Name:……..Signature: ……

P525/1
Chemistry
Paper 1
Oct./Nov. 2024
2 ¾ hours

S.5

UGANDA ADVANCED CERTIFICATE OF EDUCATION

CHEMISTRY

Paper 1

(Theory)

MID TERM 3

2 hours 45 minutes.

INSTRUCTIONS TO CANDIDATES:

- Answer **all** questions in section **A** and any **six** questions in section **B**
- All questions **must** be answered in the spaces provided; no answer sheet must be attached.
- The Periodic Table, with relative atomic masses, is attached at the end of the paper.
- Mathematical tables(3-figure tables) are adequate or non-programmable scientific electronic calculators may be used
- Illustrate your answers with equation(s) where applicable.
- Where necessary, use the following:
  Molar gas constant R = 8.31 JK -1 mol -1
  Molar volume of a gas at s.t.p is 22400cm^3.
  Standard temperature = 273 K
  Standard pressure = 101325 N m^{-2}

For Examiner' Use Only																
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**Total**

SECTION A. (46 MARKS)

Attempt all questions in this section.

1. (a) State what is observed and write an equation for the reaction that occurs when;

(i) Acidified potassium manganate (VII) solution is heated with methyl benzene.

(02 marks)

(ii) Alkaline potassium manganate (VII) solution reacted with propene. **(02 marks)**

(b) With appropriate conditions, write equations to show how the major product in (a) (i) above can be converted to 2-phenylpropane. **(02 marks)**

2. (a) State Graham's law of gaseous diffusion. **(01 mark)**

(b) Methane diffused through a porous partition in1.1985 minutes while an equal volume gaseous oxide of sulphur SO_X at the same temperature diffused in 2.68 minutes.

(i) Determine the value of **x** in the oxide of sulphur. ***(2$\frac{1}{2}$ marks)***

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(ii) Write an equation and a mechanism for the reaction that occurs when gaseous oxide above reacts with benzene. **(02 marks)**

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3. Aluminium and silicon are period 3 element of the periodic table.

(a) For each of the elements, write the formula of oxide and chloride formed. **(02 marks)**

Element	**Formula of oxide**	**Formula of chloride**
Aluminium		
Silicon		

(b) Write an equation for the reaction that occurs when; **(03 marks)**

(i) Oxide of Aluminum is treated with hot concentrated sodium hydroxide solution.

_____

_____

(ii) Chloride of silicon is reacted with water.

_____

_____

4. (a) (i) What is meant by the term Radioactivity. **(01 mark)**

_____

_____

_____

(ii) Complete and balance the nuclear reaction and name Element Y. **(01 mark)**

$$^{24}_{11}Na \quad + \quad ^{1}_{0}n \longrightarrow \quad Y + \ ^{0}_{-1}e$$

_____

_____

(b) When the carbide of Y was hydrolyzed with water, compound M was formed.

(i) Identify compound M. **(01 mark)**

_____

(ii) Write an equation for the reaction that occurred to yield compound M. **(01 mark)**

_____

_____

(b) State what is observed and write an equation when compound M is treated with ammoniacal copper (I) chloride solution. **(02 marks)**

_____

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5. The elements Beryllium, magnesium, calcium and barium belong to group (ii) of the periodic table.

(a) Compare the reaction of Beryllium and magnesium with steam. Write an equation where applicable. **(02 marks)**

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_____

_____

_____

(b) The solubility of the hydroxides of these elements in water at a given temperature is shown in table below.

Hydroxide	$Be(OH)_2$	$Mg(OH)_2$	$Ca(OH)_2$	$Ba(OH)_2$
Solubility(gdm^{-3})	Insoluble	0.10	1.50	33.20

(i) Explain why beryllium hydroxide is insoluble in water. ***($1\frac{1}{2}$ marks)***

_____

_____

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(ii) How does solubility of the hydroxides vary from $Mg(OH)_2$ to $Ba(OH)_2$ .Give a **reason** for your answer. ***($1\frac{1}{2}$ marks)***

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6. One of the limitations of colligative property is that the solute should be non-volatile.

