NAME OF CANDIDATE: _____ FORM 4 _____

MZUZU DIOCESE

2021 MALAWI SCHOOL CERTIFICATE OF EDUCATION MOCK EXAMINATION

CHEMISTRY

PAPER I

(100 marks)

Theory

Wednesday, 4 August

Time Allowed: 2hours
1:30 – 3:30 pm

Instructions

1. **This paper contains 14 printed pages. Please check.**

2. Write your name clearly in the space provided on top of this page and all other pages.

3. This paper contains **two** sections, **A** and **B.** In **Section A** there are **ten** short answer questions while in **Section B** there are **three** restricted essay questions.

4. Answer **all** the **thirteen** questions in the spaces provided.

5. Use of electronic calculators is allowed.

6. The maximum number of marks for each answer is indicated against each question. This paper has a total of **100 marks**.

7. In the table provided on this page, **tick** against the question number of the question you have answered.

8. Hand in your paper to the invigilator when time is called to stop writing.

Question Number	Tick if answered	Do not write in these columns	
1			
2			
3			
4			
5			
6			
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8			
9			
10			
11			
12			
13			
Total			

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SECTION A   (70 marks)

1. a. Describe any **one** component of a scientific investigation.

_____

_____

_____ **(1 mark)**

b. State any **two** importance of drawing line graph to interpret data in a table during scientific investigation.

   i. _____

   _____ **(1 mark)**

ii. _____

   _____**(1 mark)**

   c. Two elements **S** and **T** form ions with the electron configuration as shown below.

$$S^- : 2,8 \quad \text{and} \quad T^+: 2,8,8$$

   i. Write down the electron arrangement of the atoms of **S** and **T**.

   S _____ **(1mark)**

   T _____ **(1 mark)**

   d. Give any **two** physical properties of element **T**.

   i. _____ **(1 mark)**

ii. _____ **(1 mark)**

   2. a. Explain the effect on atomic radius when valence electrons are lost.

   _____

   _____

   _____ **(2 marks)**

b. Draw an electron dot and cross diagram to show bonding in an ethane molecule (C_2H_6).

(3 marks)
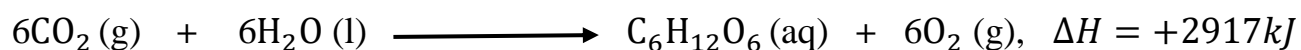
3. a. i. Define 'exothermic reaction'.
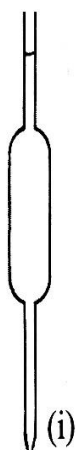
_____

_____

_____ **(1 mark)**

ii. Construct a well labelled energy level diagram for the process of photosynthesis represented by the following thermo-chemical equation:
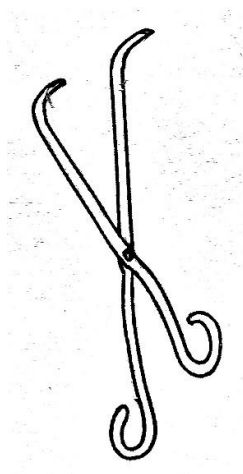
$$6CO_2 \text{ (g)} \ + \ 6H_2O \text{ (l)} \longrightarrow C_6H_{12}O_6 \text{ (aq)} \ + \ 6O_2 \text{ (g)}, \ \Delta H = +2917kJ$$

(3 marks)

Figure 1 below shows laboratory apparatus (i) and (ii)

3. b. Name the apparatus shown in the **Figure** above.

(i) _____ **(1 mark)**

(ii) _____ **(1 mark)**

c. State the use of apparatus (i)

_____

_____ **(1 mark)**

4. a. Table 1 shows results of an experiment on displacement reactions involving zinc (Zn), aluminium (Al), tin (Sn) and iron (Fe) metals and their aqueous solutions.

Table 1

	$ZnSO_4$ (aq)	$AlSO_4$ (aq)	$SnSO_4$ (aq)	$FeSO_4$ (aq)
Zinc (Zn)	No reaction	No reaction	Reaction	Reaction
Aluminium (Al)	Reaction	No reaction	Reaction	Reaction
Tin (Sn)	No reaction	No reaction	No reaction	No reaction
Iron (Fe)	No reaction	No reaction	Reaction	No reaction

i. Write a balanced chemical equation for the reaction between zinc (Zn) and iron sulphate ($FeSO_4$) solution.

