



TEST CODE **02212020**

FORM TP 2012156

MAY/JUNE 2012

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

CHEMISTRY

UNIT 2 – Paper 02

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX compulsory questions in TWO sections.
2. Section A consists of THREE structured questions, one from each Module. Section B consists of THREE extended response questions, one from each Module.
3. For Section A, write your answers in the spaces provided in this booklet. For Section B, write your answers in the answer booklet provided.
4. All working must be shown.
5. The use of non-programmable calculators is permitted.
6. A data booklet is provided.

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

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02212020/CAPE 2012

SECTION A

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

MODULE 1

THE CHEMISTRY OF CARBON COMPOUNDS

1. (a) Draw and state the name of FOUR isomeric alcohols with formula $C_4H_{10}O$.

(i)	(ii)
Name _____	Name _____

(iii)	(iv)
Name _____	Name _____

[8 marks]

- (b) Identify the type of isomerism illustrated in (a) above.

_____ [1 mark]

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- (c) State ONE other **type** of isomerism that can be displayed by alcohols.

[1 mark]

- (d) EACH isomer in 1. (a) on page 2 was treated with acidified potassium permanganate. Describe the expected observation in EACH case.

Alcohol	Observation
(i)	
(ii)	
(iii)	
(iv)	

[4 marks]

- (e) $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+_{(\text{aq})}$ would also react with the alcohols in a way similar to $\text{KMnO}_4/\text{H}^+_{(\text{aq})}$.

State the colour change with $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+_{(\text{aq})}$ which would indicate a positive result.

[1 mark]

Total 15 marks

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MODULE 2

ANALYTICAL METHODS AND SEPARATION TECHNIQUES

2. (a) State ONE use of chromatography in criminal investigations.

[1 mark]

- (b) Outline FOUR essential experimental steps in the separation of the components of a dye using thin-layer chromatography (TLC).

[4 marks]

- (c) Define the terms 'stationary phase' and 'mobile phase' in relation to thin-layer chromatography (TLC).

Stationary phase

Mobile phase

[2 marks]

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- (d) Name TWO materials commonly used as the stationary phase in TLC.

[2 marks]

- (e) Figure 1 shows the separation of the components of a dye on a TLC plate.

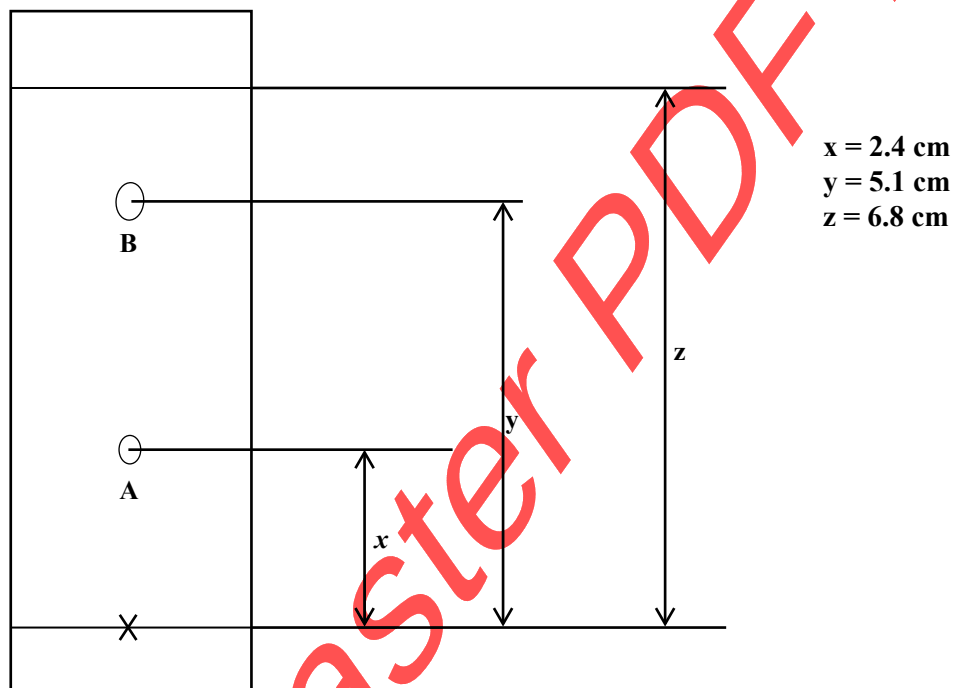


Figure 1. The separation of the components of a dye using TLC

- (i) Calculate the R_f values of components A and B.

R_f values of component A _____

[1 mark]

R_f values of component B _____

[1 mark]

GO ON TO THE NEXT PAGE

- (ii) Suggest TWO reasons for the difference in the R_f values of A and B.

[2 marks]

- (iii) State TWO factors, other than the distance travelled by the solvent, which influence the R_f value of a solute.

