CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

13 JANUARY 2020 (a.m.)

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FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE | 0 | 1 | 2 | 1 | 2 | 0 | 2 | 0 |

SUBJECT _____ CHEMISTRY – Paper 02 _____

PROFICIENCY _____ GENERAL _____

REGISTRATION NUMBER

SCHOOL/CENTRE NUMBER

NAME OF SCHOOL/CENTRE

CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

DATE OF BIRTH

SIGNATURE _____

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

CHEMISTRY

Paper 02 – General Proficiency

2 hours and 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions in TWO sections.

2. Answer ALL questions.

3. Write your answers in the spaces provided in this booklet.

4. Do NOT write in the margins.

5. Where appropriate, ALL WORKING MUST BE SHOWN in this booklet.

6. You may use a silent, non-programmable calculator to answer questions.

7. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**

8. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Do NOT spend more than 30 minutes on Question 1.

1. The rate of reaction of magnesium with a solution of dilute sulfuric acid can be investigated by measuring how long it takes for a specific volume of gas to be produced. Andrew conducted two experiments to investigate factors that can affect the rate of reaction between magnesium and sulfuric acid. In Experiment 1, magnesium strips were added to 50 cm^3 of 2 mol dm^{-3} sulfuric acid in a 250 cm^3 conical flask. The volume of gas produced over a period of six minutes was measured and some of the measurements are shown in Figure 1. The data recorded for Experiment 1 are summarized in Table 1 **on page 6**.
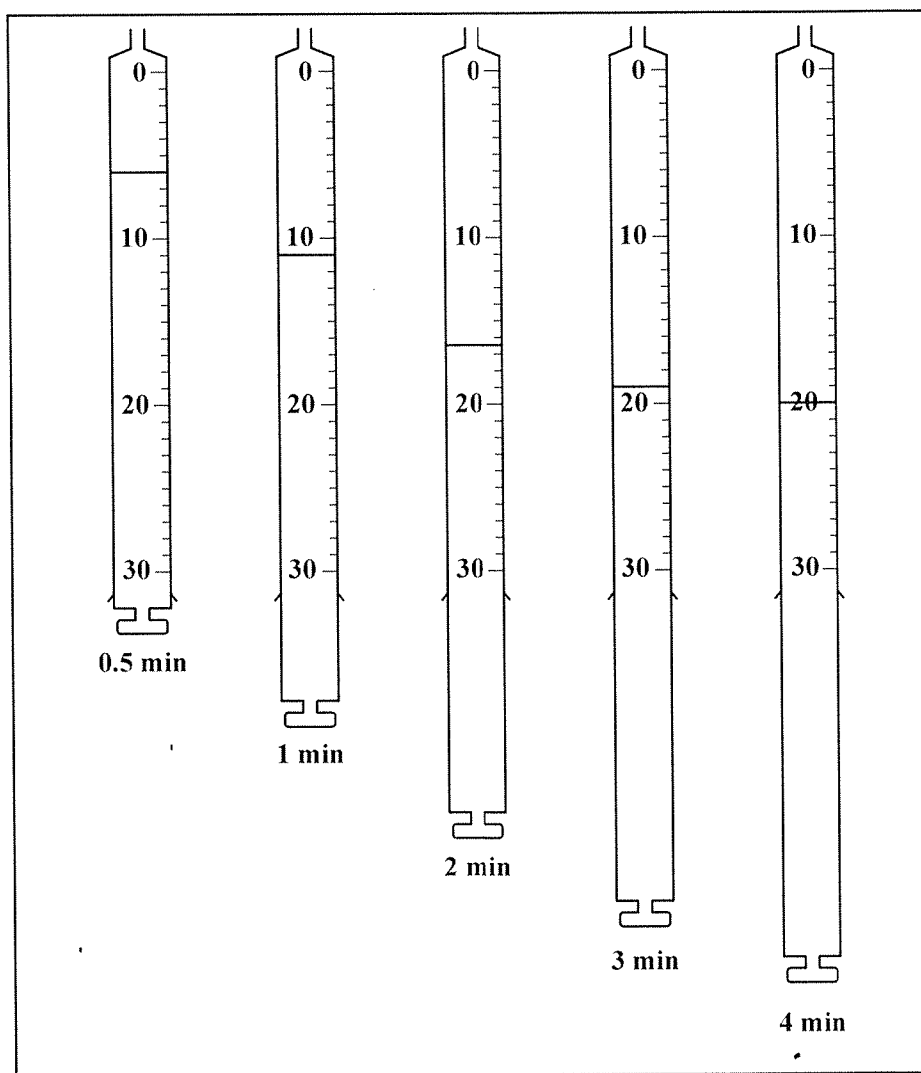
**Figure 1. Diagrams showing the volumes, in cm^3,
of gas produced as seen on a gas syringe**

