KCSE PREDICTIONS 2020

CHEMISTRY PAPER 2

1. (a) Use the information below to answer the questions that follow.

$Ca_{(S)} + \frac{1}{2}O_{2(g)} \rightarrow CaO_{(S)}$ $\Delta H = -635$ KJ mol^{-1}

$Ca_{(S)} + O_{2(g)} \rightarrow CaO_{2(g)}$ $\Delta H = -394$ KJ mol^{-1}

$Ca_{(S)} + e_{(S)} + \frac{3}{2}O_{2(g)} \rightarrow CaCO_{3(S)}$ $\Delta H = -1207$ KJ mol^{-1}

Calculate the enthalpy change for the reaction.

$CaO_{(S)} + CO_{2(g)} \rightarrow CaCO_{3(S)}$ **(3 marks)**

(b) State **one** factor that should be considered when choosing a fuel for cooking. **(1 mark)**

(c) The following data was obtained during an experiment to determine the molar heat of combustion of ethanol.

Volume of water used	= 500cm³
Initial temperature of water	= 25°C
Final temperature of water	= 44.5°C
Mass of ethanol + lamp before burning	= 121.5g
Mass of ethanol + lamp after burning	= 120.0g

Calculate the

(i) Heat evolved during the experiment (density of water = 1g/cm^3, specific heat capacity of water = 4.2Jg^{-1-}K^1).
(1 mark)

(ii) Molar heat of combustion of ethanol (C = 12, O = 16, H = 1). **(2 marks)**

(d) Write the thermo equation for the complete combustion of ethanol. **(1 mark)**

(e) At 298K and one atmosphere pressure, graphite changes into diamond according to the equation.

$$C_{(graphite)} \rightarrow C_{(diamond)} \qquad \Delta H = +2.9 \text{ KJ/mol}$$

In the space provided, sketch a simple energy level diagram for the above change. **(2 marks)**

(f). Study the information in the table below then answer the questions that follows.

Bond	Bond energy (kJmol^{-1}
H – H	435
Cl – Cl	243
H – Cl	431

Calculate the enthalpy change for the reaction.

$$H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$$ **(2 marks)**

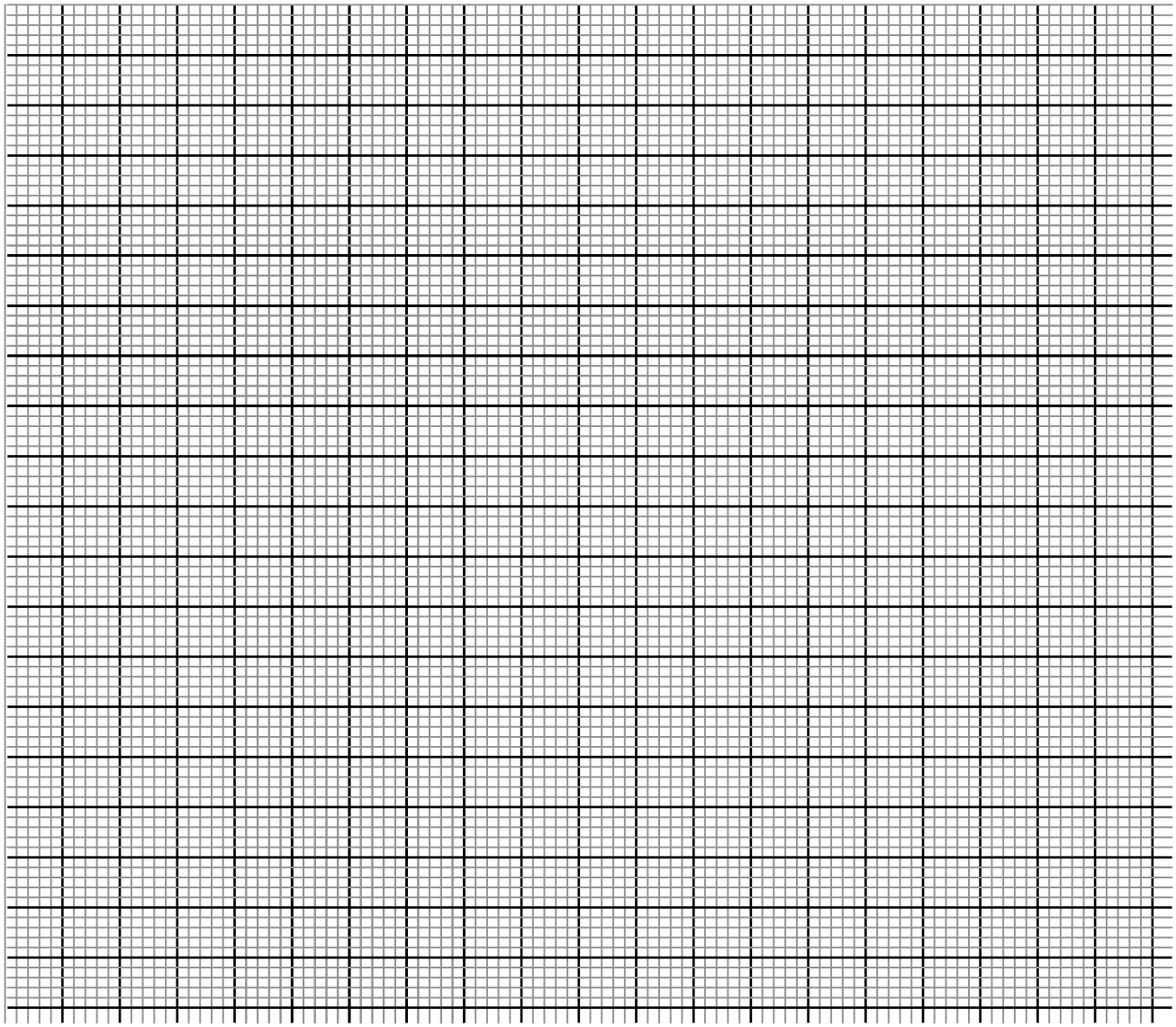
2. (a) At 25°C 50g of substance X were added to 100g of water to make a saturated solution.

