Name:…….Index No:…….....

School:…….....Adm no:…….....Class:……

Candidate's Signature:……..... Date: ……

233/3
CHEMISTRY PRACTICAL
Paper 3
KASSU JUNE 2022
TIME: *2 ¼* **HOURS**

KASSU JET – JUNE 2022

Kenya Certificate of Secondary Education (K.C.S.E)
233/3
Chemistry Practical
Paper 3
2 ¼ **Hours**

INSTRUCTIONS TO CANDIDATES:

- Answer all the questions in the spaces provided in the question paper.
- You are **NOT** allowed to start working within the first 15 minutes of the 2 ¼ hours allowed for this paper. This time is to enable you read the question paper and make sure you have all the chemicals and apparatus that you may need.
- All working **MUST** be clearly shown.
- Mathematical tables and silent scientific calculators may be used.
- Candidates should check to ascertain that all papers are printed as indicated and that no questions are Missing

For Examiner's Use Only:

Question	Maximum score	Candidate's score	Examiner's initials
1	14		
2	10		
3	10		
4	06		
Total score	40		

1. You are provided with:
   - Solution A_1, potassium iodate solution
   - Solution A_2, acidified sodium hydrogen sulphite solution
   - Solution A_3 starch indicator
   - Distilled water in a wash bottle.
   - Stop watch / stop clock

   You are required to find out the effect of concentration of potassium iodate A_1 on the rate of reaction with acidified sodium hydrogen sulphite A_2.

   Note: the end point of reaction of potassium iodate with acidified sodium hydrogen sulphite is indicated in the formation of a blue coloured complex using starch indicator.

   Procedure 1:
   (a) Using a 10 cm^3 measuring cylinder to pour 5 cm^3 of aqueous sodium hydrogen sulphite into the conical flask.
   (b) Use another 10 cm^3 of measuring cylinder to pour 5 cm^3 of starch solution into the same conical flask.
   (c) Using a burette pour 15 cm^3 of distilled water into the same beaker.
   (d) Using a burette pour 20 cm^3 of aqueous potassium iodate into the beaker and immediately start the stop watch.
   (e) Swirl the mixture in the conical / flask and continue to swirl until a sudden blue colour change is seen.
   (f) Stop the stop-watch and record time taken seconds for the sudden blue colour change to appear.
   (g) Rinse the beaker with water.

   Experiment 2:
   (h) Repeat procedure 1 using 17 cm^3 of distilled water and 18 cm^3 of aqueous potassium iodate.
   (i) Repeat procedure 1 using 21 cm^3 of distilled water and 14cm^3 of aqueous potassium iodate.
   (j) Repeat experiment 1 using 23 cm^3 of distilled water and 12 cm^3 of aqueous potassium iodate.
   (k) Repeat experiment 1 using 25 cm^3 of distilled water and 10 cm^3 of aqueous potassium iodate.

(a) Complete the table below.