01212020/J/CSEC 2020

(a)   Define the term 'rate of reaction'.

....

....

....

....

(1 mark)

(b)   (i)   From the gas syringes displayed in Figure 1 **on page 5**, record the volume of gas produced in the appropriate spaces in Table 1. The volume at times 0, 5 and 6 minutes have already been recorded.

TABLE 1: DATA FOR EXPERIMENT 1

Time/min	Volume of Gas Produced/cm^3
0	0
0.5	
1	
2	
3	
4	
5	20
6	20

(5 marks)

GO ON TO THE NEXT PAGE

(ii)   Use the data in Table 1 to plot a graph of the volume of gas produced against time, using the axes below.   **(5 marks)**
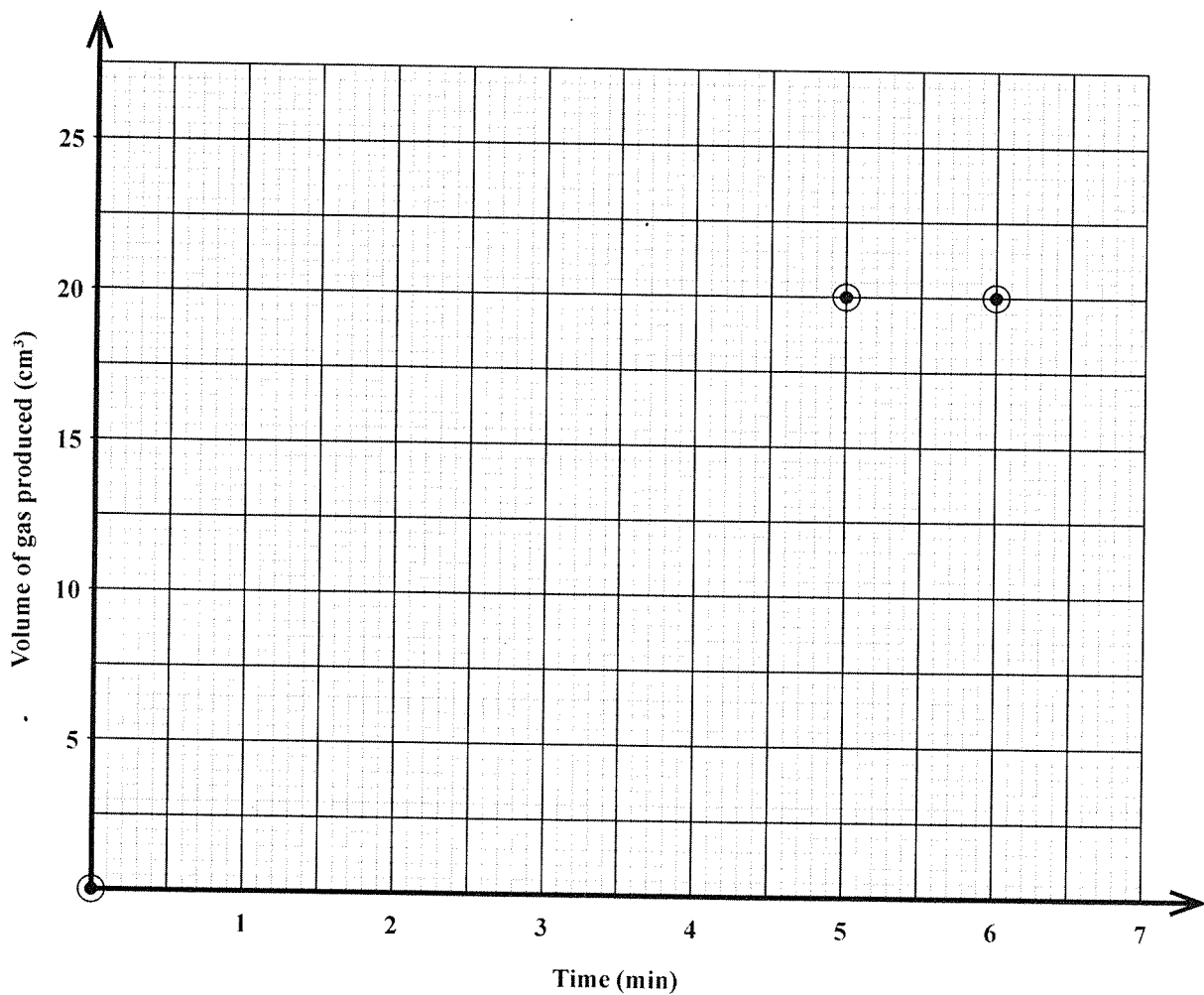
(iii)   From your graph, determine the time taken for the reaction to be completed.

