TEST CODE **02112032**

FORM TP 2012154

MAY/JUNE 2012

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

CHEMISTRY

UNIT 1 – Paper 032

ALTERNATIVE TO INTERNAL ASSESSMENT EXAMINATION

2 hours

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. Answer ALL questions on this paper.
2. Use this answer booklet when responding to the questions. For EACH question, write your answer in the space indicated and return the answer booklet at the end of the examination.
3. The use of non-programmable calculators is allowed.
4. A data booklet is provided.

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

NOTHING HAS BEEN OMITTED.

Answer ALL questions.

1. You are are provided with

- T, a solution of sodium thiosulphate
- S, sulphuric (VI) acid solution
- A piece of white paper; 6 cm square on which a bold black cross, +, has been printed.

When acid is added to a solution of sodium thiosulphate, $Na_2S_2O_3$, a fine colloidal suspension of sulphur is formed along with sulphur dioxide as the only sulphur containing products.

(a) Procedure

Experiment 1

(i) Place a 200 cm^3 beaker on the square piece of white paper with the bold black cross.

(ii) Using a measuring cylinder, put 50 cm^3 of S into the beaker.

(iii) Using a different measuring cylinder, add 50 cm^3 of T to the beaker and IMMEDIATELY start the stop clock.

(iv) Stop the clock IMMEDIATELY as the cross disappears when viewed directly from above.

(v) Record the time taken for the cross to disappear.

(vi) Discard the mixture and carefully wash the beaker.

Experiment 2

(vii) Place the 200 cm^3 beaker on the square piece of white paper with the bold black cross.

(viii) Using the measuring cylinder, place 50 cm^3 of S into the beaker.

(ix) Using a different measuring cylinder, prepare a mixture of sodium thiosulphate (T) and water by using 40 cm^3 of the sodium thiosulphate (T) and 10 cm^3 of the water.

(x) Add the mixture to the beaker and IMMEDIATELY start the stop clock.

(xi) Stop the clock IMMEDIATELY as the cross disappears when viewed directly from above.

(xii) Record the time taken for the cross to disappear.

(xiii) Discard the mixture and carefully wash the beaker.

Experiments 3 - 5

(xiv) Repeat Steps (vii) to (xiii) using **the volumes of sodium thiosulphate and water specified in Table 1.**

TABLE 1: DATA

Expt. Number	**Volume of Acid (cm^3)**	**Volume of Thiosulphate (cm^3)**	**Volume of Water (cm^3)**	**Time, t (s)**	**$\frac{1}{\text{Time}}$; $\frac{1}{t}$ (3 decimal places)**
1	50	50	0		
2	50	40	10		
3	50	30	20		
4	50	25	25		
5	50	20	30		

[8 marks]

(b) Write the ionic equation for the reaction of thiosulphate with acid.

_____

[2 marks]

(c) Plot a graph of volume of thiosulphate against $\frac{1}{t}$ using the axes provided in Figure 1 on page 5. **[4 marks]**

(d) What is measured by $\frac{1}{t}$?

_____

[1 mark]

(e) From your graph deduce the relationship between your answer in (d) and the concentration of thiosulphate.

_____

_____

[2 marks]

(f) Use the shape of the graph to deduce the order of the reaction with respect to thiosulphate ions.

_____

[1 mark]