What is meant a saturated solution? **(1 mark)**

(b) The table **below** gives the solubilities of substance X at different temperatures.

Temperature °C	14	24	33	40	46	52
Solubility g/100g H_2O	24	36	50	62	72	90

(i). Plot a graph of the solubility of substance X (vertical axis) against temperature. **(3 marks)**



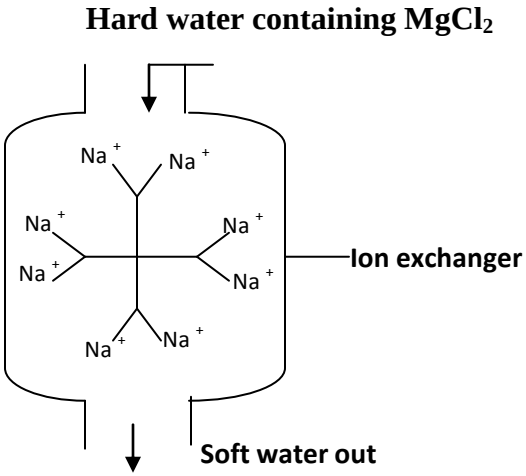
(ii) Using the graph.

I. Determine the solubility of substance X at 20°C. **(1 mark)**

II. Determine the mass of substance X that remained undissolved given that 90g of substance X were added to 100cm³ of water and warmed to 35°C. **(2 marks)**

III. Calculate the molarity of the solution at 30°C. (Relative formula mass of X = 122.5). **(3 marks)**

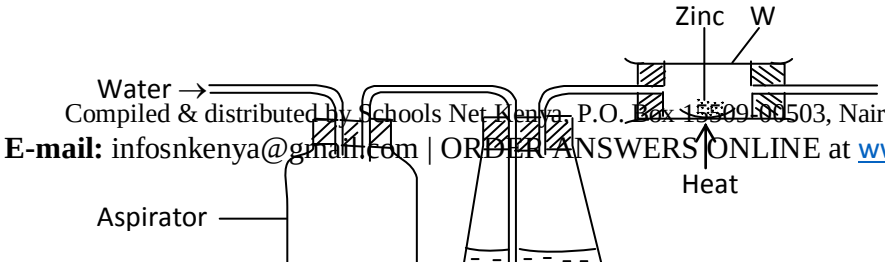
(c) The figure below shows an ion exchanger used to soften hard water



(i) Draw the ion exchanger and show how it will appear at the end of softening process. **(2 marks)**

(ii) How is the ion exchanger recharged after exhaustion **(1 mark)**

3.(a) Below is an incomplete diagram of a set-up of the apparatus used to obtain nitrogen gas from the air.