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....

          (1 mark)

(iv)   During which time interval was the rate of reaction fastest?

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....

          (1 mark)

(v) Explain your answer in (b) (iv).

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(3 marks)

(vi) From your graph, determine the volume of gas produced at 2.5 minutes.

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(1 mark)

(vii) Use your answer in (b) (vi) to determine the number of moles of gas produced at 2.5 minutes.

[one mole of gas occupies 22.4 dm³ at standard temperature and pressure.]

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....

(3 marks)

(viii) Andrew wanted to identify the gas produced. He placed a lighted splint in a sample of the gas, which extinguished with a 'squeaky pop'. Deduce the identity of the gas.

....

....

(1 mark)

GO ON TO THE NEXT PAGE

(c)   (i)   Andrew's second experiment required the use of the same mass of magnesium but in the powdered form instead of strips. State the factor that Andrew is now investigating.

....

....

(1 mark)

(ii)   Write a balanced chemical equation with state symbols for the reaction that occurred between magnesium and sulfuric acid in the experiments.

....

....

(2 marks)

(iii)   State ONE factor, other than the factor investigated by Andrew, which can affect the rate of a reaction.

....

....

(1 mark)

Total 25 marks

2.   (a)   When oxidation and reduction occur together during a chemical reaction, the reaction is described as REDOX. Some substances can act as oxidizing agents while others act as reducing agents. The equation for the REDOX reaction between aqueous copper (II) chloride and aqueous iodide is given below.

$$2Cu^{2+}(aq) + 4I^-(aq) \rightarrow 2CuI(s) + I_2(aq)$$
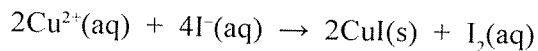
(i)   Define 'reduction' in terms of oxidation states.

....

....

(1 mark)

(ii)   Deduce the oxidation state of Cu in CuI.

....

....

(1 mark)

(iii)   Define the term 'oxidizing agent'.

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(2 marks)

(iv)   With reference to the equation above, state, with a reason, which substance is acting as an oxidizing agent.

....

....

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....

(2 marks)

(v)   Solution A was added to a small portion of an aqueous solution of potassium iodide in a test tube. The colourless potassium iodide turned brown. State whether Solution A contained an oxidizing agent or a reducing agent.

....

....

(1 mark)

(vi) Explain your answer in (a) (v).

....

....

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....

(2 marks)

(vii) Write a balanced chemical equation to show the formation of the brown product in the reaction in (a) (v).

....

....

(2 marks)

(b)   When a piece of zinc metal was added to an aqueous solution of copper (II) sulfate in a test tube, a chemical reaction occured as shown in the equation below.

$$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$$
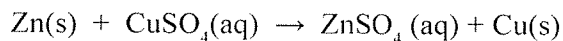
Describe what is observed with regard to the chemical reaction that occurs in the test tube.

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(2 marks)

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(c) One of the substances in the equation in (b) **on page 11**, is acting as a reducing agent. Describe a simple laboratory test that could be used to identify a reducing agent.

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(2 marks)

Total 15 marks

3. (a) List THREE characteristics of a homologous series.

