

Name \_\_\_\_\_

Adm No. \_\_\_\_\_

Candidate's Signature \_\_\_\_\_

Date \_\_\_\_\_

**233/2**  
**CHEMISTRY**  
**PAPER 2**  
**THEORY**  
**TERM 1 2016**  
**2 HOURS**

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**Kenya Certificate of Secondary Education**  
**CHEMISTRY**  
**PAPER 2**  
**THEORY**  
**2 HOURS**

**INSTRUCTIONS TO CANDIDATES**

- (a) Write your name and admission number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) Answer all the questions in the spaces provided.
- (d) All working **MUST** be clearly shown.
- (e) Non-programmable silent electronic calculators and KNEC mathematical tables may be used.

**FOR EXAMINER'S USE ONLY**

<b>QUESTION</b>	<b>MAXIMUM SCORE</b>	<b>CANDIDATE'S SCORE</b>
1	14	
2	12	
3	11	
4	11	
5	11	
6	11	
7	11	
<b>TOTAL SCORE</b>	<b>80</b>	

*This paper consists of 13 printed pages*

*Turn Over*

1. (a) The diagram below shows a set-up used by a students in an attempt to prepare and collect oxygen gas.  
Water   Solid W   Water

(i) Complete the diagram by correcting the mistakes on it. ( 2mark s)

(ii) Identify solid W \_\_\_\_\_ ( 1 mark )

(b) A piece of phosphorus was burnt in excess air. The product obtained was shaken with a small amount of hot water to make a solution.

(i) Write an equation for the burning of phosphorus in excess air. (1 mark )

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(ii) The solution obtained in (b) above was found to have a pH of 2. Give reasons for this observation. (2 marks )

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(c ) Explain why cooking pots made of aluminium do not corrode easily when exposed to air. (2 marks )

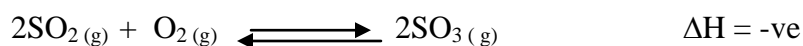
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(d) The reaction between sulphur (IV) oxide and oxygen to form sulphur (VI) oxide in the contact process is exothermic.



A factory manufacturing sulphur (VI) acid by contact process produces 350kg of sulphur (VI) oxide per day. (Conditions for the reaction : a catalyst, 2 atmospheres pressure and temperature between 400 – 500<sup>0</sup>C )

(i) What is meant by an exothermic reaction? (1 mark)

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(ii) How would the yield per day of sulphur (VI) oxide be affected if temperature lower than 400<sup>0</sup>C are used. Explain. (2 marks)

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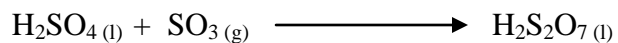
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(iii) All the sulphur (VI) oxide produced was absorbed in concentrated sulphuric (VI) acid to form oleum.



Calculate the mass of oleum that was produced per day.

( S = 32, O = 16, H = 1 )

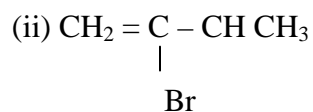
(3 marks)

2. (a) Give the IUPAC names of the following compounds.



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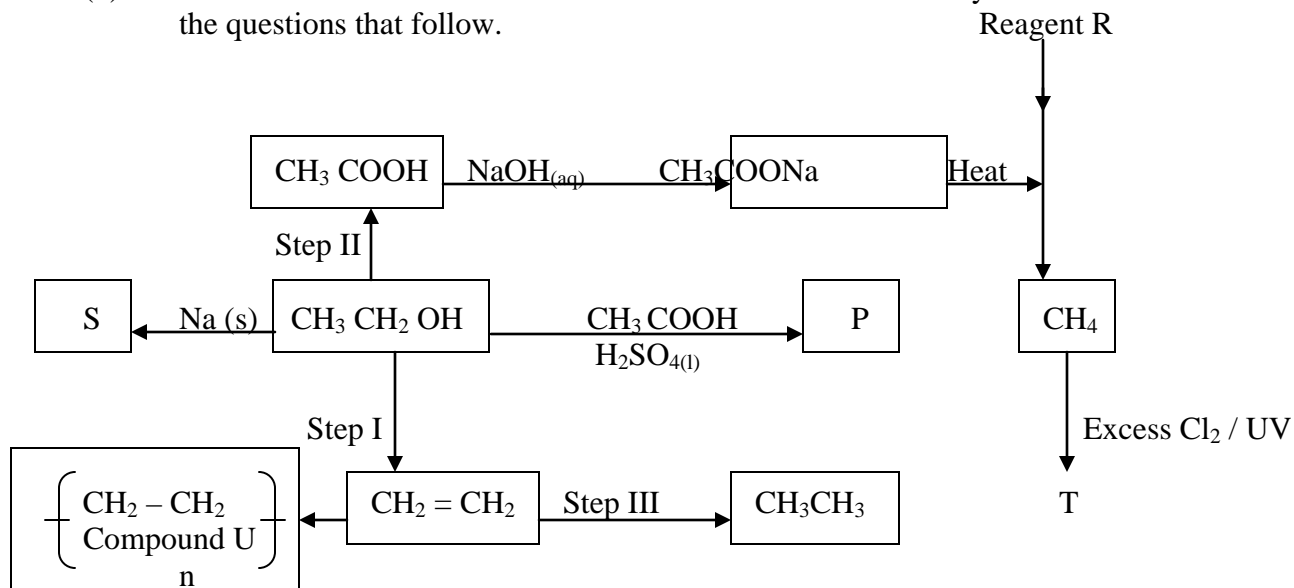
(1 mark)



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(1 mark)

- (b) The structure below shows some reactions with ethanol. Study it and answer the questions that follow.