_____ **(2 marks)**

ii. Use the results to arrange the metals in order of increasing reactivity.

_____ **(1 mark)**

iii.   Which of the metals is the strongest reducing agent?

_____ **(1 mark)**

b.   Below are electrode potentials of some half-reaction reactions.

Half – reaction	**Electrode Potential (E^θ volts)**
$Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn_{(s)}$	-0.76
$Fe^{3+}_{(aq)} + e^- \longrightarrow Fe^{2+}_{(aq)}$	0.77
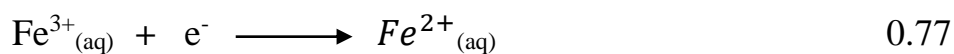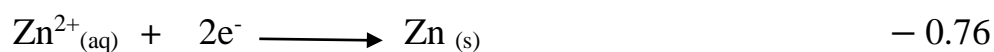
Calculate the e.m.f. of the cell.

(3 marks)

c. i. Define 'oxidation number'

_____

_____ **(1 mark)**

ii. Work out the oxidation number of sulphur (S) in a sulphite ion (SO_3^{2-}) given that the oxidation number of oxygen (O) is -2.

(2 marks

5. **a. Figure 2** shows structures of some organic compounds **A, B, C, D** and **E.**
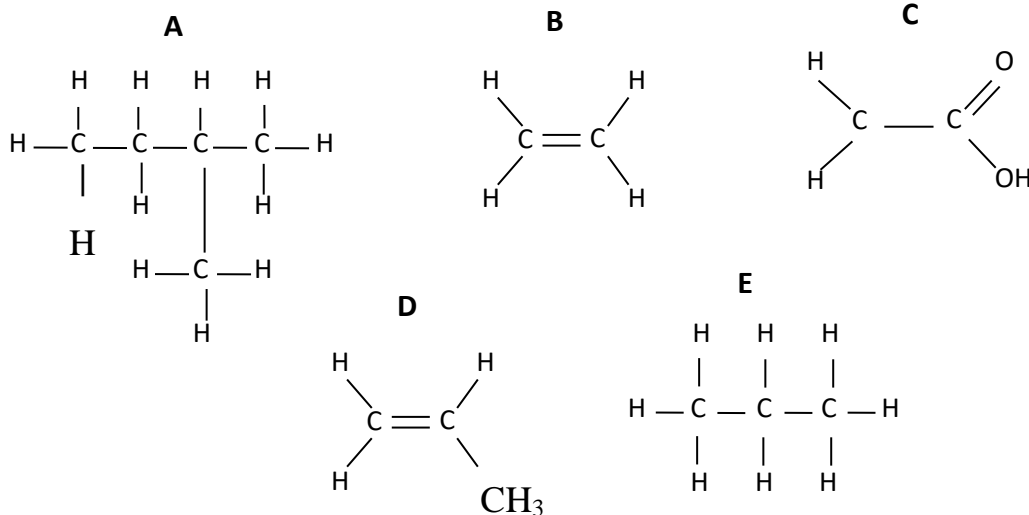
i. Name compound **A.**

_____ **(1 mark)**

ii. Which compound is soluble in water?

_____ **(1 mark)**

iii. Give a reason for the answer in **5. a. ii.**

_____

_____ **(1 mark)**

iv. Compound **B** is a monomer. Write an equation to show its polymerization.

(1 mark)

v. Mention the kind of polymerization in **5. a. iv.**

_____ **(1 mark)**

vi. Write the other isomers of substance **A.**

(2 marks)