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(3 marks)

(b) (i) Draw the FULLY displayed structural formula for Compound A which has the molecular formula C_3H_8.

Compound A

(2 marks)

GO ON TO THE NEXT PAGE

(ii) State the homologous series to which Compound A belongs.
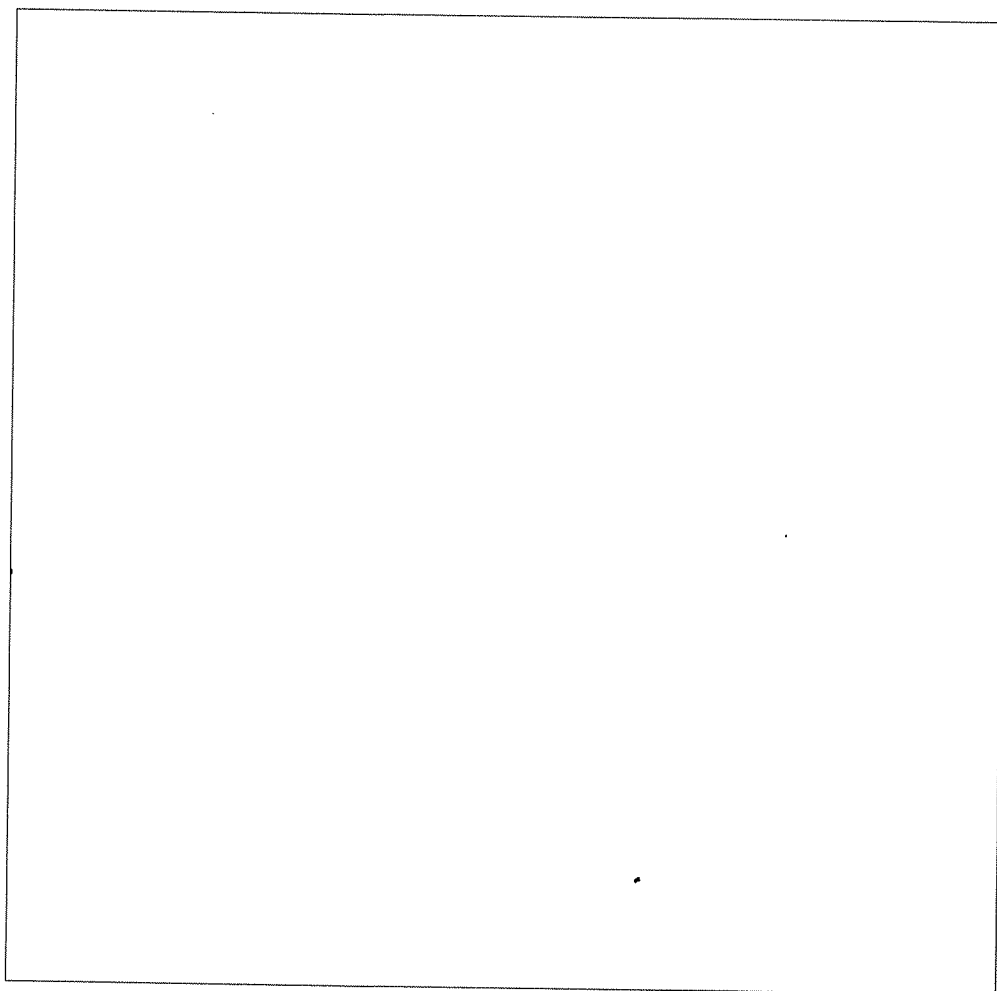
....

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(1 mark)

(iii) Write the molecular formula for the compound which has five carbon atoms of the homologous series stated in (b) (ii).

....