(i) Complete the diagram to show how nitrogen gas is collected. **(1 mark)**

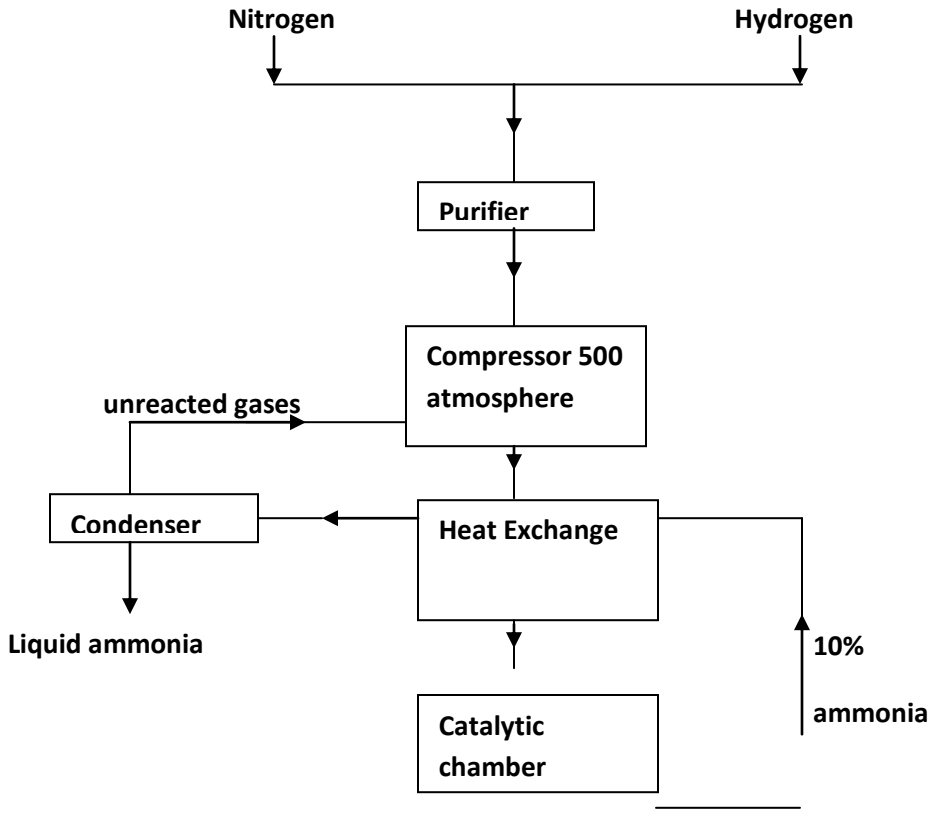
(ii) State the role of the following:

I Water entering the aspirator. **(1 mark)**

II Potassium hydroxide solution. **(1 mark)**

(iii).Write a chemical equation for the reaction that takes place in combustion tube. **(1 mark)**

(b).The diagram below represents the Haber's process for the manufacture of ammonia. Study it and answer the questions that follow.



(i) Name any **two** impurities removed by the purifier. **(2 marks)**

(ii) Name the catalyst used in the process **(1 mark)**

.....

(iii) In the Haber's process the conversion of nitrogen and hydrogen into ammonia is only 10%.

