

NAME..... INDEX NO.....

CANDIDATE'S SIGNATURE.....

DATE.....

233/2  
CHEMISTRY (THEORY)  
PAPER 2  
JULY/AUGUST 2011  
TIME: 2 HRS.

## NANDI EAST, NANDI SOUTH AND TINDIRET DISTRICTS JOINT EXAMINATION 2011

*Kenya Certificate of Secondary Education*  
**CHEMISTRY PAPER 2 (THEORY)**  
**TIME: 2 HRS.**

### **INSTRUCTIONS TO CANDIDATES:**

Write your **Name** and **Index number** in the spaces provided **above**.  
**Sign** and write the **date** of examination in the spaces provided **above**.  
Answer **ALL** the questions in the spaces provided in the question paper.  
All workings **must be** clearly shown where necessary.  
Mathematical tables and electronic calculators **may be** used.

### **FOR EXAMINER'S USE ONLY:**

Questions	Maximum Score	Candidate's Score
1	12	
2	12	
3	11	
4	12	
5	9	
6	11	
7	13	
<b>Total Score</b>	<b>80</b>	

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

						<b>A</b>		
	<b>B</b>		<b>C</b>		<b>D</b>		<b>E</b>	
<b>F</b>	<b>G</b>							
							<b>H</b>	

- (a) Select an element that can form an ion with a charge of -2. Explain. (2mks)

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- (b) What type of structure would the oxide of **C** have. Explain your answer. (2mks)

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- (c) How does reaction of **H** compare with that of **E**. (1mk)

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- (d) Explain how you would expect the PH values of aqueous solution of oxides of **B** and **D**. (3mks)

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- (e) Explain why **G** has a lower melting point than **B**. (2mks)

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- (f) 3.2g of B reacts completely when heated with chlorine gas. Calculate the mass of the product formed  $Cl = 35.5$ , R.A.M of Y = 24.0. (2mks)

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2. (a) Study the table and answer the questions that follow:

Compound	Melting point (K)	Boiling point (K)
$C_2H_4O_2$	289.6	391
$C_3H_6$	88	225.3
$C_3H_8O$	146	370.2
$C_5H_{12}$	143	309.3
$C_6H_{14}$	177.7	341.7

- (i) Which of the compounds is a solid at 283.0K? Explain. (1mk)

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- (ii) Choose two compounds which are members of the same homologous series and explain the difference in their melting points. (3mks)

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- (iii) The compound  $C_3H_8O$  is an alkanol. How does its solubility in water differ from the solubility of  $C_5H_{12}$  in water? Explain. (2mks)

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(b) Complete combustion of one mole of a hydrocarbon produced four moles of carbon (IV) oxide and four moles of water only.

(i) Write formula of the hydrocarbon. (1mk)

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(ii) Write the equation for the combustion reaction. (1mk)

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(c) In a reaction, an alkanol J was converted to a hex-1-ene.

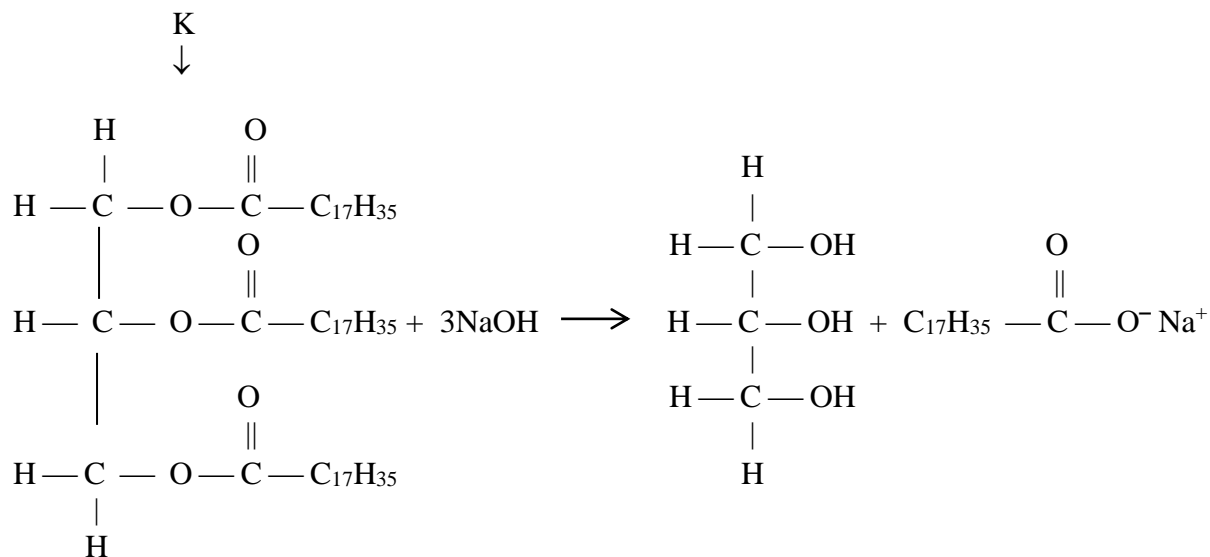
(i) Give the structural formula of the alkanol J. (1mk)

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(ii) Name the reagent and conditions necessary for the reaction in C (i) above. (1mk)

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(d) Compound K reacts with sodium hydroxide as shown below.