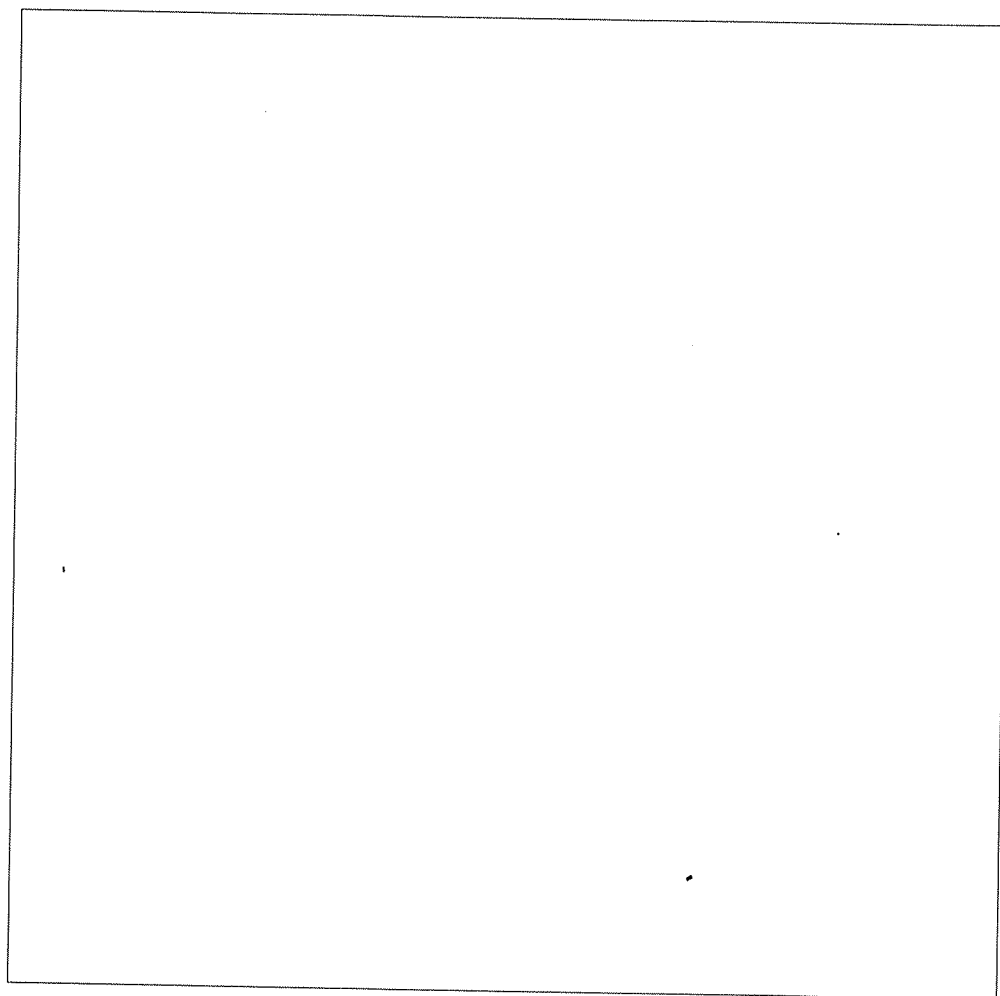..

(1 mark)

(c) (i) Draw the FULLY displayed structural formula for Compound B which has the molecular formula C_3H_6.

Compound B

(2 marks)

GO ON TO THE NEXT PAGE

(ii) State the homologous series to which Compound B belongs.

....

....

(1 mark)

(iii) Write the molecular formula for the compound which has five carbon atoms of the homologous series stated in (c) (ii).

....

....

(1 mark)

(d) For EACH of the following homologous series write

(i) the general formula

Carboxylic acid ....

Alcohol ....

(2 marks)

(ii) the name of the first member.

Carboxylic acid ....

Alcohol ....

(2 marks)

Total 15 marks

SECTION B

Answer ALL questions.

4.　　(a)　　Jack was required to conduct an investigation on the electrolysis of concentrated sodium chloride solution.

　　　　　　(i)　　Identify TWO ions present in the electrolyte and include their state symbols.

　　　　　　...

　　　　　　...

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(2 marks)

　　　　　　(ii)　　State TWO factors that affect the discharge of an ion in the electrolyte during electrolysis.

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　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(2 marks)

　　　　　　(iii)　　Predict which ions present in the electrolyte will be attracted towards the anode.

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　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(2 marks)

　　　　　　(iv)　　Write a balanced equation for the reaction at the anode.

　　　　　　...

　　　　　　...

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(2 marks)

GO ON TO THE NEXT PAGE

(v) Write a balanced equation for the reaction at the cathode.