The remaining unreacted gases are recycled. What is the advantage of recycling. **(1mark)**

.....

iv) A part from the catalyst and pressure of 500 atmospheres, name any other condition required for this process. **(1mark)**

(c) Give any **two** uses of ammonia **(1 mark)**

.....

d) In the manufacture of nitric (V) Acid from ammonia and air, ammonia is catalytically oxidized to nitrogen (II) oxide

(i) Name the catalyst used in the reaction. **(1mark)**

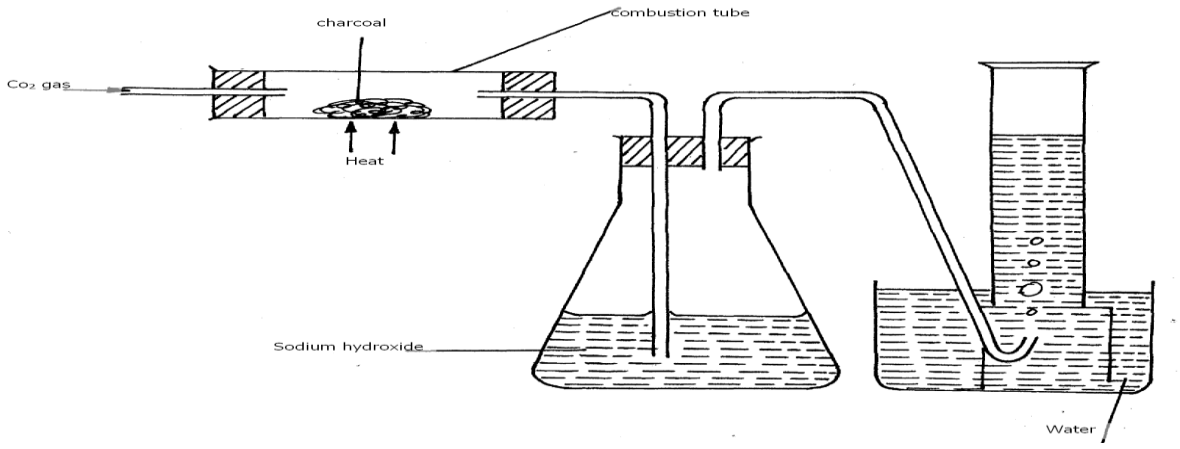
.....

(ii) Write a balanced chemical equation for the reaction between ammonia and air. **(1mark)**

(iii) State **one** environmental problem likely to be faced in an area where nitric (v) acid manufacturing plant is located. **(1 mark)**

.....

4. In an experiment, carbon (IV) Oxide gas was passed over heated charcoal and the gas produced collected as shown in the diagram below.



(i) Write an equation for the reaction that took place in the combustion tube . **(1 mark)**

(ii) Name another chemical substance that can be instead of sodium hydroxide . **(1 mark)**

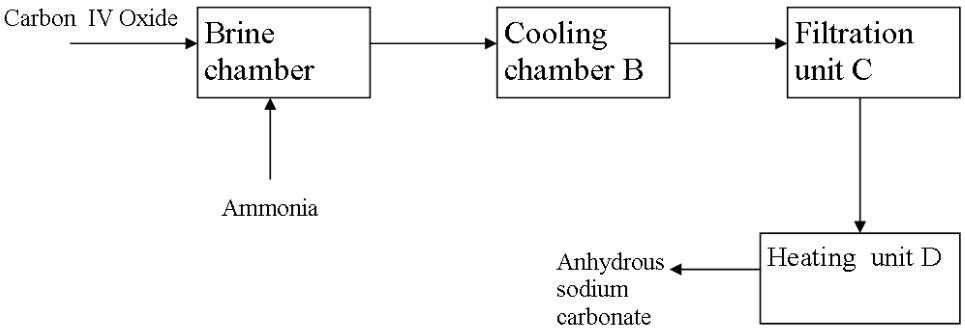
(iii) Describe a simple chemical test to distinguish between carbon (II) Oxide and carbon (IV) Oxide **(2 marks)**

(**iv)** What is the purpose of sodium hydroxide in the above set-up **(1 mark)**

(v) What property of the gas makes it possible to be collected ass shown above? **(1 mark)**

(vi) State one use of carbon (II) oxide **(1 mark)**

(b) In order to prepare sodium carbonate in the laboratory, students passed carbon (IV) oxide and ammonia gas into brine as shown in the flow diagram below. Use it to answer the questions that follow:

