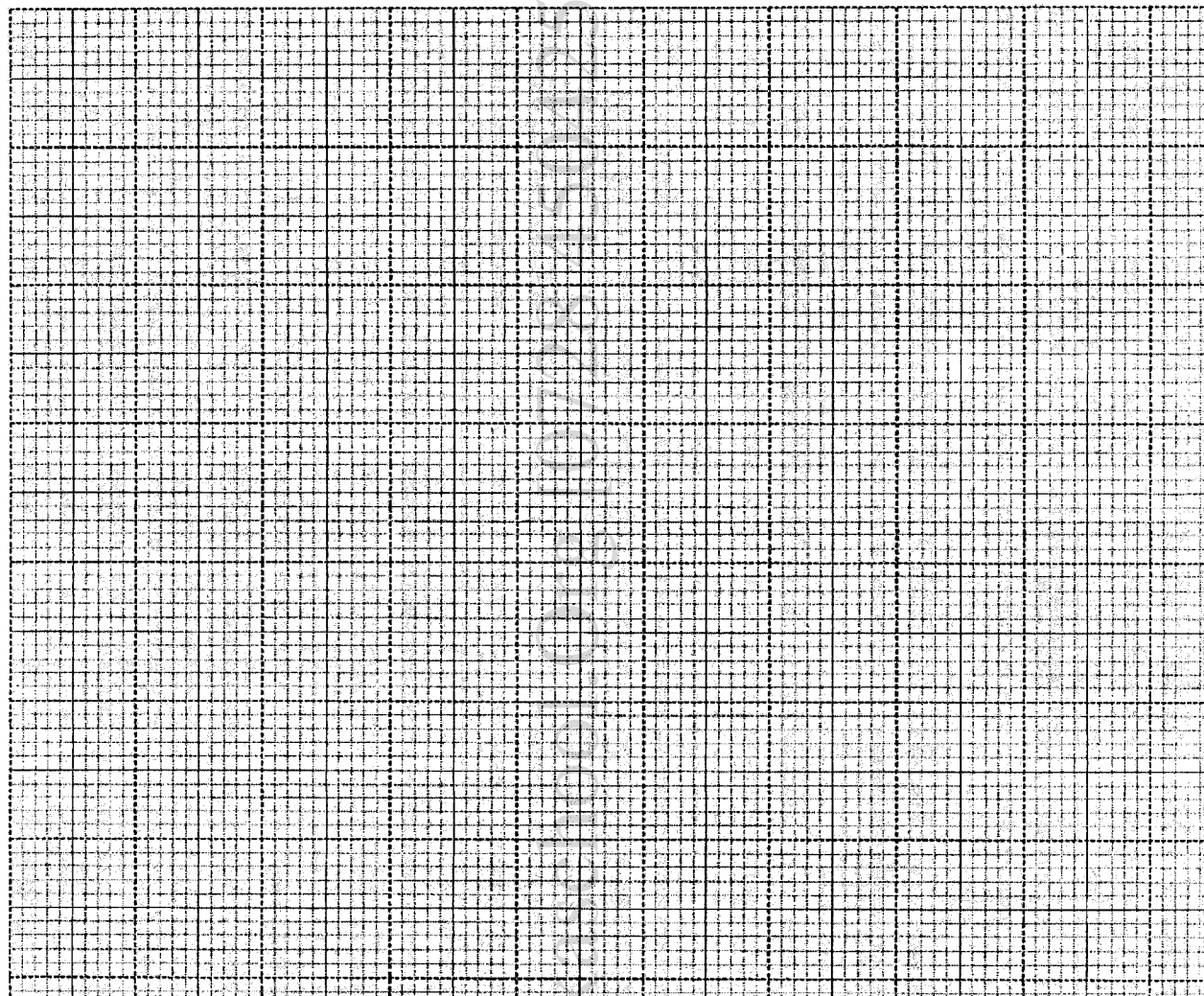
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4. (a) The table below shows the results obtained when Sammy carried out an experiment to study how  $200\text{cm}^3$  of hydrogen peroxide solution at  $20^\circ\text{C}$  decomposed when  $4.0\text{g}$  of manganese (IV) oxide was added. Volume of oxygen was measured after every 10 seconds.

