CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

CHEMISTRY

UNIT 2 – Paper 032

ALTERNATIVE TO SCHOOL-BASED ASSESSMENT

2 hours

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. 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. You are advised to take some time to read through the paper and plan your answers.

8. 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.**

9. **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.

Answer ALL questions.

1. (a) R and S are two fragrant organic liquids. You are required to carry out the tests indicat
in Table 1, gently shaking after EACH addition. Record your observations and relev
deductions in the table provided.

Include in your recordings:

− Details of colour changes
− The names of gases evolved and details of the tests used to identify EACH

TABLE 1: TESTS

Test	Observation	Inference
Using 2 cm³ portions of **R**: (i) Add carefully 1 cm³ conc. H_2SO_4, heat and pass gas through $Br_2(aq)$.	[2 marks]	[1 mar
(ii) Add $H_2SO_4(aq)$ followed by aqueous potassium dichromate (VI) and heat.	[2 marks]	[1 mar
Using 2 cm³ portions of S: (iii) Add $Na_2CO_3(s)$.	[2 marks]	[2 mar]
(iv) Add PCl_5.	[2 marks]	[1 ma
(v) Add 3 cm³ of **R** followed by conc. H_2SO_4 and boil for 1 minute. Pour mixture into 100 cm³ beaker half-filled with water.	[2 marks]	[1 ma

[16 ma

(b)   Write the equation representing the reaction in Test (v) of (a) using the structural formulae of the functional groups contained in **R** and **S** respectively.

[2 marks]

Total 18 marks

2. An experiment is carried out to determine the solubility of ammonium chloride by back titration, 5.0 cm³ of a saturated ammonium chloride solution are added to a 250.0 cm³ volumetric flask and made up with distilled water. After shaking, 20.0 cm³ portions are added separately to a conical flask to which is added 20.0 cm³ of 0.2 mol dm⁻³ sodium hydroxide solution. The mixture is heated strongly, then gently until no more ammonia evolves. The flasks are cooled and the contents titrated with 0.1 mol dm⁻³ HCl. Figure 1 shows the burette readings.

Start   End   Start   End   Start   End

Titration 1   **Titration 2**   **Titration 3**
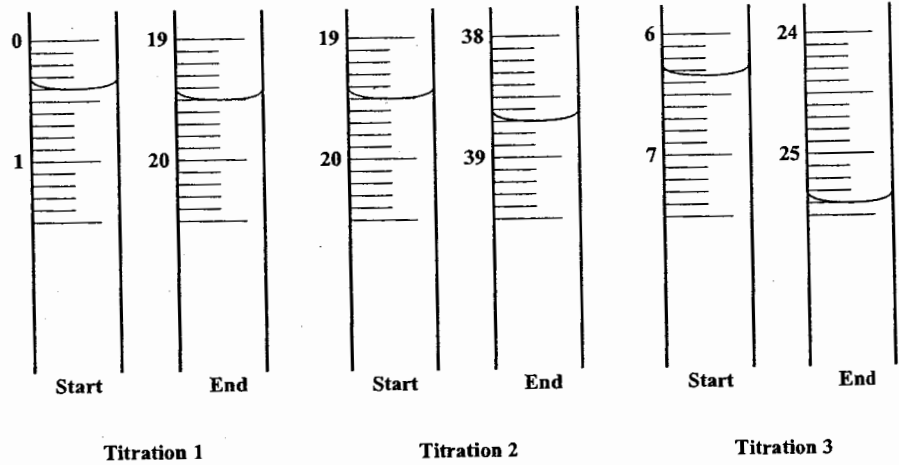
· **Figure 1. Burette readings**

(a) Suggest an indicator and its colour change at the end point, that can be used in the titration above.

....•

....

[2 marks]

(b) In the space provided below, construct a suitable table to record the titration results. Include the initial and final burette readings (to 2 decimal places), and the volumes of hydrochloric acid used.

[6 marks]

(c) State TWO reasons why back titration is used to determine the solubility of ammonium chloride.

....

....

....

....

[2 marks]

(d) Describe a simple chemical test to determine when the evolution of ammonia gas has ceased.

....

....

[1 mark]

(e) Calculate the number of moles of sodium hydroxide present in 20.0 cm^3 of 0.2 mol dm^{-3} NaOH.

[1 mark]

(f) Determine the number of moles of HCl added in the titration.

[1 mark]

(g) Calculate the number of moles of NaOH remaining after boiling with the ammonium chloride solution.

[1 mark]

(h)   Calculate the number of moles of NaOH which reacted with 20.0 cm³ of ammoni
        chloride solution.

[1 ma

(i)   Calculate the number of moles of ammonium chloride present in 20.0 cm³ of the dilu
        solution.

[1 ma

(j)   Calculate the number of moles of ammonium chloride present in 5.0 cm³ of the satura
        solution.

[1 ma

(k)   Calculate the solubility of ammonium chloride in water at room temperature in g dm

[1 m

Total 18 m

3. It was observed by members of a village downstream from an agricultural plot that after washing their clothing a few times, the fabric started to disintegrate.

A science student suggested that the acid leached from the fertilizers applied to the plot had, overtime, resulted in increased acidity of the river and hence damage to the villagers' clothing.

Plan and design an experiment to establish the validity of this suggestion.

Your answer should include the following:

(a) Hypothesis

....

....

....

....

[1 mark]

(b) Aim

....

....

....

....

[1 mark]

(c) Apparatus and materials

....

....

....

....

[2 marks]

GO ON TO THE NEXT PAGE

(d)   Procedure

....

....

....

....

....

....

[3 marks]

(e)   Variables

(i)   Controlled

....

....

[1 mark]

(ii)   Manipulated

....

....

[1 mark]

(iii)   Responding

....

....

[1 mark]

(f)   Data to be collected

....

....

[1 mark]

(g)   Expected results

....

....

[1 mark]

Total 12 marks

END OF TEST

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