

FORM TP 2024005



TEST CODE 01212020

JANUARY 2024

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

CHEMISTRY

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions in TWO sections. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. Where appropriate, ALL WORKING MUST BE SHOWN in this booklet.
5. You may use a silent, non-programmable calculator to answer questions.
6. 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.**
7. **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.

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SECTION A

Answer ALL questions.

DO NOT spend more than 30 minutes on Question 1.

1. Marcus was asked to design an experiment to investigate how the solubility of potassium nitrate (KNO_3) varied with temperature.

“It is known that potassium nitrate is soluble in water but not soluble in pentane.”

- (a) Explain why the statement above is true.

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(3 marks)

The procedure that Marcus used to carry out the experiment to investigate how the solubility of potassium nitrate (KNO_3) varied with temperature is outlined below.

Procedure

- Exactly 100 cm³ of distilled water was measured and poured into a clean, dry 250 cm³ beaker.
- The beaker with the water was weighed and the mass recorded in Table 1, on page 6.
- While maintaining the temperature at 10 °C, solid potassium nitrate was added slowly, with stirring, until no more salt dissolved.
- The beaker with the salt solution was weighed and the mass recorded in Table 1, on page 6.
- The experiment was repeated with six different 250 cm³ beakers while maintaining temperatures of 20 °C, 30 °C, 40 °C, 50 °C, 60 °C and 70 °C.

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Figure 1 shows the reading on the balance for the mass of the beaker and salt solution, in grams, for each corresponding temperature.

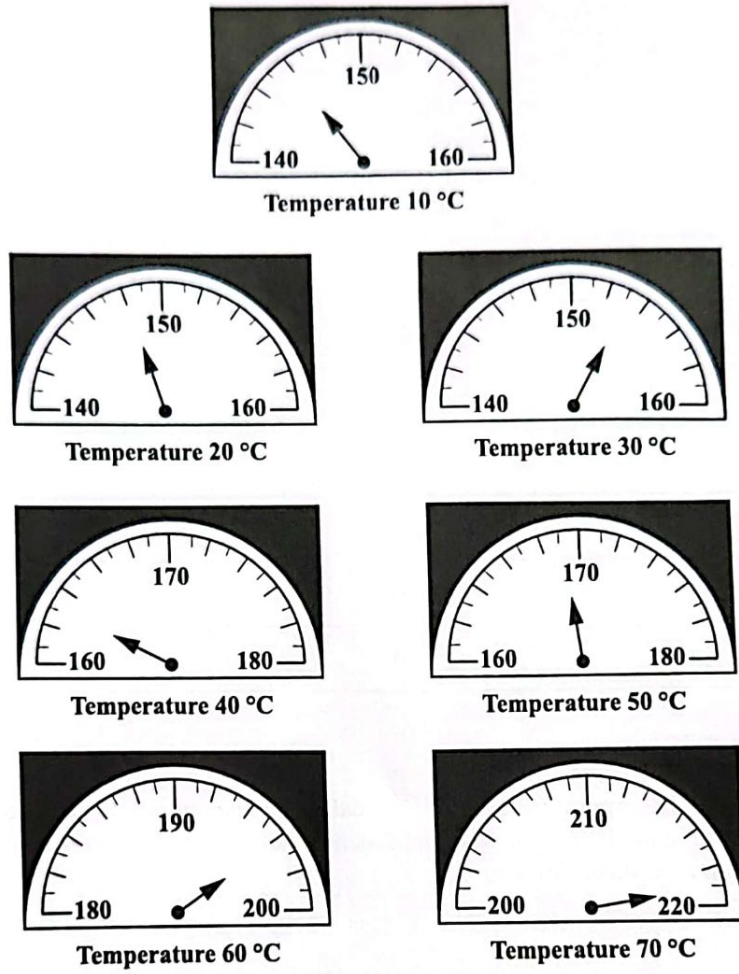


Figure 1. Mass of beaker and salt solution in grams for each corresponding temperature



- (b) For EACH temperature shown in Figure 1 on page 5, record, in Table 1, the corresponding mass of the beaker and the salt solution.