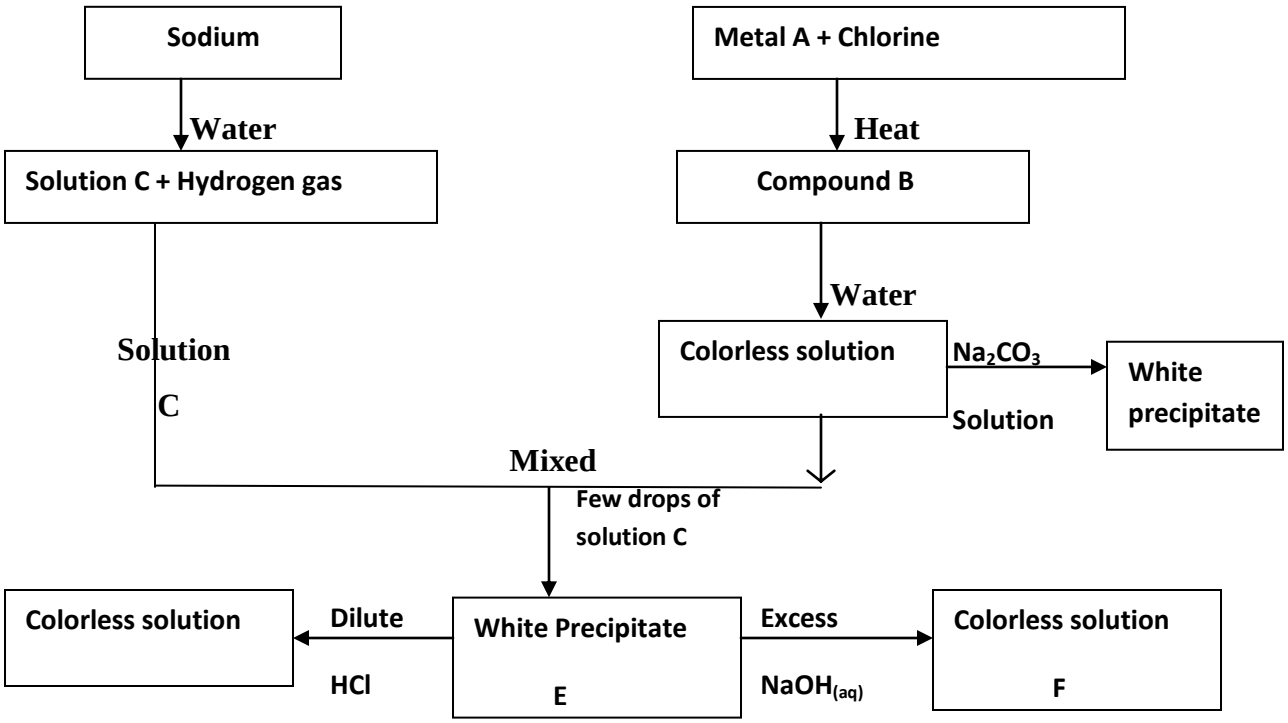


(i) Why is the mixture obtained in chamber A cooled down in chamber B? **(1 mark)**

(ii) Write an equation for the reaction that recurs in the heating chamber D **(1 mark)**

(iii) Give a reason why it is difficult to prepare potassium carbonate by the same method. **(1 mark)**

5. Study the flow diagram below and use it to answer the questions that follow.



(a) Give the name and formula of the following.

(i) White precipitate **E**

Name

(1 mark)

Formula

(1 mark)

(ii) Colourless solution F

Name

(1 mark)

Formula

(1 mark)

(b) What property is exhibited by white precipitate E when it reacts with Sodium hydroxide and HCl acid.

(1mark)

(c) Write an ionic equation for the reaction between white precipitate E and excess sodium hydroxide solution.

(1 mark)

(d) You are provided with.

i) Potassium carbonate solid

ii) Zinc hydroxide

iii) Nitric (v) acid

iv) Distilled water

State briefly how you would prepare solid zinc carbonate using the reagents given**.** **(3 marks)**

.....

.....

.....

.....

.....

(e) Distinguish between a weak acid and a strong acid giving an example of each. **(1 mark)**

(f). Identify an acid in the forward reaction given by the equation below:

$$HSO^-_{4(aq)} + H_2O_{(l)} \leftrightharpoons H_2SO_{4(aq)} + OH^-_{(aq)}$$ **(1 mark)**

6. The grid below shows part of the periodic table. Use it to answer the questions that follow. The letters do not represent actual symbols.