- (i) Write the formula of the organic compounds P and S.

P \_\_\_\_\_

S \_\_\_\_\_

- (ii) Name the type of reaction, the reagent (s) and condition for the reactions in the following steps”

( 3 marks )

I) Step I \_\_\_\_\_

II) Step II \_\_\_\_\_

III) Step III \_\_\_\_\_

- (iii) Name reagent R \_\_\_\_\_

(1 mark )

- (iv) Draw the structural formula of T and give its name.

(1 name)

- (v) I) Name compound U \_\_\_\_\_

( 1 mark )

II) If the relative molecular mass of U is 42000, determine the value of n.  
( C = 12, H = 1 )

( 2 marks )

(vi) State why  $C_2H_4$  burns with a more smoky flame than  $C_2H_6$ .

(1 mark)

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3. (a) In the preparation of carbon (IV) oxide in the laboratory, dilute hydrochloric acid is added to marble chips. The gas is then passed through water and collected by downward delivery.

(i) What observations are made when the acid is added to the marble chips.

(1 mark)

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(ii) Why is hydrochloric acid preferred to sulphuric acid in the above reaction?

(1 mark )

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(iii) Why is the gas passed through water before collection?

(1 mark)

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(iv) Write an ionic equation for the reaction which occurs.

(1 mark )

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(v) Explain why calcium hydroxide is used to detect the presence of carbon (IV) oxide while sodium hydroxide is not used. ( 1 marks )

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(b) The figure below was used to investigate the effect of carbon (II) oxide on copper (II) oxide.  
Dry carbon (II) oxide    Hard glass tube    Copper (II) oxide    Glass wool    Z    Liquid M

(i) On the diagram, indicate what should be done for the reaction to occur. (1 mark )

(ii) Write an equation for the reaction that occurs in the hard glass tube. (1 mark)

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(iii) Name liquid M and state its use. (1 mark)

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(iv) What is the purpose of the glass wool? (1 mark)

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(v) Why is it necessary to burn the gas at Z? (1 mark)

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(vi) Name two other oxides that react as copper (II) oxide above. (1 mark)

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4. (i) Study the information given below and answer the questions that follow.

Element	Atomic radius (nm)	Ionic radius (nm)	Formula of oxide	Mpt of oxide ( $^{\circ}\text{C}$ )
A	0.364	0.421	$\text{A}_2\text{O}$	-119
B	0.830	0.711	$\text{BO}_2$	837
E	0.592	0.485	$\text{E}_2\text{O}_3$	1466
G	0.381	0.446	$\text{G}_2\text{O}_5$	242
J	0.762	0.676	$\text{JO}$	1054

(i) Which elements are non-metals? Give a reason. (2 marks)

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(ii) Explain why the melting point of the oxide of E is higher than that of the oxide of G. (2 marks)

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(iii) Give two elements that would react vigorously with each other. Explain your answer. (2 marks)

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- (b) Study the information below and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	Electronic configuration	Ionization energy (kJ / mole )	
		1 <sup>st</sup> I.E	2 <sup>nd</sup> I.E
X	2.2	900	1800
Y	2.8.2	736	1450
Z	2.8.8.2	590	1150

- (i) What chemical family do the elements X,Y and Z belong? (1 mark)

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- (ii) What is ionization energy? (1 mark )

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- (iii) The 2<sup>nd</sup> ionization energy is higher than the 1<sup>st</sup> ionization energy of each. Explain. (1 mark)

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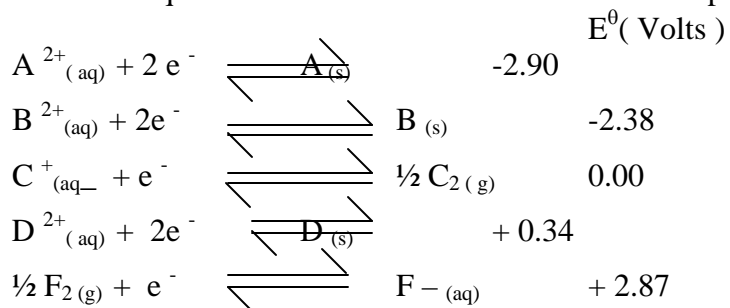
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- (iv) When a piece of element Z is placed in cold water, it sinks to the bottom and an effervescence of colourless gas that burns explosively is produced. Use a simple diagram to illustrate how this gas can be collected during this experiment. ( 2 marks )



5. Use the standard electrode potentials for elements A,B, C, D and F given below to answer the questions that follow. The letters do not represent the actual symbols of the elements.