**TABLE 1: MASS OF POTASSIUM NITRATE SOLUTION
AT VARYING TEMPERATURES**

Temperature (°C)	Mass of Beaker and 100 cm ³ of Water (g)	Mass of Beaker and Salt Solution (g)	Mass of Salt Dissolved (g)
10	110	146	36
20	110	148	
30	110		
40	110		
50	110		
60	110		
70	110		

(5 marks)

- (c) For EACH temperature in Table 1, calculate the mass of potassium nitrate that was dissolved in the beaker of water and record the value in the space provided. The first one has been completed for you.

(3 marks)

- (d) Using the axes provided in Figure 2 on page 7, plot a graph of the mass of salt dissolved (solubility) against temperature and draw a smooth curve.

(5 marks)



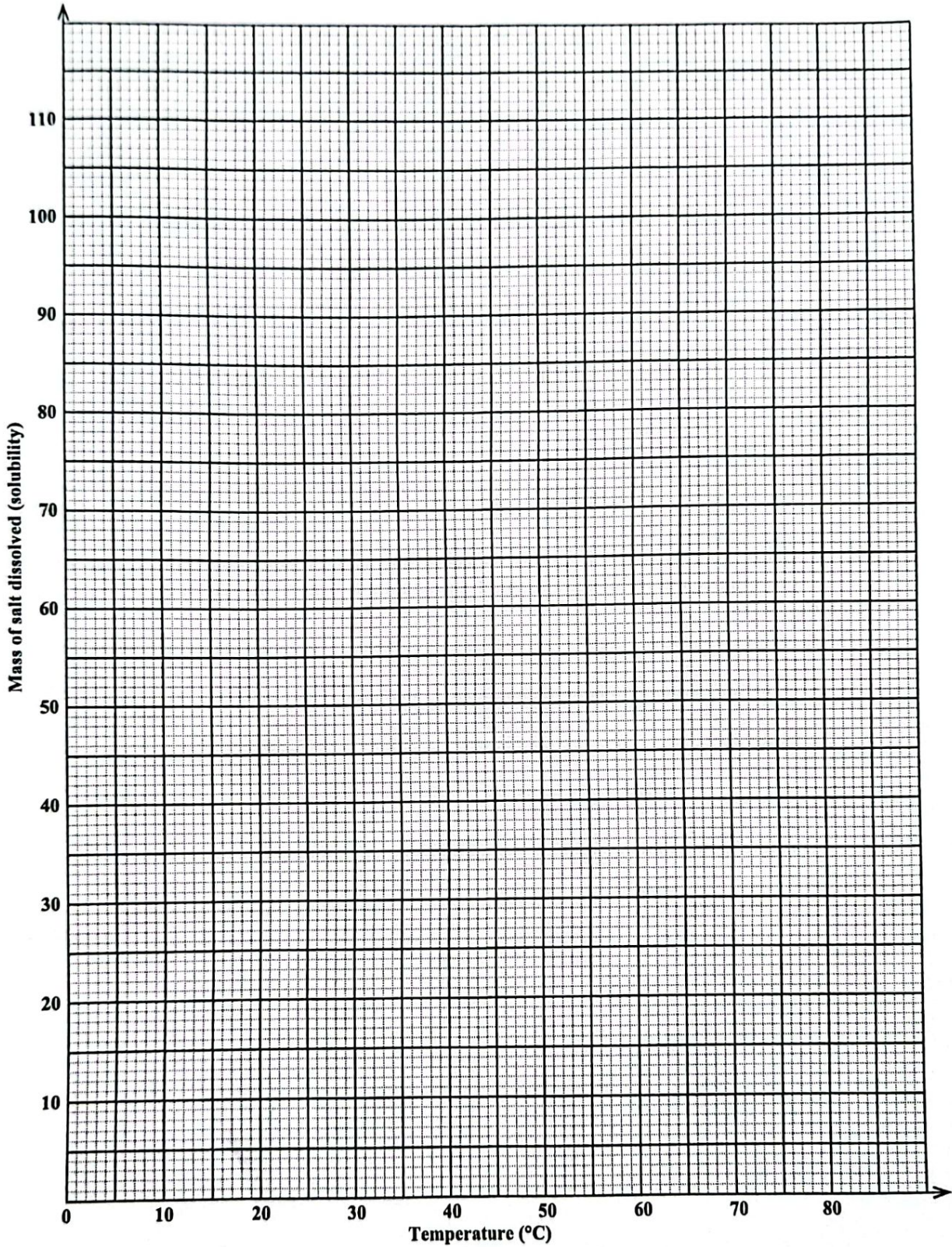


Figure 2. Mass of salt dissolved (solubility) against temperature

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2. W, X, Y and Z are four elements found in the periodic table. Their positions in the periodic table in relation to the elements sodium (Na) and chlorine (Cl) are shown in Figure 3.

