Chemistry III

015

29/07/2021 08:30 AM – 10:00 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2020-2021

SUBJECT: CHEMISTRY III PRACTICAL EXAM

COMBINATIONS:

- BIOLOGY-CHEMISTRY-GEOGRAPHY **(BCG)**
- MATHEMATICS-CHEMISTRY-BIOLOGY **(MCB)**
- PHYSICS-CHEMISTRY-BIOLOGY **(PCB)**
- PHYSICS-CHEMISTRY-MATHEMATICS **(PCM)**

DURATION: 1 hour 30 minutes

Marks: /30

INSTRUCTIONS:

1) Write your name and index number on the answer booklet as written on your registration form, and **DO NOT** write your names and index number on additional answer sheets if provided.
2) Please read carefully before you start and make sure that you have all the apparatuses and chemicals that you may need.
3) This paper has one question.
4) Answer the question in this paper and record your answers in the spaces provided.
5) Non-programmable scientific calculators may be used.

BACK TITRATION: DETERMINATION OF PERCENTAGE PURITY OF Na_2SO_3 IMPURE SAMPLE

Titration of $Na_2S_2O_3.5H_2O$ (0.1 mole/litre) against iodine (I_2) liberated by oxidation of iodide ions by $K_2Cr_2O_7$ = 0.02 mole/litre.

PROCEDURE:

(i) Pour 100 ml of H_2SO_4 (1 mole/litre) solution in a beaker.

(ii) Add 100 ml of $K_2Cr_2O_7$, (0.02 mole/litre) to the H_2SO_4 acid solution in the beaker.

(iii) Add **0.3 g of** Na_2SO_3 **crystals** to the above 200 ml solution mixture of $K_2Cr_2O_7$ (0.02 mole/litre) and H_2SO_4 (1 mole/litre) then stir gently.

(iv) Label this 200 ml solution mixture of $K_2Cr_2O_7$ (0.02 mole/litre) and H_2SO_4 (1 mole/litre) solution containing 0.3 g of Na_2SO_3 crystals as **P**

(v) Measure 50 ml of solution **P** using a measuring cylinder and pour it in an empty conical flask or beaker then add in it 25 ml of KI (0.2 mole/litre) solution.
Call (label) this solution as **Q**.

(vi) Fill the burette with $Na_2S_2O_3.5H_2O$ (0.1 mole/litre) solution.

(vii) Titrate the $Na_2S_2O_3.5H_2O$ (0.1 mole/litre) into the red solution (Q) until the solution turns orange.

(viii) Add some drops (about a half dropper full) of starch solution in the orange **Q** solution of iodine in the conical flask to obtain a blue-black solution.

(ix) Continue the titration of $Na_2S_2O_3.5H_2O$ (0.1 mole/litre) in the blue-black iodine solution **Q** above until the black colour discharges (disappears).

(x) Record the volume of $Na_2S_2O_3.5H_2O$ used to reach equivalent point with **Q** in the table of results.

(xi) Repeat the experiment **procedures v) to xi) 2 times** to get consistent results.

TABLE OF RESULTS (9 marks)

Experiment	1	**2**	**3**
Initial volume of FA3 ($Na_2S_2O_3.xH_2O$) (ml)			
Final volume of FA3 ($Na_2S_2O_3.xH_2O$) (ml)			
Volume of FA3 ($Na_2S_2O_3.xH_2O$) used(ml)			

Equations of the reactions:

$$Cr_2O_7^{2-}{}_{(aq)} + 3\ SO_3^{2-} + 8H^+ \rightarrow 2\ Cr_2(SO_4)_{3(aq)} + 4H_2O_{(l)}$$

$$Cr_2O_7^{2-}{}_{(aq)} + 6I^-{}_{(aq)} + 14H^+{}_{(aq)} \rightarrow 3I_{2\ (aq)} + 7\ H_2O_{(l)} + 2\ Cr^{3+}{}_{(aq)}$$

$$I_{2\ (aq)} + 2S_2O_3^{2-}{}_{(aq)} \rightarrow 2I^-{}_{(aq)} + S_4O_6^{2-}{}_{(aq)}$$

Questions:

a) Calculate the average volume of $S_2O_3^{2-}$ used in this titration. **(2 marks)**

b) Calculate the number of moles of $S_2O_3^{2-}$ used in the titrated volume.

(2 marks)

c) Calculate the number of moles of Iodine (I_2) that reacted with $S_2O_3^{2-}$ during titration. **(2 marks)**

d) Determine the number of moles of $Cr_2O_7^{2-}$ that reacted to produce the iodine (I_2) in 50 ml of solution Q. **(2 marks)**

e) Determine the number of moles of $Cr_2O_7^{2-}$ in the 200 ml of solution P. **(2 marks)**

f) Calculate the number of moles of $Cr_2O_7^{2-}$ (0.02 mole/litre) in the 100 ml of solution before adding **neither** 100ml H_2SO_4 (1 mole/litre) **nor** 0.3 g of Na_2SO_3 to it. **(2 marks)**

g) Calculate the number of moles of $Cr_2O_7^{2-}$ (0.02 mole/litre) that reacted with Na_2SO_3 in the 0.3 g impure sample to obtain solution P. **(2 marks)**

h) Determine the number of moles of Na_2SO_3 in 0.3 g impure sample. **(2 marks)**

i) Calculate the mass of Na_2SO_3 in the 0.3 g of impure Na_2SO_3 **(2 marks)**

j) Calculate the percentage composition of Na_2SO_3 in the 0.3g impure sample. **(3 marks)**