- (i) Which element is likely to be hydrogen? Give a reason for your answer. ( 2 marks )

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- (ii) What is the  $E^\theta$  value of the strongest reducing agent ? (1 mark )

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- (iii) In the space provided, draw a labeled diagram of the electrochemical cell that would be obtained when half-cells of elements B and D are combined. ( 3 marks )

- (iv) Calculate the  $E^\theta$  value of the electrochemical cell constructed in (iii) above. (1 mark )

- (b) During the electrolysis of aqueous copper (II) sulphate using copper electrodes, a current of 0.2 amperes was passed through the cell for 5 hours.  
 (i) Write an ionic equation for the reaction that took place at the anode. (1 mark)

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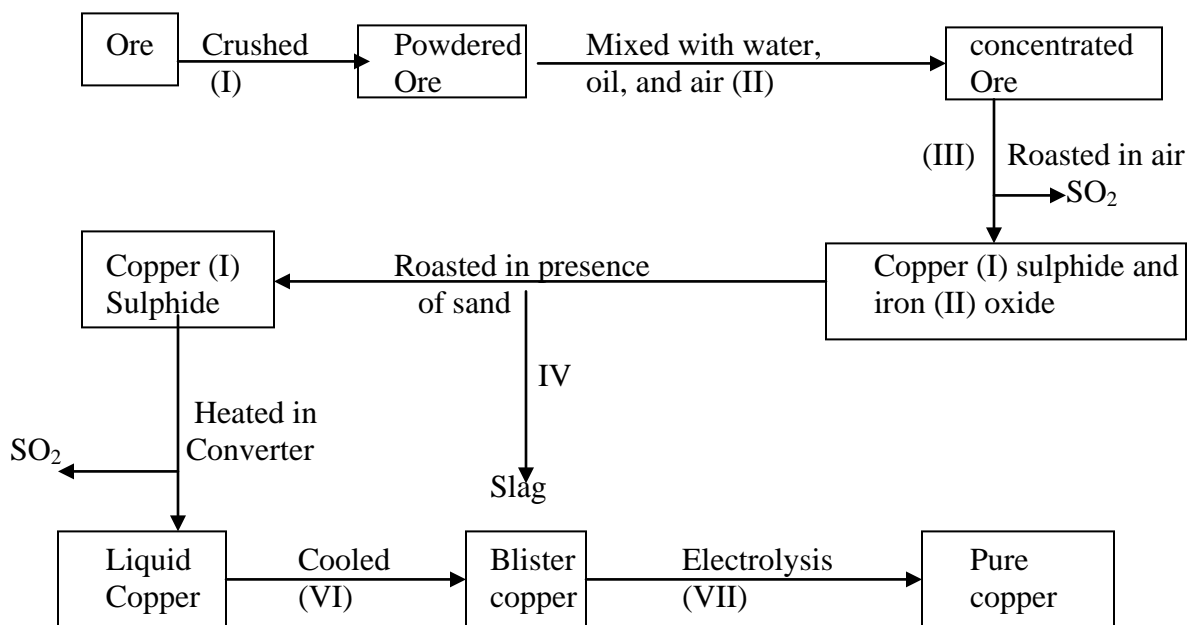
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- (ii) Determine the change in mass of the anode which occurred as a result of the electrolysis process. (Cu = 63.5, 1 Faraday = 96500 coulombs ). ( 3 marks )

6. The diagram below is a flow chart for the extraction of copper. Study it and answer the questions that follow.



- (a) Write the formula of the major ore of copper metal. (1 mark )

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(b) Name process (II) (1 mark)

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(c) Give an equation for the reaction that occurs in stage (III). (1 mark)

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(d) Explain what happens in stage (IV). (2 marks)

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(e) Write half cell equations for the reactions occurring at the anode and cathode in stage (VII). (1 marks)

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(f) Draw a simple diagram showing the set-up that is used in electrolytic purification of copper. (2 marks)

(g) A green rocky material is suspected to be malachite,  $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$ . Describe how the presence of copper can be ascertained. (3 marks)

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7. (a) The count rate for a sample of the beta emitter, lead – 224 are as shown in the table below.

Counts per minute	150	113	85	64	48	38	28	23	19
Time (min)	0	8	16	24	33	40	48	56	64

- (i) Plot a graph of counts per minute against time for lead – 224. (3 marks )

7. (ii) What is the half life of lead -224? (1 mark)

(iii) After how many minutes was count rate 70 counts per minute? (1 mark)

(iv) State two uses of radioactivity in medicine. ( 2 marks )

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(b) (i) State two differences between nuclear and chemical processes. ( 2 marks )

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(ii) The half-life of a radioactive element is 60 days. Find the time taken for its activity to drop from 4800 counts per minute to 150 counts per minutes. ( 2 marks )