(a) Giving a reason for your answer, state how vaporization of the solute would affect the colligative property and its Relative molecular mass. **(03 marks)**

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_____

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(b) A solution containing 1.5% of a polymer has an osmotic pressure of 3.6 $X10^{-4}$ atmospheres at 25^0C. Calculate the molecular mass of the polymer. ***($2\frac{1}{2}$ marks)***

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7. A compound R consists of 94.7% bromine and the rest beryllium. It has a vapour density of $1.509X10^{-2}$ gcm^{-3} at s.t.p. (Br = 80, Be = 9)

(a) Determine the empirical formula of R and hence deduce its molecular formula**.** **(03 marks)**

_____

_____

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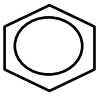
(b) Write the structure of R. **(01 mark)**

8. Complete the following equations and write a mechanism for the reaction that occurs.

(a)  $\xrightarrow[H^+ (aq)]{(CH_3)_2\text{-}C=CH_2}$ _____ **(03 marks)**

(b) $CH_3C{\equiv}CH \xrightarrow[Hg^{2+} (aq)/\ 60^0C]{\text{Dil. } H_2SO_4}$ _____ **(03 marks)**

_____

9. (a) Define the term **Eutectic mixture**. **(01 mark)**

_____

_____

_____

(b) Metals Y and Z form an eutectic mixture with 28% metal Y and an eutectic point 80^0C. Draw a well labelled phase diagram for the two metals. (Melting points of Z and Y are 185^0C and 242^0C). **(02 marks)**

(c) State one; **(01 mark)**

(i) Similarity between metal Y and the eutectic mixture formed.

_____

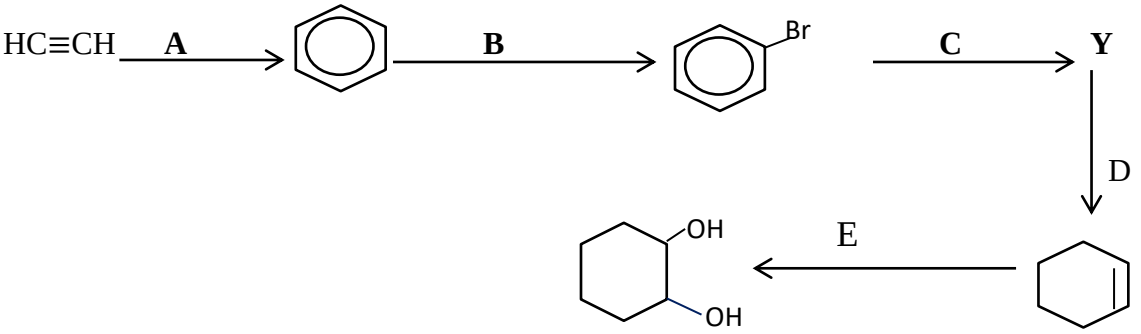
(ii) Difference between the eutectic mixture formed and compound of metal Z.

_____

SECTION B. (54 MARKS)

Answer **six** questions from this section.

10. Consider the following reaction scheme. Use it to attempt the following questions.



(a) Write the IUPAC name of compound Y. **(01 mark)**

_____

_____

(b) (i) State the conditions for the reaction occurring in step B and C. **(01 mark)**

B

_____

C

_____

_____

(ii) Name the reagent (s) in step E and A. **(01 mark)**

E

_____

A

_____

(iii) Name the type of reaction occurring in step A. **(01 mark)**

_____

_____

(c) Write a mechanism for the reaction that occurred in step D. **(02 marks)**

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(d) With appropriate conditions for the reaction, show how compound HC≡CH can be converted to propanone (CH_3COCH_3). **(03 marks)**

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11. (a) Write the name and formula of the chief ore from which Aluminium can be extracted. **(01 mark)**

Name

_____

Formula

_____

_____

(b) Describe how;

(i) Pure aluminium oxide is obtained from its chief ore. **(05 marks)**

(ii) Aluminium is obtained from pure aluminium oxide. **(03 marks)**

12. (a) What is meant by the term **Rate constant**. **(01mark)**

(b) In an experimental study of a reaction in solution between two compounds A and B, the following information was obtained for the initial rate of reaction.