Total 18 marks

GO ON TO THE NEXT PAGE

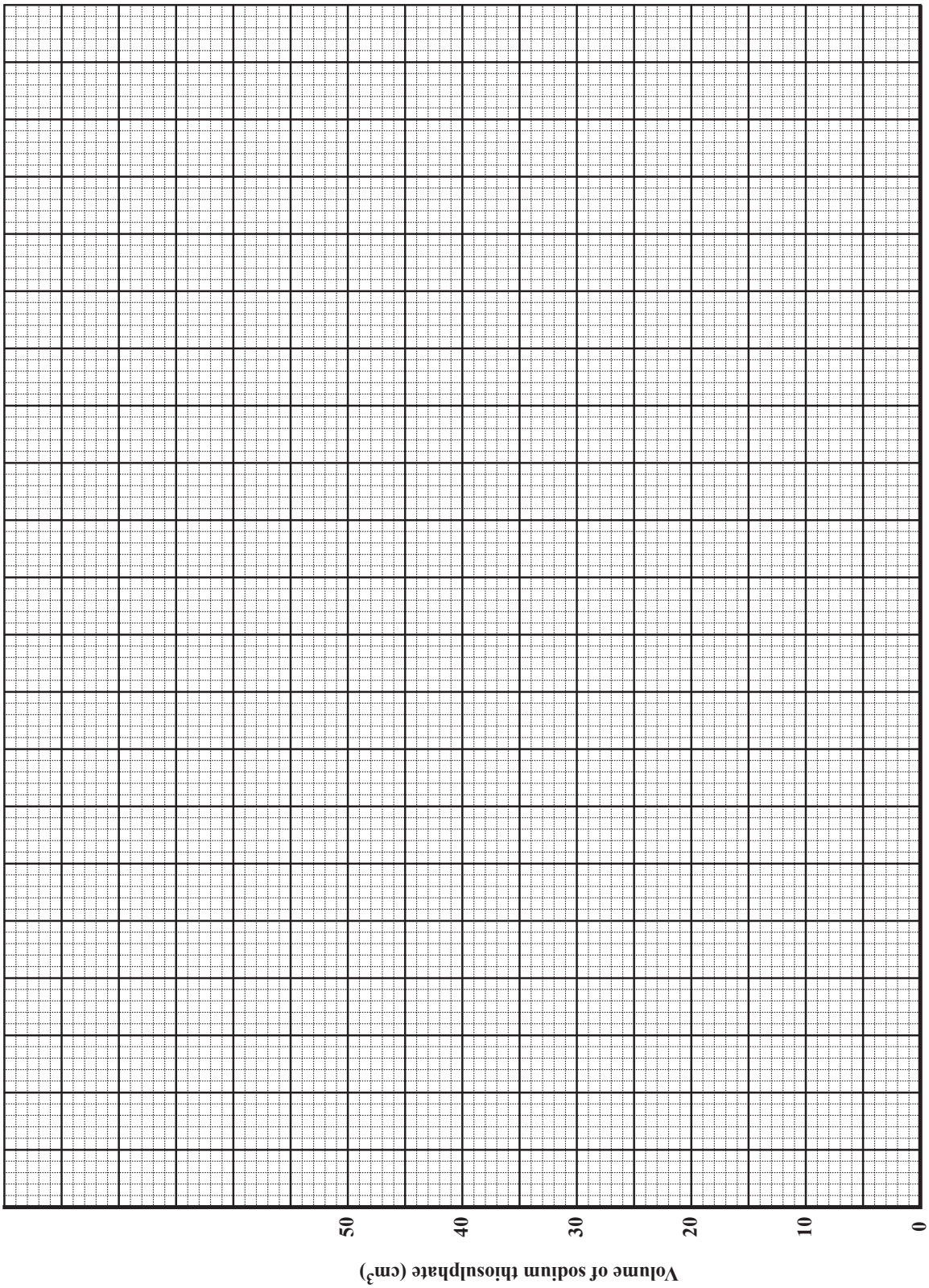

Figure 1. Volume of sodium thiosulphate against $\frac{1}{t}$

2. The label of a hydrogen carbonate of a Group I metal, $XHCO_3$, was accidently removed from its container.

A student used the following procedure to determine the identity of the metal, X.

3.65 g of the hydrogen carbonate, $XHCO_3$, was dissolved in 250 cm^3 of water. 20 cm^3 of this solution was placed in a conical flask and titrated with 0.05 mol d^{-3} H_2SO_4(aq).

Three titrations were needed to obtain consistent values.

Figure 2 shows the burette readings before and after each titration.

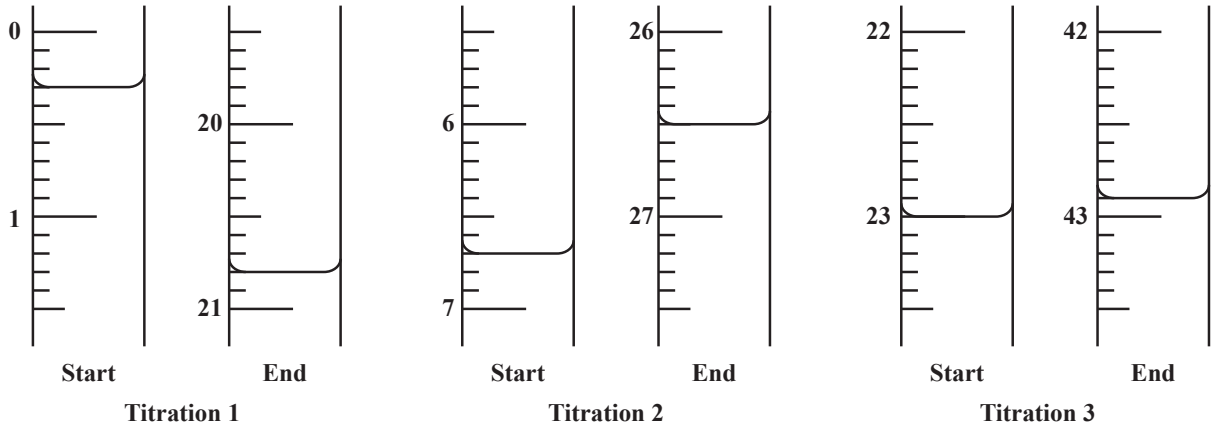

Figure 2. Readings on the burette

(a) Suggest an indicator that can be used in the above titration.

_____

[1 mark]

(b) In the space below, construct Table 2 to record the titration results. You should include the initial and final burette readings and the volumes of $_2SO_4$(aq) used.

[6 marks]

(c) Write the ionic equation for the reaction that occurs during the titration.

_____

[2 marks]

(d) Calculate the number of moles of acid used in the titration.

[2 marks]

(e) Deduce the number of moles of $XHCO_3$ that reacted with the acid.

_____

[1 mark]

(f) Calculate the concentration of the hydrogen carbonate solution in mol dm^{-3}.

[1 mark]

(g) Calculate the molar mass of $XHCO_3$.

[3 marks]

(h) Determine the relative atomic mass of the metal, X.

_____

[1 mark]

(i) Suggest the formula of the hydrogen carbonate.

_____

[1 mark]

Total 18 marks

3. The pharmacist at your local drugstore insists on the effectiveness of Brand A antacid over Brand B.

Plan and design an experiment to determine the truth of the pharmacist's claim.

(a) Hypothesis:

_____

_____

[1 mark]

(b) Aim:

_____

_____

[1 mark]

(c) Apparatus and materials:

_____

_____

_____

_____

[3 marks]

(d) Experimental procedure:

_____

_____

_____

_____

_____

[3 marks]

(e) Variables:

(i) Manipulated

_____

(ii) Responding

_____

(iii) Controlled

_____

[3 marks]

(f) Expected results:

_____

_____

_____

[1 mark]

Total 12 marks

END OF TEST

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