[2 marks]

Total 15 marks

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MODULE 3

CHEMISTRY AND THE ENVIRONMENT

3. (a) Describe how the concepts of reuse, recycle and reduce can be applied to paper as a solid waste.

Paper

Reuse

[1 mark]

Recycle

[1 mark]

Reduce

[1 mark]

- (b) Suggest TWO ways in which the presence of nuclear waste can affect the terrestrial environment.

[2 marks]

- (c) In landfills, chemical and microbial reactions can lead to the formation of gaseous pollutants. State the names OR chemical formulae of TWO landfill gases.

[2 marks]

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- (d) (i) Describe, **with the aid of equations**, the steps involved in the fermentation of sucrose.

[5 marks]

- (ii) When beer is exposed to air for some time, it produces a sharp smell and is described as becoming “sour”.

Identify TWO possible compounds responsible for the sharp smell and state the type of reaction responsible.

Compound 1: _____

Compound 2: _____

Type of Reaction _____

[3 marks]

Total 15 marks

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SECTION B

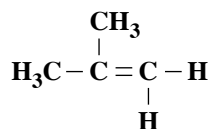
Answer ALL questions in this section.

Write your answers in the answer booklet provided.

MODULE 1

THE CHEMISTRY OF CARBON COMPOUNDS

4. Compound A is an alkene. Study its structural formula given below and answer the questions which follow.



Compound A

- (a) Give the structural formula for the reaction of Compound A with
- (i) aqueous bromine
 - (ii) liquid bromine
 - (iii) cold KMnO_4/H^+
 - (iv) hot KMnO_4/H^+ . [6 marks]
- (b) State whether Compound A exhibits geometric (cis/trans) isomerism. [1 mark]
- (c) Give TWO reasons for your answer in (b). [2 marks]
- (d) Outline the mechanism for the reaction between Compound A and HBr , using curved arrows to show the movement of electrons. [5 marks]
- (e) State the type of reaction mechanism outlined in (d) above. [1 mark]

Total 15 marks

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MODULE 2

ANALYTICAL METHODS AND SEPARATION TECHNIQUES

5. (a) Two pieces of apparatus used in the filtration process are shown in Figure 2 and Figure 3 respectively.

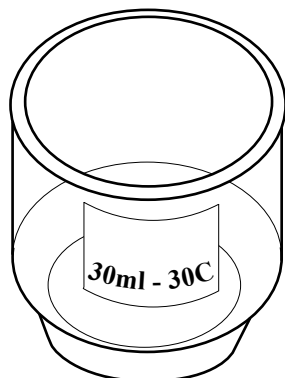


Figure 2

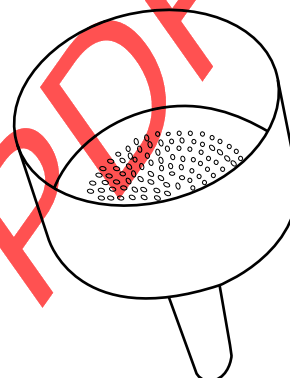


Figure 3

State the names and functions of these pieces of apparatus.

[5 marks]

- (b) When a solute is shaken in a mixture of two immiscible solvents and allowed to stand, a dynamic equilibrium is established in which the solute is partitioned or distributed between the two solvents.
- (i) Write an equation to explain the term 'partition coefficient' or 'distribution coefficient' using the example of an ester dissolved in a mixture of water and toluene. **[1 mark]**
- (ii) State TWO factors which affect the value of the partition coefficient. **[2 marks]**
- (iii) Explain the principles of solvent extraction with respect to the recovery of an organic compound from an aqueous solution. **[4 marks]**
- (iv) A solution of 10.0 g of an ester, Y, in 100 cm³ of water was shaken with 200 cm³ of ether. After separation, the aqueous solution was found to contain 1.6 g of Y.

Calculate the partition coefficient of Y between ether and water.

[3 marks]

Total 15 marks

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MODULE 3

INDUSTRY AND THE ENVIRONMENT

6. (a) List FOUR factors which would influence the location of an industrial plant. [4 marks]
- (b) State TWO safety concerns associated with the locating of an ammonia plant and for EACH concern suggest a measure that can be taken to reduce its effect. [4 marks]
- (c) The reduction in harmful gaseous emission from vehicles has been achieved by fitting vehicles with catalytic converters. These allow for the conversion of carbon monoxide and nitrogen monoxide to carbon dioxide and nitrogen, respectively.

Write TWO equations for these conversions.

[4 marks]

- (d) The burning of fossil fuels in industrialised countries emits sulphur dioxide as one of the combustion products.

- (i) ONE reason why sulphur dioxide is considered to be a pollutant is that it produces acid rain.

Write an equation to support this reason.

[2 marks]

- (ii) Give ONE reason (other than the production of acid rain) why sulphur dioxide is considered to be a pollutant. [1 mark]

Total 15 marks

END OF TEST

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