Initial rate of reaction (Mol $dm^{-3}s^{-1}$)	Initial concentrations (mol dm^{-3}	
	A	B
10×10^{-4}	1.0×10^{-1}	1.2×10^{-1}
4.0×10^{-4}	2.0×10^{-1}	1.2×10^{-1}
8.0×10^{-4}	2.0×10^{-1}	2.4×10^{-1}

(i) Determine the order of reaction with respect to
Reagent A. **(02 marks)**

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_____

Reagent B **(02 marks)**

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(ii) Write the rate equation and hence the overall order of reaction. **(02 marks)**

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(iii) Calculate the value of the rate constant and state its units. **(02 marks)**

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13. (a) State what is observed and write an equation(s) for the reaction that would take place when the following substances are mixed.

(i) **$CH_3CH=CHCHO$** and **bromine water.** **(02 marks)**

Observation

_____

_____

equation

_____

_____

(ii) Sodium carbonate and aqueous solution of aluminium chloride. **(02 marks)**

Observation

_____

_____

equation

_____

_____

(iii) Benzoic acid and sodium carbonate solution. **(02 marks)**

Observation

_____

_____

equation

_____

_____

(b) Write the formula of the functional group that would be distinguished by the following reagents. In each case state what is observed.

(i) Ammoniacal silver nitrate solution. **(02 marks)**

Formula

_____

observation

_____

(ii) Acidified 2,4-Dinitro phenyl hydrazine solution. **(02 marks)**

Formula

_____

observation

_____

14. (a) Solutions of miscible liquids are either ideal of non-ideal.
(i) Explain the term ideal solution. **(02 marks)**

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_____

(ii) Describe what causes solution of miscible liquids to behave non-ideally.
(04 marks)

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(b) A mixture containing 2 – nitro phenol and 4 – nitro phenol was steam distilled at 760mm Hg pressure. Describe how a mixture of 2 – nitro phenol and 4 – nitro phenol can be separated by steam distillation. **(03 marks)**

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15. (a) write short notes on the following. (Your answer should include reaction and a mechanism where applicable)

(a) **Friedel crafts' acylation**. **(03 marks)**

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(b) Wurtz reaction. **(02 marks)**

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(c) Electrophilic addition reaction. **(04 marks)**

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16. Calcium and Beryllium are group (II) elements of the periodic table though Beryllium behaves different from Calcium.

(a) Write the general outermost electronic configuration of the elements. **(01 mark)**

_____

(b) State reasons why Beryllium behaves different from Calcium. **(02 marks)**

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(c) Compare the following reactions .In each case, write equation(s) where applicable.

(i) Calcium and Beryllium with hot concentrated sodium hydroxide solution.

(03 marks)

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(ii) Carbides of calcium and beryllium with water. **(03 marks)**

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17. (a) State what is meant by the terms

