

FORM TP 2015159



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MAY/JUNE 2015

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

CHEMISTRY

UNIT 2 – Paper 02

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. A data booklet is provided.
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.

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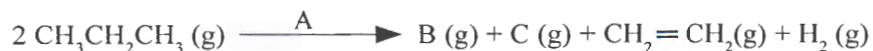
SECTION A

Answer ALL questions.

MODULE 1

THE CHEMISTRY OF CARBON COMPOUNDS

1. Propane is one of the major components of liquefied petroleum gas (LPG). The petroleum industry uses a process to produce another alkane and two alkenes from propane according to the equation below.



- (a) (i) Identify the process represented by the equation.

.....
[1 mark]

- (ii) State the conditions at A.

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[1 mark]

- (iii) Write the condensed structural formulae of

B

C

[2 marks]

- (b) (i) Account for the tetravalency of the carbon atom.

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[2 marks]



- (ii) Aqueous bromine will only react with propane in sunlight but aqueous bromine reacts quickly with propene without sunlight.

Using appropriate notation and equations, explain the steps involved in the mechanism of the chemical reaction of aqueous bromine with propane (in sunlight) **OR** aqueous bromine with propene (without sunlight).

[4 marks]

- (iii) Name the mechanism of the reaction selected in (b) (ii).

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[1 mark]

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(c) Describe the observations expected when

(i) aqueous bromine is added to liquid heptane (in sunlight)

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[2 marks]

(ii) acidified potassium permanganate solution is added to liquid heptene (without sunlight).

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[2 marks]

Total 15 marks



MODULE 2

ANALYTICAL METHODS AND SEPARATION TECHNIQUES

2. (a) In a titrimetric analysis, state ONE operation which can affect

(i) accuracy

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[1 mark]

(ii) precision.

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[1 mark]

(b) List TWO requirements which a primary standard reagent that is to be used in a titrimetric analysis must satisfy.

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[2 marks]

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- (c) In a thermometric titration, 25 cm³ of 2 mol dm⁻³ NaOH were used to determine the concentration of hydrochloric acid.
- (i) Using the results in Table 1, plot a graph of temperature against volume of acid on the axes provided on page 7.

TABLE 1: RESULTS OF TITRATION

Volume of Acid (cm ³)	Temperature (°C)
5.00	30.0
10.00	32.0
15.00	32.5
20.00	33.0
25.00	34.0
30.00	33.5
35.00	33.0
40.00	33.0
45.00	33.0

[4 marks]

- (ii) Hence, determine the end-point volume of the acid.

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[1 mark]

- (iii) Calculate the concentration of the acid.

[2 marks]

GO ON TO THE NEXT PAGE



(d) Outline the experimental steps for this type of titration.

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[4 marks]

Total 15 marks



MODULE 3

INDUSTRY AND THE ENVIRONMENT

3. (a) Sulfuric acid is manufactured in industry by a process known as the Contact Process. The slowest step during the process is the conversion of SO_2 to SO_3 which can be represented by the equation:



List the THREE ways in which the rate of SO_3 production can be improved.

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[3 marks]

- (b) The manufacturing conditions utilized during the Contact Process can be optimized by considering Le Chatelier's principle.

- (i) State Le Chatelier's principle.

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[1 mark]

- (ii) What general conditions of temperature and pressure are predicted by Le Chatelier's principle in order for the MAXIMUM yield of SO_3 to be obtained?

Temperature

Pressure

[2 marks]

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(iii) Describe how the sulfur trioxide produced is converted to concentrated sulfuric acid.

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[2 marks]

(iv) Write TWO equations to represent the process that you described in (b) (iii).

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[4 marks]

(v) Outline the safety considerations that guide the process in (b) (iii).

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[3 marks]

Total 15 marks

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- (b) List TWO classes of naturally occurring polymers, giving an example of ONE.

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[3 marks]

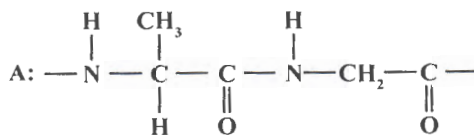
- (c) Terylene is a co-polymer formed from the monomers ethane-1, 2-diol and benzene-1, 4-dicarboxylic acid.

Using a chemical equation, show how terylene can be formed from the two monomers.

[4 marks]



- (d) The structure, A, shown below represents the repeating unit of a polymeric substance.



Deduce the structural formulae of the monomers used to form the polymer.

[4 marks]

Total 15 marks



MODULE 2

ANALYTICAL METHODS AND SEPARATION TECHNIQUES

5. (a) Explain how chromatography can be used to separate a mixture of dyes.

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[4 marks]



- (b) Figure 1 shows the separation of a mixture of amino acids, obtained in the hydrolysis of a dipeptide, on a thin layer chromatography (TLC) plate.

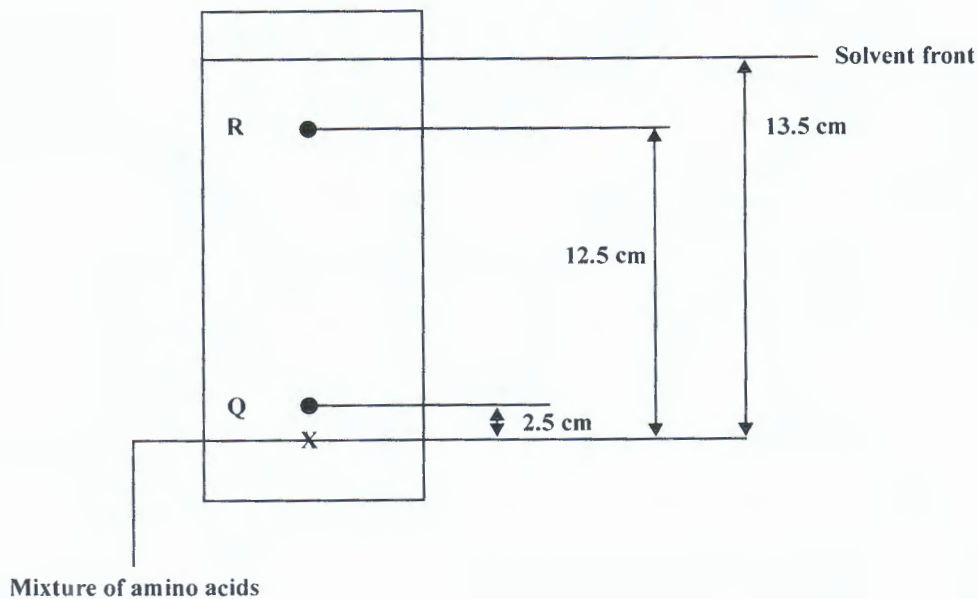


Figure 1. The separation of a mixture of amino acids

- (i) Explain how the presence of the components can be detected.

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[2 marks]



(ii) Calculate the R_f (retention factor) values of Q and R.

[3 marks]

(iii) Suggest TWO reasons for the difference in the R_f values of R and Q.

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[2 marks]

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MODULE 3

INDUSTRY AND THE ENVIRONMENT

6. (a) Chlorine is considered to be the most important halogen. Using an appropriate annotated diagram, describe how chlorine can be produced through use of a diaphragm cell. Include the equations occurring at EACH electrode.

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[6 marks]



- (ii) "Like CFCs, the products of the combustion of fossil fuels also have a negative effect on the environment."

Suggest THREE reasons to support this statement.

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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.

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