

Term 2 - 2022  
FORM 4  
CHEMISTRY PAPER 2 (233/2)  
Time: 2 Hours

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Name .....Index Number.....

Admission Number.....Class.....

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**Instruction to the candidates**

- a) Write your Name and Index number, Admission Number and Class in the spaces provided at the top of this page.
- b) Answer all the questions in the spaces in the spaces provided in this paper using English.
- c) KNEC Mathematical tables and silent electronic calculators may be used.
- d) All working **MUST** be clearly shown where necessary

**For Examiner's use only**

Questions	Maximum score	Candidate's Score
1	10	
2	14	
3	14	
4	10	
5	11	
6	11	
7	10	
	80	

***This paper consists of 12 printed Pages***  
***Candidates should check the question paper to ensure that all the***  
***pages are printed as indicated and no questions are missing.***

1. (a) Define nuclear fission.

(1 mark)

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(b) State two similarities between nuclear fission and nuclear fusion?

(2 marks)

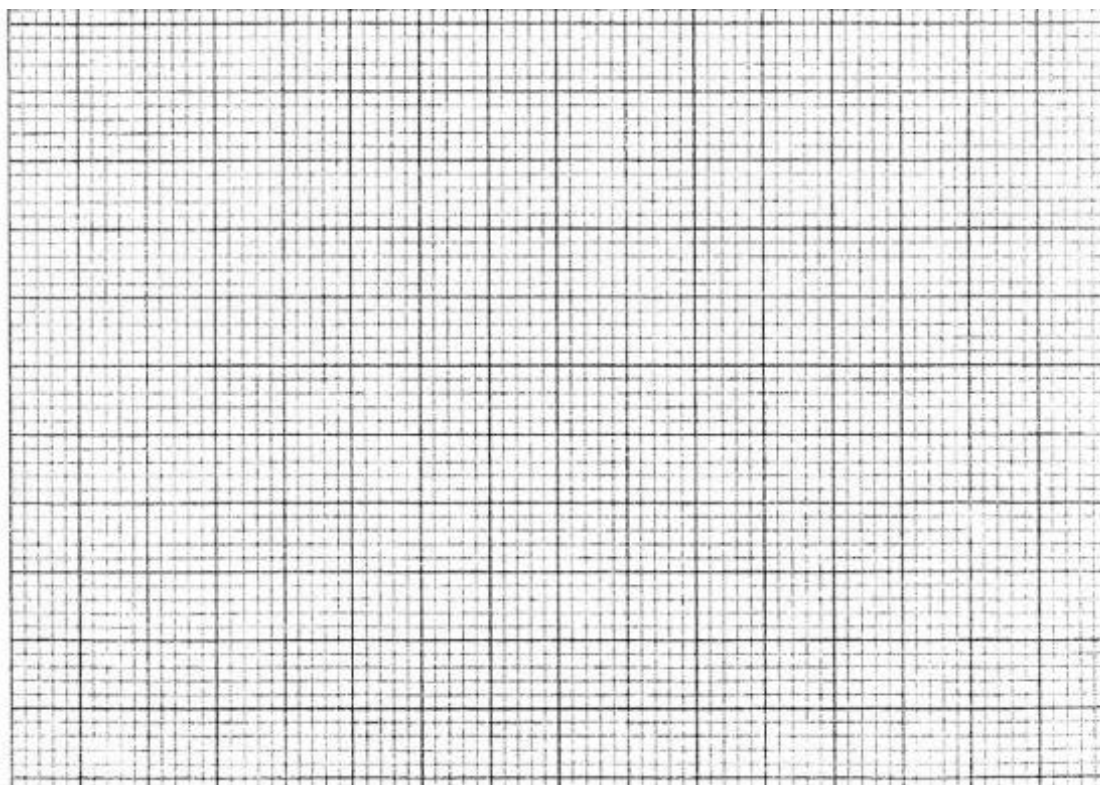
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(c) The following table shows the activity of a sample of protactinium ( $^{234}_{91}\text{Pa}$ ), a radioactive element, measured at regular intervals.

<b>Time (sec)</b>	10	30	50	70	90	110	130	150	170	190
<b>Activity(c/s)</b>	33	29	23	17	14	12	10	9	8	6

(i) Plot a graph of activity against time.