(i) Radioactivity

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(ii) Half-life

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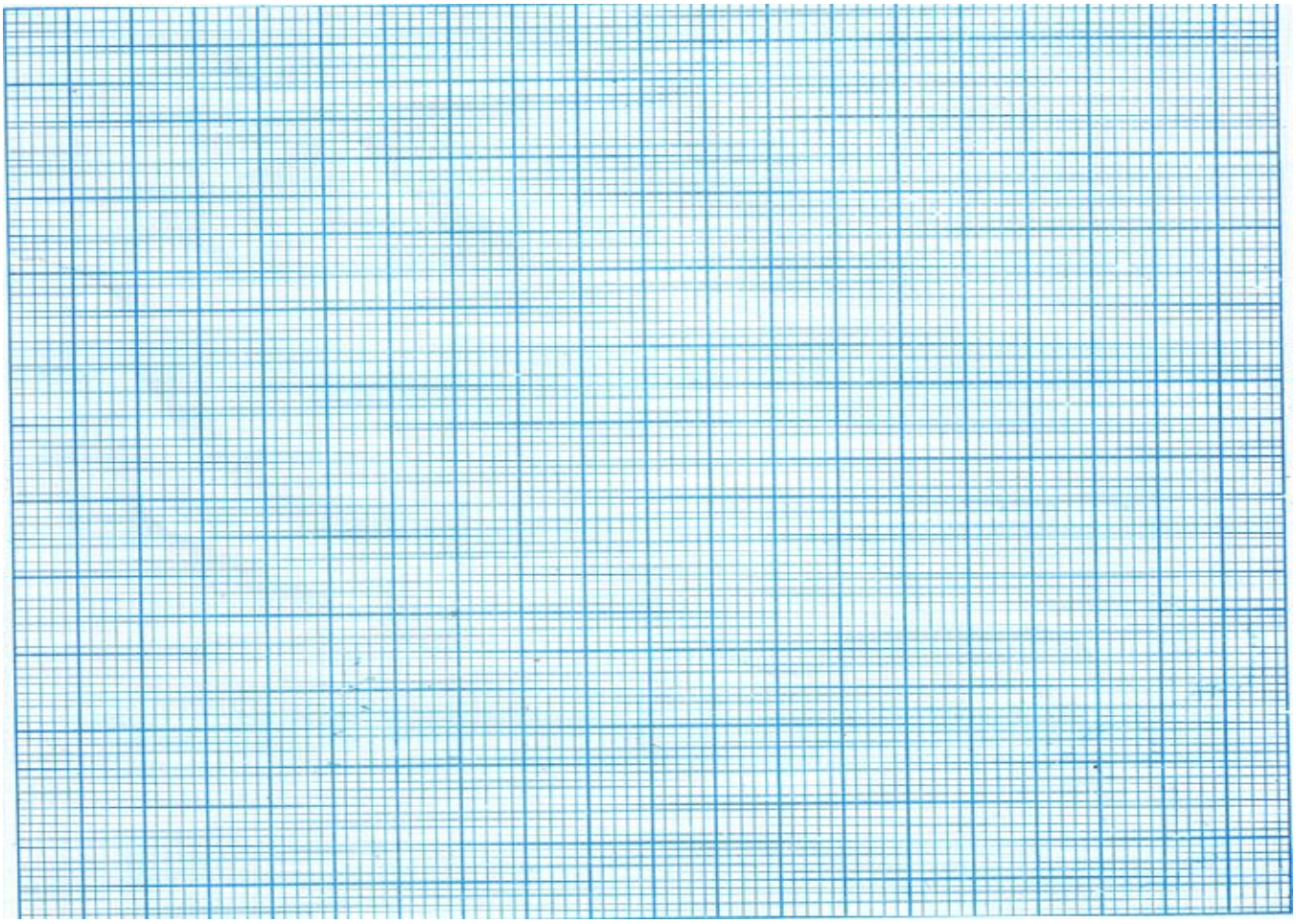
(b) The table below shows data for radioactive decay of element ***A***

Time (hours)	0.0	5.0	10.0	15.0	20.0	25.0	30.0
Activity (counts per minute)	25.00	23.00	21.25	19.50	18.00	16.50	15.25

(i) Plot a graph of activity against time. **(03marks)**



(ii) Determine the half-life of element ***A.*** **(02marks)**

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_____

(iii) Determine the decay constant and state its units. **(02marks)**

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END

WISH YOU SUCCESS IN YOUR EXAMS.