b. Figure 3 is a diagram showing structures of plastics **A** and **B**.
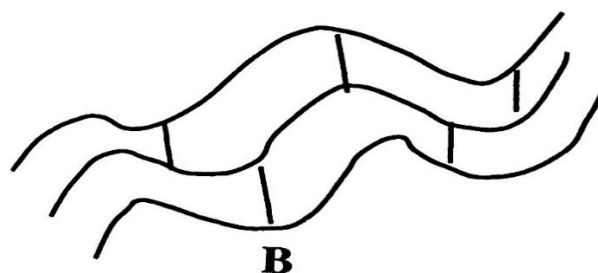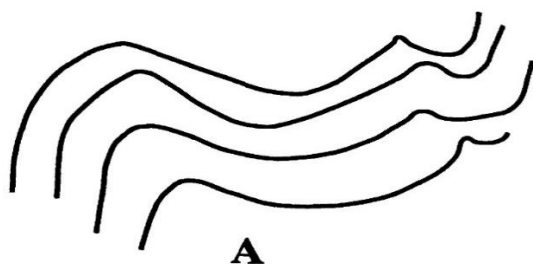
i. Which structure shows plastic that can be recycled?

_____ **(1 mark)**

ii. Give a reason for the answer in **5.b. i.**

_____

_____

_____

(1 mark)

iii. Give any **one** example of structure **A** that is used to make clothing and ropes.

_____ **(1 marks)**

6. Table 2 gives readings of a thermometer collected at regular time intervals by a student as an unknown substance was heated from solid state to gaseous state.

Temperature (^{0}C)	25	30	35	40	40	45	50	55	55	60	65
Time (s)	0	5	10	15	20	25	30	35	40	45	50

a. Plot a graph of temperature against time.   **(4 marks)**
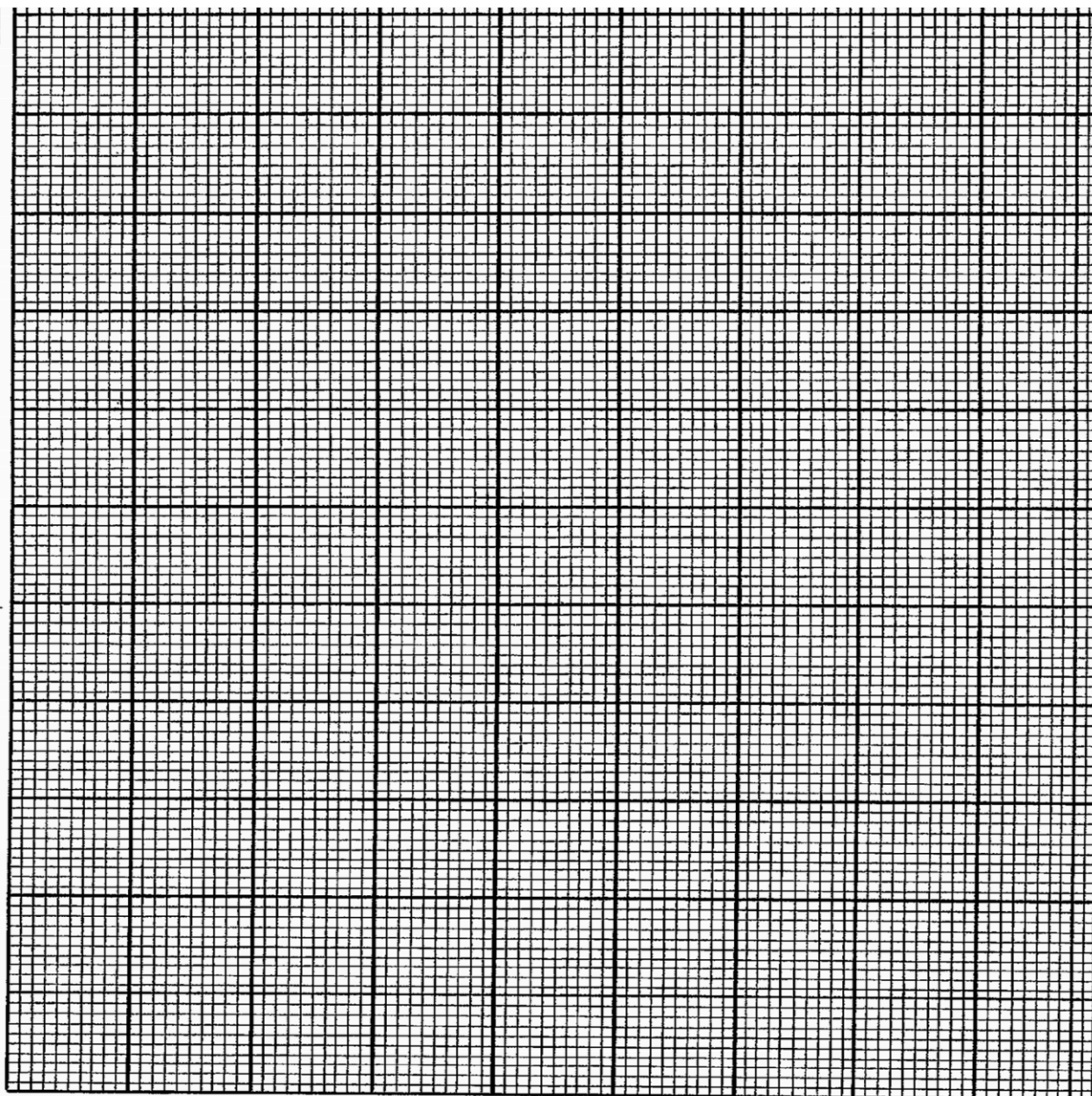
b.   Use the graph to predict if the unknown substance was pure or impure.

