

2915/206
ANALYTICAL CHEMISTRY II
PRACTICE
Oct./Nov. 2021
Time: 4 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN ANALYTICAL CHEMISTRY
MODULE II

ANALYTICAL CHEMISTRY II PRACTICE

4 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

A battery operated calculator.

*This paper consists of **THREE** questions.*

*Answer **ALL** questions in the answer booklet provided.*

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 6 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. Question 1 (45 marks)

Part I (a)

You are provided with the following:

- Liquid A
- Liquid B
- Liquid C
- 2, 4 - dinitrophenylhydrazine reagent solution
- Ferric nitrate reagent
- Schiff's reagent
- Iodine solution
- 1, 2 - dimethoxyethane
- 3 M NaOH solution
- Distilled water

You are required to:

- (i) Carry out the tests described below on liquids A, B and C respectively.
- (ii) Record all the observations and inferences accordingly.

Procedure

- (i) Measure 2 ml of 2,4-dinitrophenylhydrazine reagent solution and place it in a test tube. Add 2 drops of liquid A. Shake the reaction mixture thoroughly and allow it to settle for **three** minutes. Record your observation. Repeat the procedure above using liquids B and C.

Liquids	Observation	Inference
A	(1 mark)	(1 mark)
B	(1 mark)	(1 mark)
C	(1 mark)	(1 mark)

- (ii) Transfer 4 drops of liquid A into a clean dry test tube. Add 10 drops of 1,2-dimethoxyethane then add 10 drops of ferric nitrate reagent and swirl the contents. Record your observations.

Repeat the procedure using liquids B and C instead of A and record your results.

Liquids	Observation	Inference
A	(1 mark)	(1 mark)
B	(1 mark)	(1 mark)
C	(1 mark)	(1 mark)

- (iii) Place 2 ml of Schiff's reagent in a test tube. Add 3 drops of liquid A. Shake the reaction mixture and allow it to stand for two minutes. Record the observation made. Repeat the procedure using liquids B and C.

Liquids	Observation	Inference
A	(1 mark)	(1 mark)
B	(1 mark)	(1 mark)
C	(1 mark)	(1 mark)

- (iv) Put 1 ml of liquid A in a test tube, add :
- I. 1 ml of 1,2-dimethoxyethane;
 - II. 1 ml of water ;
 - III. 1 ml of water and ;
 - IV. 1 ml of 3 M NaOH solution respectively and shake the solution well to mix..

Add about 1.5 ml of iodine solution and shake. Record your observations. Repeat the procedure using liquids B and C.

Liquids	Observation	Inference
A	(1 mark)	(1 mark)
B	(1 mark)	(1 mark)
C	(1 mark)	(1 mark)

- (v) Give the possible structure of liquid B given that it has four carbon atoms. (1 mark)

Part I (b)

You are provided with the following:

- Solution P
- Iodine solution
- Benedict solution
- Dilute HCl (2.0 M solution)
- NaHCO₃ solution

You are required to design an experiment to test for reducing sugars, starch and non reducing sugars , and test them for solution P as shown in the table below.

Food substance	Procedure	Observation	Conclusion
Starch	(2 marks)	(1½ marks)	(1½ marks)
Reducing sugar	(3 marks)	(1½ marks)	(1½ marks)
Non reducing sugar	(3 marks)	(1½ marks)	(1½ marks)

(i) State the importance of the following in the above tests:

I. dilute HCl; (1½ marks)

II. NaHCO₃ solution. (1½ marks)

2. Question 2 (25 marks)

You are provided with the following:

- Solid H
- Barium chloride
- 2 M Pb(NO₃)₂ solution
- Acidified potassium chromate (VII)
- Ammonia solution
- Moist litmus paper

You are required to:

- (i) carry out the tests described on solid H.
(ii) Record **all** the **observations** and **inferences** accordingly.

(a) Procedure

Divide solid H into two equal portions.

- (i) Add about 10 cm³ of distilled water to the first portion of solid H in a boiling tube.

Observation	Inference
(2 marks)	(2 marks)

Divide the solution into a further five equal portions.

- (ii) To the **first** portion of the solution, add **three** drops of lead (II) nitrate.

Observation	Inference
(2 marks)	(2 marks)

- (iii) To the **second** portion of the solution, add **three** drops of dilute nitric acid.

Observation	Inference
(2 marks)	(2 marks)

- (iv) To the **third** portion of the solution, add a few drops of acidified potassium chromate (VII) solution and shake it.

Observation	Inference
(1 mark)	(1 mark)

- (v) To the **fourth** portion of the solution, add ammonia solution dropwise till in excess.

Observation	Inference
(2 marks)	(2 marks)

- (vi) To the **fifth** portion of the solution, add 3 - 4 drops of Barium Chloride solution followed by drops of HCl till in excess.

Observation	Inference
(2 marks)	(1 mark)

- (vii) Put the remaining portion of solid **H** into a clean dry boiling tube and heat strongly. Using a litmus paper, test for the acidity or basicity of the gas evolved.

Observation	Inference
(2 marks)	(2 marks)

- (b) Give the identity of solid **H**. (1 mark)
- (c) Write the chemical equation when solid **H** is heated. (2 marks)

3. **Question 3** (30 marks)

You are provided with the following:

- 0.15 M sodium thiosulphate
- 2.0 M Hydrochloric acid
- One 10 cm^3 measuring cylinder
- 50 cm^3 measuring cylinder
- 250 cm^3 conical flask (borosilicate)
- Stop watch
- Tap water
- Distilled water in a wash bottle
- White tile/white paper
- Blue pen

You are required to determine the order of reaction between sodium thiosulphate and HCl.

Procedure

- Using a blue pen, draw an X on the white paper or white tile. Place the white tile or paper on the laboratory bench (ensure the bench is dry).
- Place a clean 250 cm³ borosilicate conical flask on the white paper such that the X can be seen directly when viewed above the mouth of the conical flask.
- Measure 50 cm³ of 0.15 M sodium thiosulphate and transfer into a conical flask.
- Measure 5 cm³ of 2.0 M HCl. Then transfer the thiosulphate solution into the conical flask and start the stop watch immediately. Stir the contents of the conical flask twice and let it rest on the white paper/tile.
- Keep looking at the cross and stop the stop watch when the X is completely obscured. Record the time taken for the X to be obscured.
- Wash the conical flask with plenty of running water and drain out all the yellow solid.
- Repeat procedure 1 - 6 above, with varying volumes of sodium thiosulphate and distilled water. This is illustrated in the table below.

Volume of sodium thiosulphate (cm ³)	50	40	30	20	10
Volume of water added (cm ³)	0	10	20	30	40
Volume of acid (cm ³)	5	5	5	5	5
Time (t) taken for X to be covered	25 sec	30	27	47	1.50
$\frac{1}{t}$ (sec ⁻¹)					
Concentration of sodium thiosulphate (moles per litre)					

- (a) Tabulate your results in the table above. (15 marks)
- (b) Plot a graph of $\frac{1}{time}$ (sec⁻¹) against concentration of the sodium thiosulphate. (10 marks)
- (c) Use your graph to determine the time taken for the mark to disappear with a concentration of 0.05 M of sodium thiosulphate. (2 marks)
- (d) (i) State the order of the reaction. (1 mark)
- (ii) Explain the reasons for the answer in d (i). (2 marks)

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