Na	W					Cl	Z
	X			Y			

Figure 3. Selected elements of the periodic table

- (a) State how the elements in the periodic table are arranged.

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.....
(1 mark)

- (b) Using the elements W, X, Y and Z from Figure 3 above,

- (i) state the pair of elements found in the same period

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.....
(1 mark)

- (ii) identify the elements in Group 2

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(1 mark)

- (iii) state which element in Group 2 is more reactive

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(1 mark)



(iv) write a balanced chemical equation, including state symbols, for the reaction between Element X and dilute hydrochloric acid.

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(3 marks)

(c) Sodium and chlorine are pure substances. However, they are found combined in sodium chloride which dissolves in water to form a mixture.

(i) State the difference between a mixture and a pure substance.

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(ii) State TWO other examples of a pure substance.

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(2 marks)

(iii) Name the type of mixture formed when sodium chloride is dissolved in water.

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(1 mark)

(iv) Identify a separation technique that can be used to remove the sodium chloride from the water.

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(1 mark)



(d) Another salt of chlorine, silver chloride, does not dissolve in water.

(i) Name the type of mixture formed when a small quantity of silver chloride is added to a beaker of water.

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(1 mark)

(ii) Suggest a separation technique that can be used to remove the silver chloride from the beaker of water.

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(1 mark)

Total 15 marks



(b) (i) List THREE general characteristics of a homologous series.

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(3 marks)

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

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(1 mark)

(iii) Write the general formula for the homologous series to which Compound A belongs.

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(1 mark)

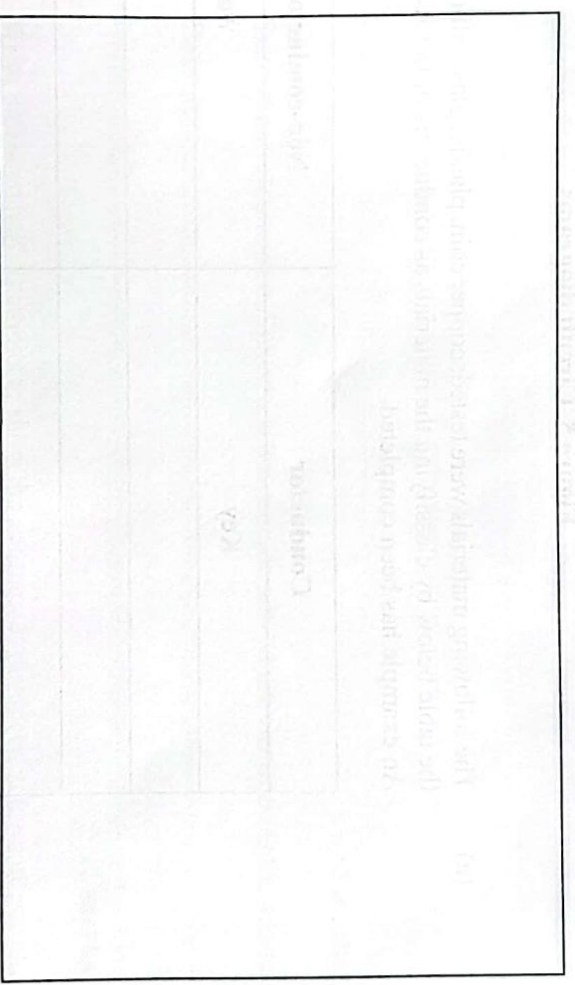
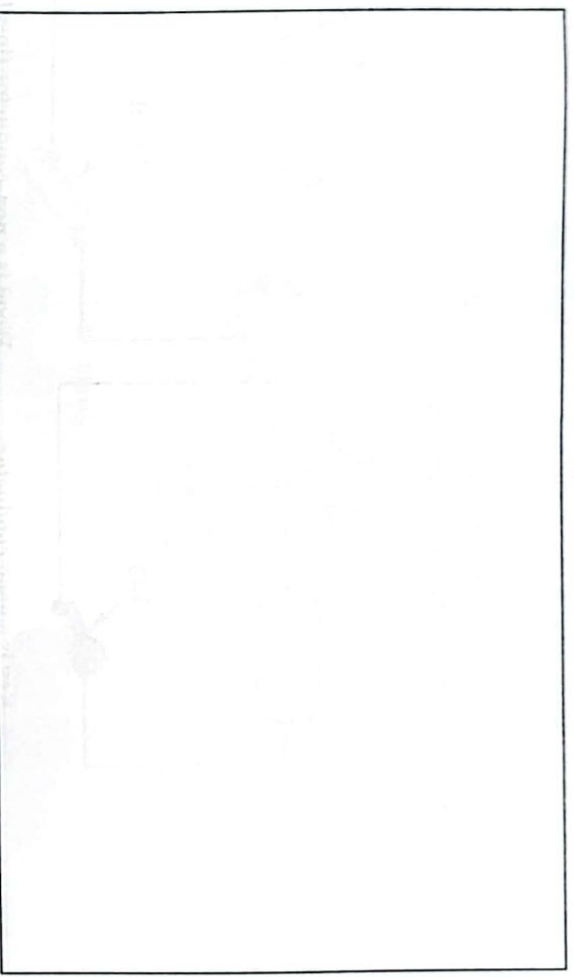
(iv) Write the molecular formula for Compound A.