_____ **(1 mark)**

c. What was the temperature of the substance after 28 seconds?

_____ **(1 mark)**

d. Why is it necessary to specify the temperature of a substance when investigating its purity using density?

_____

_____

(1 mark)

7. a. What is a 'limiting reagent' in a chemical reaction?

_____

_____

_____ **(1 mark)**

b. Calcium carbonate can be decomposed by heating according to the following equation:

$CaCO_3$ (s) $\longrightarrow$ CaO (s)   + CO_2 (g)
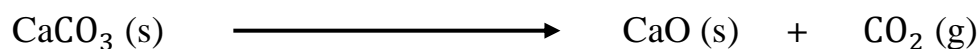
What is the percentage yield in this reaction if 13.2g of calcium oxide (CaO) is obtained on heating 25.9g of Calcium carbonate ($CaCO_3$)?   **(4 marks)**

RAMs: Ca = 40,   O = 16,   C = 12

8. a. Name the **two** allotropes of phosphorus.

_____ **(2 marks)**

b. Give any **two** differences between diamond and graphite.

i. _____

_____ **(1 mark)**

ii. _____

_____ **(1 mark)**

c. What name is given to the process of manufacturing ammonia gas from nitrogen?

_____ **(1 mark)**

e. How is nitrogen useful in transporting petroleum products?

_____

_____

_____ **(1 marks)**

f. State any **two** uses of sulphur.

i. _____

_____ **(1 mark)**

ii. _____

_____ **(1 mark)**

9. a. What is a "weak acid?"

_____

_____

_____ **(1 mark)**

b. Mention the acid which could be used to prepare ammonium chloride (NH_4Cl).

_____ **(1 mark)**

c. Name a gas produced in each of the following preparations of salts:

  i. Reacting an acid with a metal

  _____ **(1 mark)**

  ii. Reacting an acid with a carbonate

  _____ **(1 mark)**

d. The conjugate acid-base pairs for the reaction between water molecules are

  H_2O/OH^- and H_3O^+/H_2O. Write an equation for the reaction.

  _____ **(2 marks)**

10. a. State any **two** ways of expressing concentration of a solution.

  i. _____ **(1 mark)**

  ii. _____ **(1 mark)**

  b. Calculate the volume of distilled water that must be added to 128 ml of 1.25M

  sodium chloride, NaCl (aq) to prepare 0.8M solution.

(3 marks)

SECTION B   (30 marks)

11. a. Explain any **one** physical method of removing water hardness.

_____

_____

_____

_____

_____ **(2 marks)**

b. With the aid of well labelled diagram explain how water circulates continuously between the earth's surface and the atmosphere.

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_____ **(8 marks)**

12. With the aid of a well labelled diagram, describe how alcohol can be produced locally from cereals, sugar and water.

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_____ **(8 marks)**

13. Describe how 250cm³ of a 0.5M magnesium sulphate solution could be prepared using hydrated magnesium sulphate crystals ($MgSO_4 . 7H_2O$).

RAMs: Mg = 24,   S = 32,   O = 16,   H = 1.

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_____ **(10 marks)**

END OF QUESTION PAPER