(3 marks)



(ii) From the graph:

(I) The initial activity of the element.

(1 mark)

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(II) Determine the half-life of the nuclide.

(1 mark)

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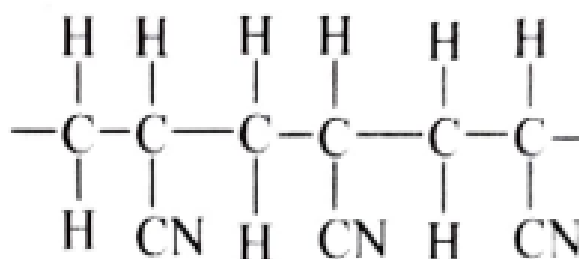
(d) State two dangers associated with radioactivity.

(2 marks)

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**2.** (a) Acrylan and orlon are names of fibers which are made of the polymer.



(i) How many repeat units are shown in this structure?

(1 mark)

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(ii) Draw a structural formula of the monomer unit from which the polymer is made.  
(1 mark)

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(iii) State two disadvantages of using the above synthetic fiber. (2 marks)

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(b) Detergents contain additives that enhance their cleaning performance. Name two such additives. (2 marks)

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(c) Calculate the mass of ethanol that can be made from 56g of ethene.  
(2 marks)

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(d) An organic **compound P** is found on analysis to have the empirical formula **C<sub>6</sub>H<sub>14</sub>O**. Compound P is slightly soluble in water. On oxidation compound P is converted into a **compound Q** of empirical formula **C<sub>3</sub>H<sub>6</sub>O** and relative molecular mass 116. Both compound P and Q react with sodium metal liberating hydrogen gas.

(i) To what class of compounds does compound P belong? (1 mark)

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(ii) Draw the displayed structural formula of P. (1 mark)

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(iii) Deduce the molecular formula of Q and draw its displayed structural formula. (2 marks)

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(iv) What other test would you carry out on Q to confirm the presence of the functional group you have indicated? (2 marks)

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- .....
- 3.** (a) During the electrolysis magnesium sulphate a current of 2 amperes was passed through the solution for 4 hours. Calculate the volume of the gas produced at the anode. (1 faraday 96,500 coulombs and volume of a gas at room temperature is 24,000cm<sup>3</sup>). (2 marks)
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(b) Table gives standard reduction potentials for some half cells.

Half-cell	Half-cell equation	E <sup>0</sup> /V
<b>I</b>	$\text{Cr}^{3+} (\text{aq}) + \text{e}^{-} \rightarrow \text{Cr}^{2+} (\text{aq})$	-0.41
<b>II</b>	$\text{Cd}^{2+} (\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cd} (\text{s})$	-0.40
<b>III</b>	$\text{Na}^{+} (\text{aq}) + \text{e}^{-} \rightarrow \text{Na} (\text{s})$	-2.71
<b>IV</b>	$\text{Cu}^{2+} (\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cu} (\text{s})$	+0.34
<b>V</b>	$\text{Pb}^{2+} (\text{aq}) + 2\text{e}^{-} \rightarrow \text{Pb} (\text{s})$	-0.13
<b>VI</b>	$\text{Br}_2 (\text{aq}) + 2\text{e}^{-} \rightarrow 2\text{Br}^{-} (\text{aq})$	+1.07
<b>VII</b>	$2\text{H}^{+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{H}_2(\text{g})$	0.00
<b>VIII</b>	$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Fe}(\text{s})$	-0.44V
<b>IX</b>	$\text{O}_2(\text{g}) + 2\text{H}_2\text{O} (\text{l}) + 4\text{e}^{-} \rightarrow 4\text{OH}^{-}(\text{aq})$	+0.40V
<b>X</b>	$\text{H}_2\text{O}_2(\text{aq}) + 2\text{H}^{+}(\text{aq}) + 2\text{e}^{-} \rightarrow 2\text{H}_2\text{O}(\text{l})$	+1.23V

- (i) Identify: (1 mark)

I. The strongest oxidizing agent.

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II. The strongest reducing agent.