Time(Sec)	0	10	20	30	40	50	60	70	80	90
Volume( $\text{cm}^3$ )	0	60	90	105	112	116	118	120	120	120

Plot a graph of volume of gas against time and label it X.

(3 marks)



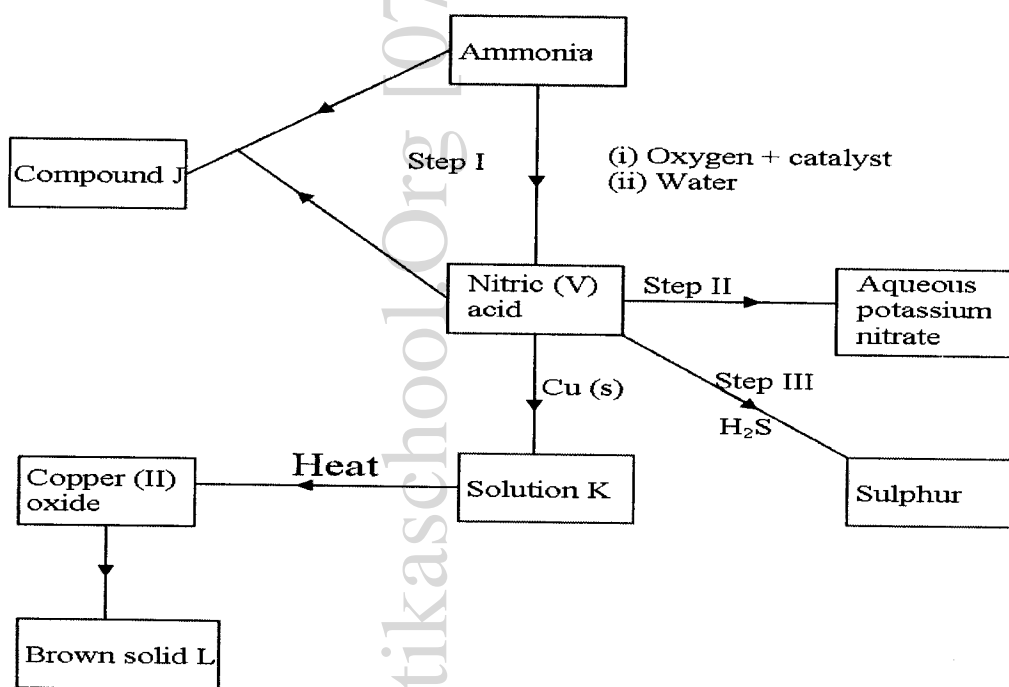
(b) Use your graph to find the;

(i) Volume of gas produced after 35 seconds. (1 mark)

(ii) Time needed to produce  $80\text{cm}^3$  of gas. (1 mark)

- (c) Explain why the volume of oxygen produced does not exceed  $120\text{cm}^3$ . (1 mark)
- (d) Sketch graph Y on the same grid to show the results when hydrogen peroxide at  $10^\circ\text{C}$  is used. Explain. (2 marks)
- (e) The mass of the solid residue after the experiment was found to be  $4.0\text{g}$ . Explain. (2 marks)

5 The scheme below shows various reactions starting with ammonia. Study it and answer the questions that follow



- (a) Name the catalyst used in step I (1 mark)
- (b) Write any two equations for the reactions that take place in step I. (2 marks)

(c) Name the process that takes place in step II. (1 mark)

(d) Explain what happens in step III. (2 marks)