						S	U	V
P	R					T	X	W
Q								

(a) Which of the elements has the largest atomic radius? Explain. **(2 marks)**

(b) Identify the most reactive non-metal. Explain. **(2 marks)**

(c) Compare the atomic radius of P and R. **(1 mark)**

(d) Give the formula of one stable ion with an electron arrangement of 2.8 which is:

(i) Negativity charged divalent ion. **(2 marks)**

(ii) Positively charged monovalent.

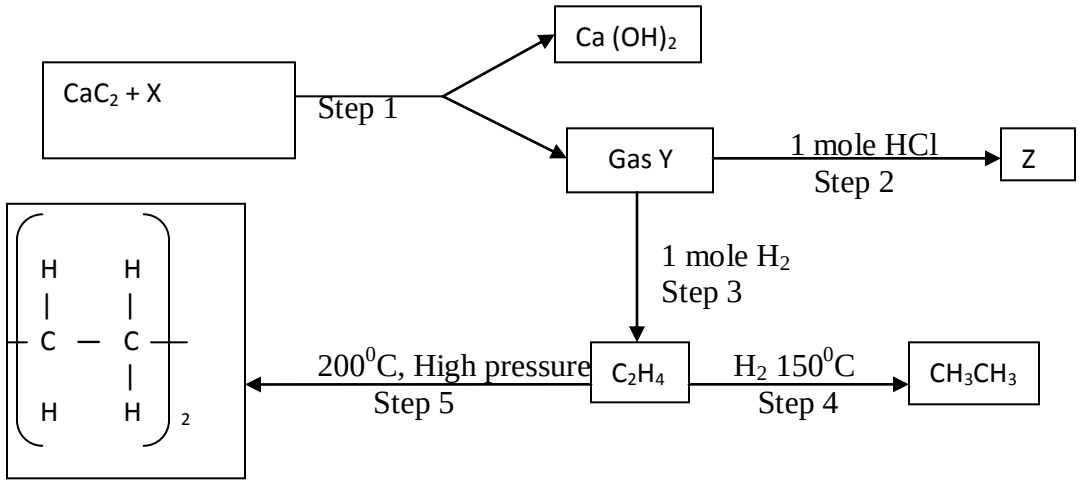
(e) Given that the mass number of W is 40. Write down the composition of its nucleus. **(1 mark)**

(f) Write the formula of the compounds formed between.

(i) Element R and X. **(1 mark)**

(ii) Give **one** property of the structure formed when R and X bond. **(1 mark)**

7. Study the diagram below and answer the questions that follow.

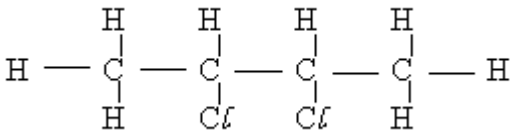


(i) Identify reagent X. **(1 mark)**

(ii) Draw the structural formula of gas Y. **(1 mark)**

(iii) What name is given to the process that takes place in step 5? **(1 mark)**

(b) An organic compound T reacts with chlorine gas in the presence of u.v light to form compound U. The structural formula of compound U is shown below.



Name the organic compound T and draw its structural formula. **(2marks)**

(c).The structure below represents two cleansing agents, L_1 and L_2.

$L_1 \rightarrow R - CH_2 - CH_3$

$|$

OSO_3Na^+

$L_2 \rightarrow R - COONa^+$

(i) Identify each of the two cleansing agents, L_1 and L_2.

L_1

(½mark)

L_2

(½mark)

(ii). State a disadvantage of each of the above cleansing agents.

L_1

(½mark)

L_2

(½mark)

(d) In an experiment an organic compound was reacted with absolute ethanol in the presence of concentrated sulphuric (VI) acid to form a compound whose formula is $CH_3\ CH_2\ CH_2\ COOCH_2\ CH_3$. Name

I. The type of reaction that took place. **(1 mark)**

II. The name of the organic compound to which the compound belonged. **(1 mark)**

(e) Write the structural formula and give the systematic name of the acid used in the above experiment. **(1 mark)**