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(1 mark)



- (e) (i) In the space provided below, draw the FULLY displayed structure of TWO structural isomers of Compound A.



(4 marks)

- (ii) State the names of the TWO isomers drawn in (e) (i).

Name of Isomer 1

Name of Isomer 2 (2 marks)

Total 15 marks



SECTION B

Answer ALL questions.

4. Figure 5 are circuit diagrams which shows the apparatus that was used to conduct an investigation to determine which materials are conductors or non-conductors (insulators) of electricity.

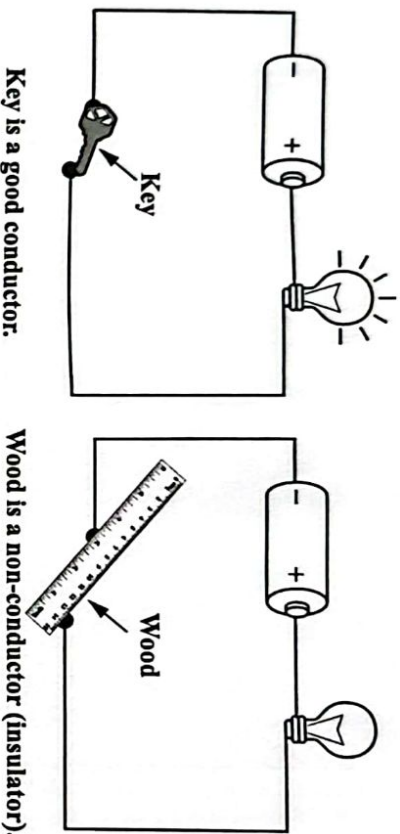


Figure 5. Circuit diagrams

- (a) The following materials were tested: copper coin, plastic, glass, aluminium can. Complete the table below by classifying the materials as conductors or non-conductors (insulators). An example has been completed.

Conductor	Non-conductor (insulators)
Key	Wood

(2 marks)



(b) Figure 6 shows an electrolytic cell which is used to test a dilute aqueous solution of sodium chloride.

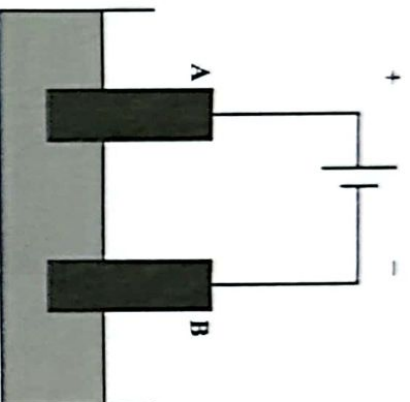


Figure 6. Electrolytic cell

(i) State ONE way in which the conduction of electricity in the solution of sodium chloride is different from that in the copper coin.

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..... (2 marks)

(ii) State which electrode in Figure 6 is the cathode and which electrode is the anode.

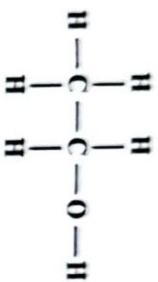
Cathode
Anode (2 marks)

(iii) Write balanced half equations to show the substances produced at the cathode and the anode.