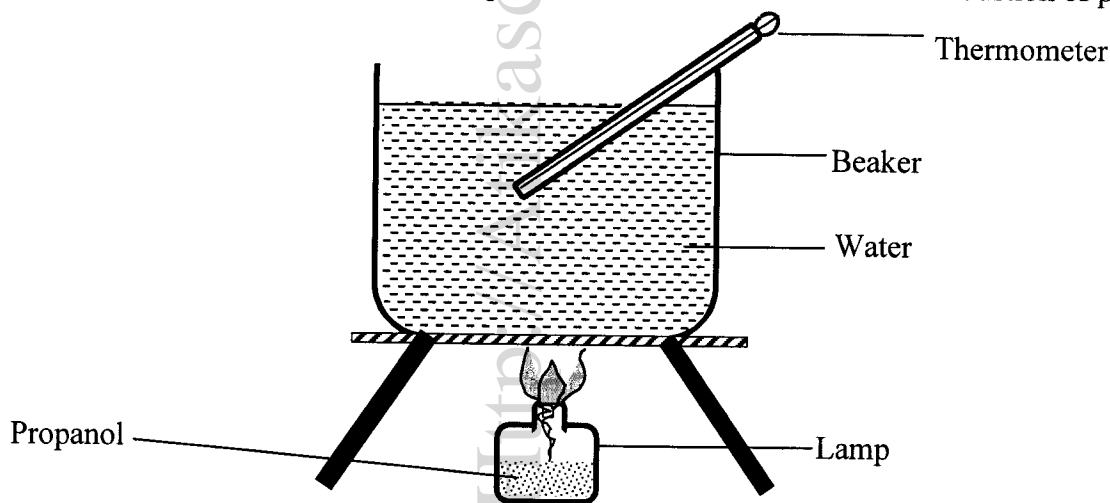
(e) Write the formula of compound J (1 mark)

(f) Calculate the percentage of nitrogen by mass that is present in compound J. (N=14, H=1, O=16) (2 marks)

(g) Give one advantage that ammonium phosphate has over ammonium sulphate as a fertilizer. (1 mark)

(h) Give one disadvantage of using artificial fertilizer. (1 mark)

6. The diagram below represents a set-up to determine the molar heat of combustion of propanol.





(a) What do you understand by the term 'molar heat of combustion'? (1 mark)

(b) During the experiment, the data given below was recorded.

Mass of water	200g
Initial temperature of water	20.5 <sup>o</sup> C
Final temperature of water	47.0 <sup>o</sup> C
Initial mass of lamp + propanol	30.42g
Final mass of lamp + propanol	29.98g
Specific heat capacity of water	4.2kJ/kg/K

C = 12, H = 1, O = 16

(i) Calculate the temperature change. (1 mark)

(ii) Calculate the mass of propanol burnt? (1 mark)

(iii) Calculate the molar heat of combustion of propanol. (2 marks)

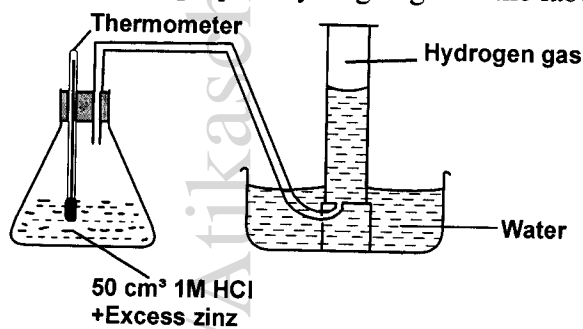
(c) (i) Write down a thermochemical equation for the complete combustion of propanol. (1 mark)

(ii) In the axis below, draw an energy level diagram for the reaction in this experiment. (2 marks)



- (d) Define the term 'fuel'. (1 mark)
- (e) What is a heating value of a fuel? (1 mark)
- (f) Determine the heating value of propanol in this experiment. (1 mark)
- (g) Other than the heating value of a fuel, state any other two factors that one has to consider when choosing a fuel. (1 mark)
- (h) It has been suggested that all motor vehicles must be fitted with electronically controlling gadget mixer of air and fuel. Why do you support this suggestion?(1 mark)

7. Below is a set-up is a set-up used to prepare hydrogen gas in the laboratory.



- a) Give a reason why the gas is collected as shown in the set-up. (1 mark)
- b) Write an ionic equation for the reaction that takes place. (1 mark)

- c) Given that the reaction was carried out at 25°C and that the highest temperature reached was 37°C.
- Calculate the enthalpy change for the reaction (Specific heat capacity =  $4.2 \text{ kJ kg}^{-1} \text{ K}^{-1}$ , density of solution =  $1 \text{ g / cm}^3$ ) (2 marks)
  - Calculate the molar enthalpy of reaction. (2 marks)
- d) The value obtained in c (ii) above is much lower than expected. State two possible reasons for this. (2 marks)
- e) State two uses of hydrogen which are also uses of carbon (II) oxide. (2 marks)
- f) Draw a set-up showing how hydrogen obtained from the reaction above can be dried and collected. (2 marks)

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