....

....

(2 marks)

(b) State whether EACH of the substances given in Table 2 are classified as conductors or non-conductors.

TABLE 2: CLASSIFICATION OF SUBSTANCES

Substance	Classification of Substance
Magnesium ribbon	
A plastic ruler	
An aqueous solution of magnesium chloride	

(3 marks)

(c) Carbon is an example of a non-metal. State TWO uses of carbon.

....

....

....

....

(2 marks)

Total 15 marks

5. (a) Compound C is a sweet-smelling compound which is often used in flavouring and perfumes.
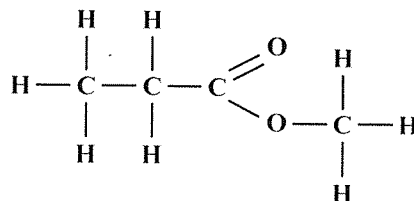
Compound C

(i) State the name of Compound C and the homologous series to which it belongs.

....

....

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....

(2 marks)

(ii) Draw the FULLY displayed structural formulae of the two molecules that are produced when Compound C is hydrolysed.

(2 marks)

(b)   Ethanol is widely used as a solvent for making cosmetics and perfumes.
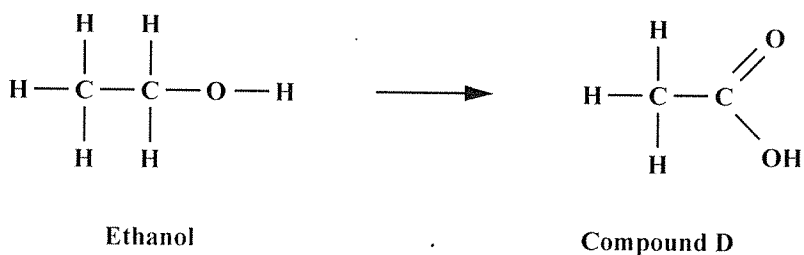
Ethanol   .   Compound D

(i)   State the name of Compound D and identify the reagent and conditions necessary for ethanol to be converted into Compound D.

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(3 marks)

(ii) Explain how ethanol can be made from the fermentation of sugar. Include the chemical equation for the overall fermentation process.

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(7 marks)

(iii) State ONE **other** use of ethanol.

....

....

(1 mark)

Total 15 marks

6.   (a)   Many metals undergo corrosion when exposed to certain conditions. Figure 2 shows an experiment where iron nails are exposed to different conditions.
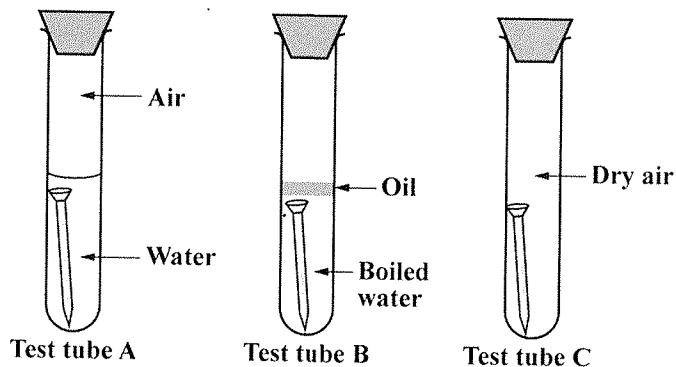

Figure 2. Iron nails under different conditions

     (i)   State the TWO conditions necessary for the corrosion of a metal.

....

....

....

....

                                        (2 marks)

     (ii)   State whether corrosion will occur for EACH of the test tubes shown in Figure 2. Give ONE reason to support your answer in EACH case.

Test tube A ....

....

Test tube B ....

....

Test tube C ....

....

                                        (6 marks)

(iii)   Suggest the reason why the boiled water was covered with oil in Test tube B.

....

....

(1 mark)

(b)   Aluminium has been used in the manufacture of various alloys because of its corrosion resistant properties.

(i)   State ONE alloy of aluminium and its use.

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(2 marks)

(ii)   Explain why the corrosion of aluminium is beneficial.

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(2 marks)

(iii)   Write a balanced equation to show the product formed when aluminium is left exposed to air.

....

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(2 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.