(i) What type of reaction is represented by the equation above? (1mk)

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(ii) To what class of organic compounds does K belong? (1mk)

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3. (a) Use the standard electrode potentials for elements A, B, C, D and E given below to answer the questions that follow:

The letters do not represent the actual symbols of the elements.

<u>Standard electrodes potentials</u>	<u>E<sup>θ</sup> (volts)</u>
$A^{2+}_{(aq)} + 2e \rightleftharpoons A_{(s)}$	-2.90
$B^{2+}_{(aq)} + 2e \rightleftharpoons B_{(s)}$	-2.38
$C^{+}_{(aq)} + e \rightleftharpoons \frac{1}{2}C_{2(g)}$	0.00
$D^{2+}_{(aq)} + 2e \rightleftharpoons D_{(s)}$	+0.34
$\frac{1}{2}E_{2(g)} + 2e \rightleftharpoons E^{-}_{(aq)}$	+2.87

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

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- (ii) What is E<sup>θ</sup> value to the strongest reducing agent? (1mk)

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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 element B and D are combined. (3mks)

- (iv) Calculate the E<sup>θ</sup> value of the electrochemical cell constructed in (iii) above. (1mk)

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(b) During the electrolysis of aqueous copper (II) sulphate using copper electrodes, a current of 0.2A was passed through the cell for 5hrs.

(i) Write an ionic equation that took place at the anode. (1mk)

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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, IF = 96500C) (3mks)

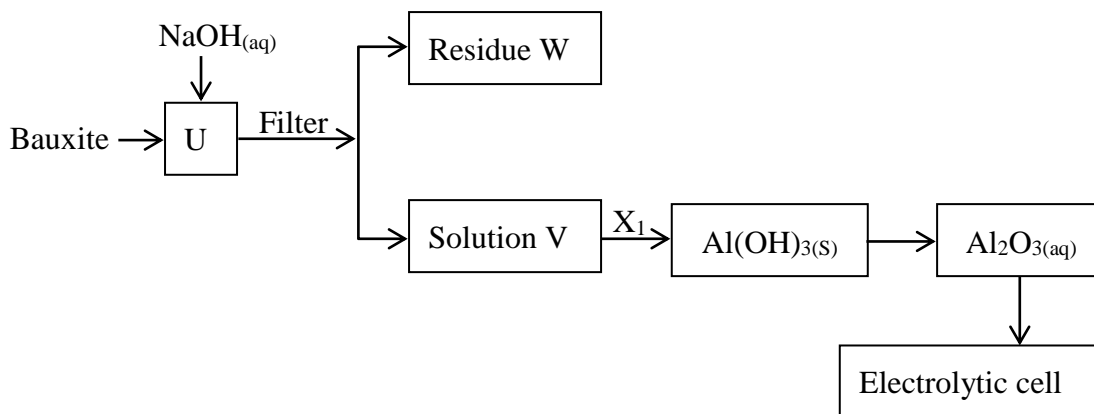
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4. The flow chart **below** illustrates the major steps in the extraction of Aluminium from Bauxite. Study it and answer the questions that follow.



(a) (i) Give the chemical formula of bauxite. (1mk)

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(ii) Write the equation for the reaction in chamber U. (1mk)

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(iii) Identify the main impurity in chamber W. (1mk)

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(b) Name the process that takes place at X<sub>1</sub> and state how it is achieved. (2mks)

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(c) State the role of cryolite ( $\text{Na}_3\text{AlF}_6$ ) in the extraction of aluminium. (1mk)

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(d) When 2.16g of aluminium foil were heated in a stream of chlorine gas, the mass of the product formed was 6.94g. calculate:

(i) Maximum mass of the product formed if chlorine gas was in excess. (Al = 27, Cl = 35.5) (3mks)

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(ii) Percentage yield of the product formed. (2mks)

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(e) Give one property which makes aluminium and its alloys suitable for making aircraft bodies. (1mk)

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5. In an experiment to investigate the solubility's of solid X and Y, the following results were obtained.