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- (ii) Construct an electrochemical cell from half-cells **V** and **VI**. (3 marks)

- (iii) Write the equation and calculate the electrode potential for the electrochemical cell constructed from half-cells **V** and **VI**. (2 marks)

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- (iv) Explain why it is not advisable to use aqueous sodium sulphate as the salt bridge in the electrochemical cell formed between half-cells **V** and **VI**. (1 mark)

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- (v) Write the cell diagram for an electrochemical cell made using half-cells **V** and **VI**. (1 mark)

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- (vi) Write an equation to show how rusting occurs.(2 marks)

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- (vii) Give two reasons why electroplating is necessary. (2 marks)

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**4.** Below is a periodic table grid study it and answer the questions. (*The letters does not represent the actual symbols of the elements*)

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

(a) Which element will require the least amount of energy to remove one of the outermost electrons. (1 mark)

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(b) Select the most reactive metal. (1 mark)

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(c) What name is given to the family of elements to which **elements D** and **G** belong? (1 mark)

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(d) An **element A** has atomic number 9. Indicate the position of **A** on the grid. (1 mark)

(e) Explain why the atomic radius of **D** is smaller than that of **C**. (1 mark)

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(f) Explain why the atomic radius of **A** is smaller than its ionic radius. (2 marks)

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(g) Element **C** combines with oxygen to form an oxide. Using dots (•) and crosses(x) to represent the outermost electrons, show how the two elements combine. (1 mark)

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(h) Explain why **chloride of E** has higher melting point than **chloride of D**. (2 marks)

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**5.** (a) Describe how you can determine change in mass when magnesium is heated. (3

marks)

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(b) The table below shows the tests that were carried out on five portions of a compound and the results obtained. Study it and answer the questions that follow.

	Test	Observation
1	Addition of few drops of sodium hydroxide to the first portion until in excess.	White precipitate soluble in excess.
2	Addition of few drops of aqueous potassium iodide to the second portion	No yellow precipitate is formed.
3	Addition of few drops of acidified barium nitrate to the third portion.	White precipitate formed.
4	Addition of few drops of Lead (II) nitrate to the fourth portion.	White precipitate formed.
5	Addition of few drops of dilute nitric (V) acid to the fifth portion.	Effervescence of a colorless gas.

(i) Identify the ions likely present in; (2 marks)

I. Step 2

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II. Step 5

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(ii) Write an ionic equation for the reaction in the fifth portion. (1 mark)

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(iii) Dilute nitric (V) acid was added to a solid which is an alloy of copper. The resultant mixture was then filtered. To the filtrate, few drops of sodium hydroxide solution was added till in excess.



- I. State any two observations made when dilute nitric (V) acid is added to the alloy. (2 marks)

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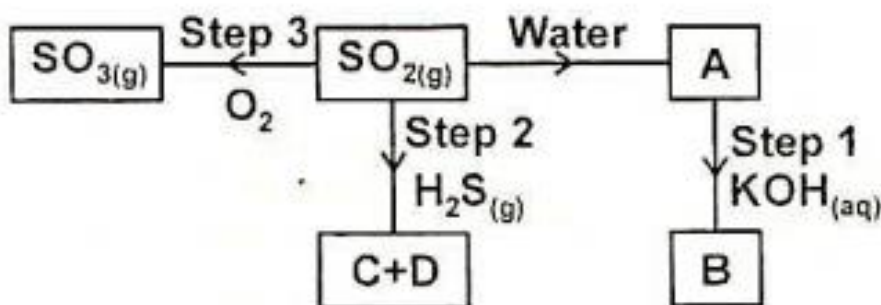
- II. Name the other metal present in the alloy. (1 mark)

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- III. Write an ion equation for the reaction that took place when few and excess sodium hydroxide solution is added. (2 marks)

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6. (a) Study the flow chart below and answer the questions that follow.