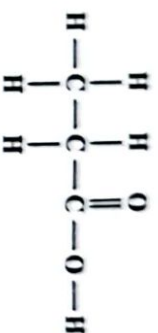
Cathode
Anode (4 marks)



5. Figure 7 shows the fully displayed structures of Compound B and Compound C, which are from different homologous series.



Compound B



Compound C

Figure 7. Fully displayed structures of Compound B and Compound C

(a) (i) State the name of Compound B and Compound C.

Compound B

Compound C

(2 marks)

(ii) State the functional group present in Compound B.

.....

(1 mark)

(b) Which of the two compounds, B or C, is more soluble in water?

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(1 mark)



(c) Compound B is made during wine production using yeast.

(i) Name the process used to make Compound B.

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(1 mark)

(ii) Describe the purpose of yeast in the production of wine.

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(2 marks)

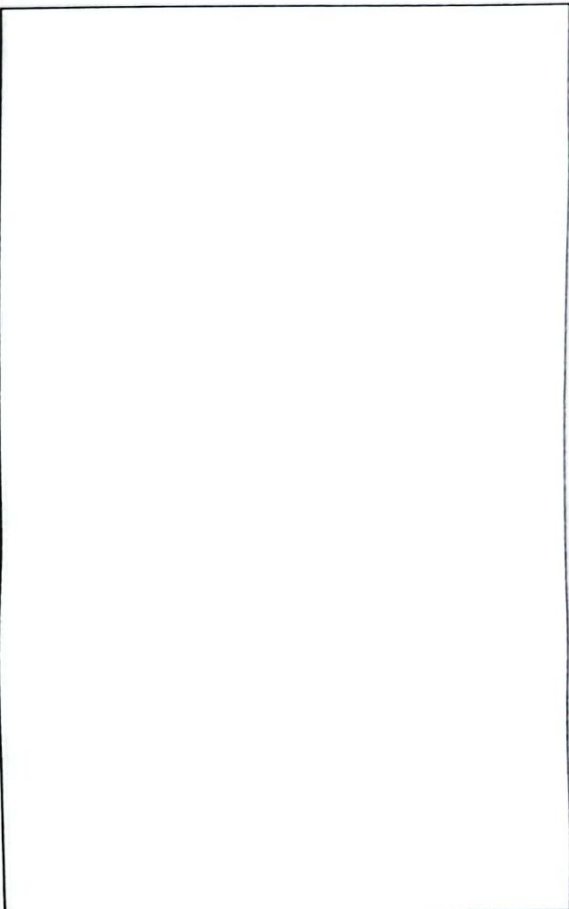
(iii) Write a balanced chemical equation, including state symbols, to show how Compound B can be made during the production of wine.

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(3 marks)



(d) Compound D and water are formed from the reaction between Compound B and Compound C.

(i) Draw the FULLY displayed structure of Compound D.



(2 marks)

(ii) Compound D can be used in the production of polymers. Define the term 'polymer'.

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(2 marks)

(iii) State the type of polymerization that Compound D engages in.

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(1 mark)

Total 15 marks



8. (a) CFCs are non-metal compounds that negatively impact the environment.

(i) State the full name for CFCs.

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(1 mark)

(ii) Give a named example of a CFC and state its formula.

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(2 marks)

(iii) Give the formula of a molecule with which CFCs react in the environment.

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(1 mark)

(iv) In many Caribbean countries, the use of CFCs as aerosol propellants is considered harmful to the environment. Hence, CFCs have been restricted in aerosol propellants or banned. Explain why CFCs are harmful to the environment.

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(3 marks)



(b) Chlorine is a gas that has many uses.

(i) State ONE use of chlorine gas.

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(1 mark)

(ii) State a laboratory test that can be used to identify chlorine gas.

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(1 mark)

(iii) A student reacts chlorine gas with aqueous potassium iodide to produce aqueous potassium chloride and a solid. Write a balanced equation, including state symbols, for the reaction.

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(3 marks)

(iv) From the balanced equation in (b) (iii), deduce whether chlorine is acting as a reducing or an oxidizing agent by showing the changes in the oxidation states of chlorine.

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(3 marks)

Total 15 marks

END OF TEST

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