Temperature ( $^{\circ}\text{C}$ )	0	10	20	30	40	50
Solubility of solid X (g/100g of water)	8	13	24	38	61	98
Solubility of solid Y (g/100g of water)	28	32	35	38	42	46

(a) On the grid provided, plot a graph of solubility of X and Y against temperature on the axis. (4mks)

GRAPH



- (b) From your graph determine:
- (i) the solubility of X at room temperature (25°C). (1mk)

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- (ii) the temperature at which the solubility of X is 45g/100g of water. (1mk)

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- (c) If a solution of X contains 35g of solid in 100g of water is cooled from 40°C, determine:

- (i) the temperature at which crystals will first form. (1mk)

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- (ii) the mass of crystals deposited if the solution is cooled to 5°C. (1mk)

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- (d) Comment on solubility's of X and Y in water. (1mk)

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6. (a) In an experiment to determine the heat of displacement of copper by iron, 50cm<sup>3</sup> of 0.2M copper (II) sulphate solution was reacted with excess iron filings powder and the following results were obtained.

Initial temperature of copper (II) sulphate solution = 25.0°C  
Final temperature of copper (II) sulphate + iron filings = 33.0°C  
Mass of iron used = 1.0g  
(Assume density of solution 1.0g/cm<sup>3</sup> heat capacity = 4.2JgK)

- (a) Explain why:
- (i) Iron metal added as a powder? (1mk)

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(ii) The iron powder was added in excess. (1mk)

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(b) Calculate:

(i) no of moles of copper (II) sulphate used in the reaction. (1mk)

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(ii) molar heat of displacement in kilojoules mol<sup>-1</sup>. (2mks)

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(iii) Write a thermo chemical equation for the reaction above. (2mks)

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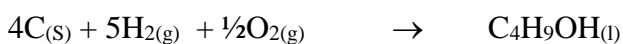
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(c) What is heating value of a fuel? (1mk)

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(d) Given the equation for the formation of Butanol. (3mks)



Calculate the standard enthalpy change for the formation of Butanol using the following information.



7. (a) Sulphur occurs naturally in two different forms called allotropes:

(i) What are allotropes. (1mk)

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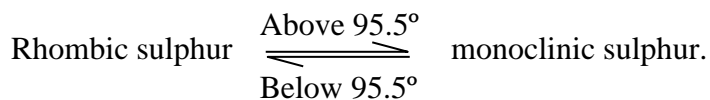


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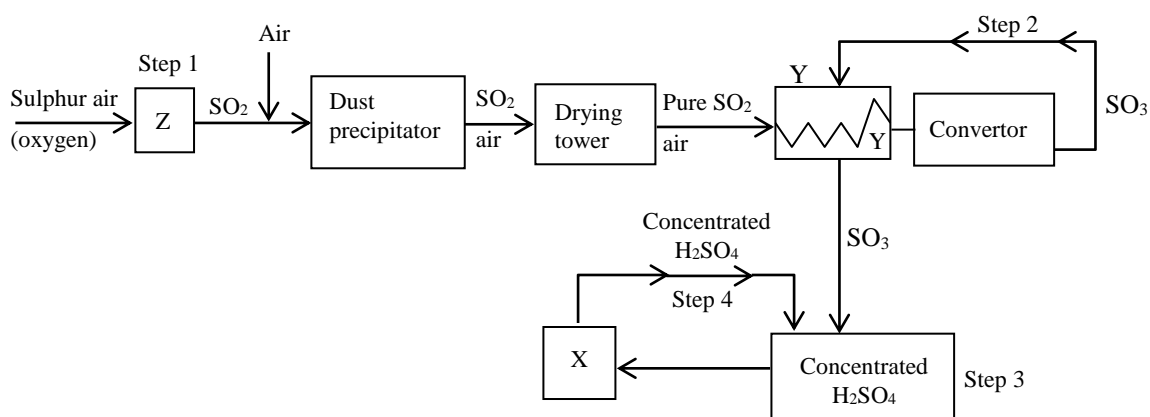
(ii) The two allotropes of sulphur are stable at different temperatures, as shown in the equations below.



Give the name to the temperature 95.5°C. (1mk)

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(b) Below is a flow diagram for the contact process for manufacture of sulphuric acid (VI).



(i) Give the name of the chambers labeled: (1½mks)

X: \_\_\_\_\_

Y: \_\_\_\_\_

Z: \_\_\_\_\_

(ii) State the **three** conditions in the converter. (1½mks)

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(iii) Explain why the gases are passed through:

I The dust precipitator and drying power. (1mk)

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II The chamber labeled Y. (1mk)

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(iv) Write the balanced equations for the reactions in:

Step 2: (1mk)

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Step 3: (1mk)

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Step 4: (1mk)

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(c) Calculate the volume of sulphur (VI) oxide gas that would be required to produce 178kg of oleum in step 3 molar gas volume at s.t.p = 22.4 litres H = 1, O = 16, S = 32. (3mks)

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