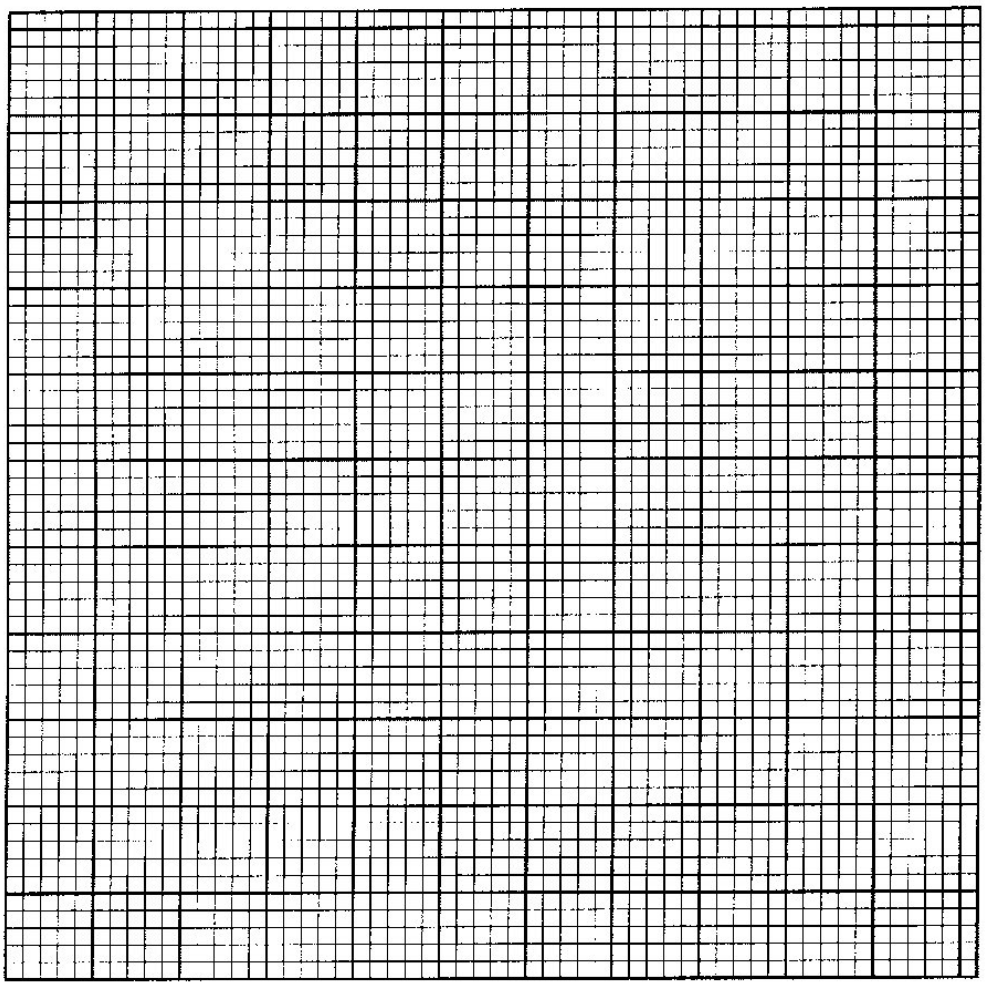
Table I

Experiment	1	2	3	4	5
Volume of Sodium hydrogen sulphite ($NaHSO_3$) used	5	5	5	5	5
Volume of distilled water used (cm^3)	15	17	21	23	25
Volume of potassium iodate (KIO_3 (aq) used in cm^3	20	18	14	12	10
Time taken to change colour (secs)					

(4 marks)

(b) On the grid below plot a graph of time taken (secs) for the colour change (vertical axis) against volume of aqueous potassium iodate used (cm^3).

(3 marks)



(c) (i) From your graph determine the time taken for the blue colour to appear if 16 cm^3 of aqueous potassium iodate was used. (Show clearly on the graph how you worked out your answer). (1 mark)

(ii) Calculate the volume of distilled water required if 16 cm^3 of aqueous potassium iodate was used. (1 mark)

(d) On the graph sketch the graph that could be expected if the above experiment s were done at a higher temperature. Explain. (1 mark)

(e) Calculate the concentration of potassium iodate solution in moles per litre in the final reaction mixture in the experiment 1. (2 marks)

(f) How does the concentration of potassium iodate solution A_1, affect its rate of reaction with acidified sodium hydrogen sulphite A_2? Explain your answer. (2 marks)

2. **You are provided with**:
- Solution B, which is 0.05M acidified potassium manganate (VII) solution ($KMnO_4$).
- Solution C, containing 5.0g/l of a dibasic acid, H_2 A.$2H_2O$

You are required to:
- Determine the concentration of dibasic acid H_2X, solution C and then the formula mass of X.

Procedure II
1. Fill the burette with solution B.
2. Using a clean pipette, place 25 cm^3 of solution C into a clean conical flask. Heat this solution to about 70^0C.
3. Titrate using solution B until a permanent pink colour just appears. Shake thoroughly during titration.
4. Record the reading in table I below.
5. Repeat the titration one more time to complete the table below.

(a) Complete the table I below.

Table I

	I	II
Final burette reading (cm^3)		
Initial burette reading (cm^3)		
Volume of solution b used cm		

(3 marks)

(b) Determine the average volume of solution B used. (1 mark)

(c) Calculate:

(i) The number of moles of manganate (VII) ions in the average volume of solution B used above. (1 mark)

(ii) Given that 2 moles of manganate (VII) ions react with 5 moles of dibasic acid $H_2X.2H_2O$. Calculate the number of moles of the dibasic acid $H_2X.2H_2O$ in the 25 cm^5 of solution C. (2 marks)

(iii) The concentration of solution C in moles per litre. (1 mark)

(iv) Calculate the formula mass of X in the dibasic acid $H_2A.2H_2O$ (H = 1, O = 16) (2 marks)

3. You are provided with solution Q. Carry out the tests below. Write your observations and inferences in the spaces provided.

Place about 2 cm^3 of the solution in five separate test-tubes.

(a) To the first portion, add aqueous sodium hydroxide drop wise until in excess.

Observations	**Inferences**
(1 mark)	(1 mark)

(b) To the second portion, add aqueous ammonia dropwise until in excess.

Observations	**Inferences**
(1 mark)	(1 mark)

(c) To the third portion, add 3 drops of dilute hydrochloric acid.

Observations	**Inferences**
(1 mark)	(1 mark)

(d) To the fourth portion, add 3 drops of barium nitrate solution.

Observations	**Inferences**
(1 mark)	(1 mark)

(e) To the last portion, add 3 drops of lead (II) nitrate solution then warm the mixture.

Observations	**Inferences**
(1 mark)	(1 mark)

4. You are provided with solid **R**. Carry out the tests below. Write your observations and inferences in the spaces provided.

i). Place one third of solid R on a metallic spatula. Burn it in non-luminous flame of the Bunsen burner.

Observations	**Inference**
(½ mark)	(½ mark)

ii). Place the remaining solid in a test-tube. Add about 6 cm^3 of distilled water and shake the mixture well. Retain the solution for the next procedure.

Observations	**Inferences**
(½ mark)	(½ mark)

(I) In another 2 cm^3, add 2 drops of acidified potassium manganate (VII).

Observations	Inferences
(1 mark)	(1 mark)

(II) To about 1cm^3, add 3 drops of acidified potassium dichromate (VI) and warm.

Observations	**Inferences**
(½ mark)	(½ mark)

(III) To about 2 cm^3 of the solution, add 1g of solid D; sodium hydrogen carbonate.

Observations	**Inferences**
(½ mark)	(½ mark)