- (i) Name a suitable method of gas collection that can be used to collect Sulphur (VI) oxide gas in the laboratory. (1 mark)

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- (ii) Name substances A, B, C and D. (2 marks)

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- (iii) State the property of Sulphur (IV) oxide exhibited in step 2. (1 mark)

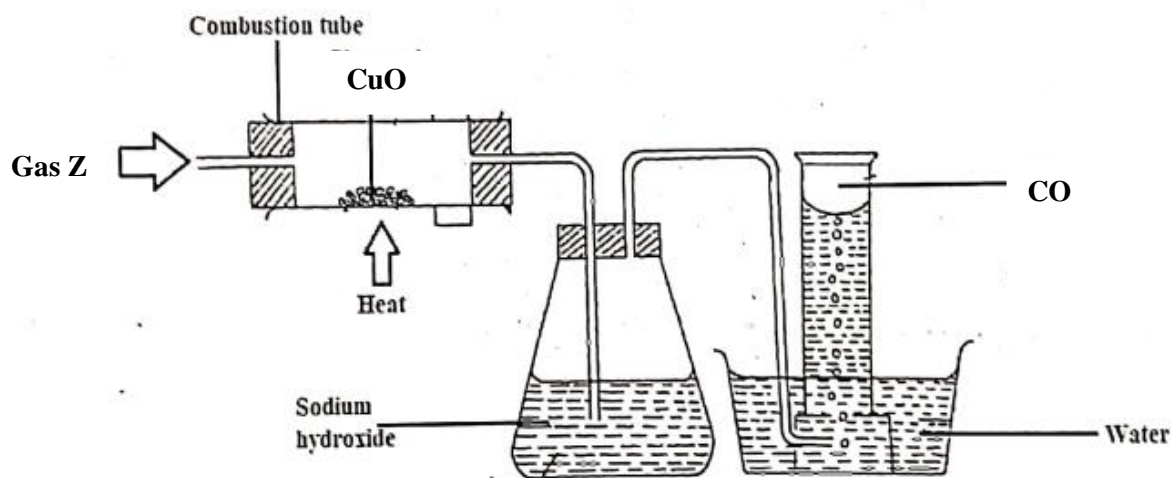
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- (b) (i) Explain the observations made when burning magnesium is lowered into a gas jar containing carbon (IV) oxide. (3 marks)

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(ii) Study the diagram below and answer the questions that follows.



I. Name gas Z.

(1 mark)

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II. Write an equation for the reaction taking place in the combustion tube.

(1mark)

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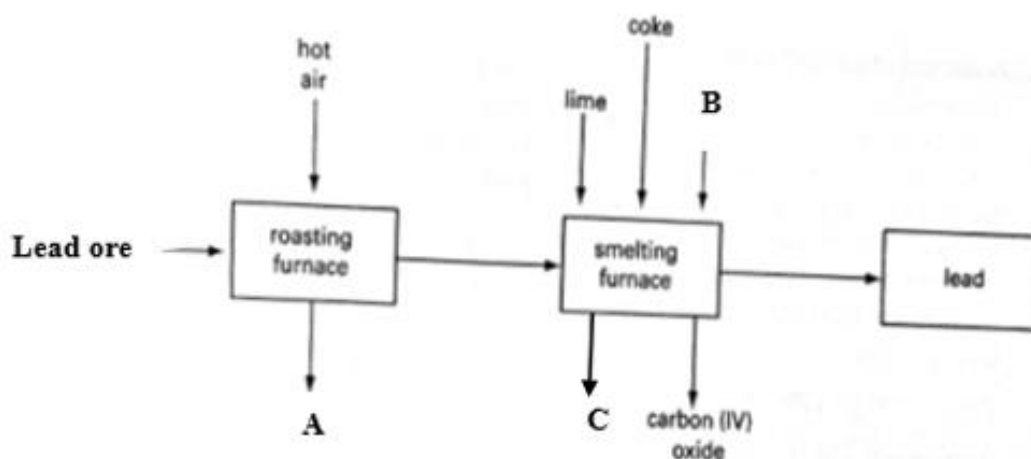
III. State and explain the observations made in the combustion tube.

(1 mark)

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**7.** The flow chart in the figure below represents some stages in the extraction of lead metal. Study it and answer the questions that follow.



(a) Identify:

(i) The lead ore.

(1 mark)

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(ii) Substance A, B and C.

(3 marks)

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(b) Write an equation for the reaction that forms **substance C**.

(1 mark)

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(c) Name an impurity present in the ore.

(1 mark)

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(d) State the process by which the ore is concentrated. (1 mark)

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(e) Write an equation for the reaction which occurs in the roasting chamber. (1 mark)

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(f) State any one use of lead.(1 mark)

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(g) Give one reason why the extraction of lead causes pollution to the environment.(1 mark)

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