UNEB UACE CHEMISTRY PAPER 3 2018

1. You are provided with the following:

FA1, which is approximately a 0.1M sodium thioslphate solution

FA2, which is a solution containing 2.4g dm-3 of potassium iodate

Solid Y, which is a salt containing dichromate ions

1M sulphuric acid solution

5% potassium iodide solution

Starch solution.

You are required to standardize FA1 and use it to determine the percentage by mass of chromonium in Y.

In acidic solution, iodate and dichromate (VI) ions react with potassium iodide to liberate iodine according to the following equations.

 $\begin{array}{l} IO_3^-(aq) + \ 6H^+(aq) + 5I^-(aq) \rightarrow \ 3I_2(aq) + \ 3H_2O(1) \\ Cr_2O_7^{2-}(aq) + \ 14H^+(aq) + \ 6I^-(aq) \rightarrow \ 2Cr^{3+}(aq) + \ 3I_2(aq) + \ 7H_2O(1) \end{array}$

The iodine liberated in both cases reacts with thiosulphate ions according to the following equation

$$2S_2 O_3^{2-}(aq) \to S_4 O_6^{2-}(aq) + 2I^-(aq)$$

PROCEDURE

a) Pipette 25.0 (or 20.0)cm³ of FA2 into a conical flask and add an equal volume of 1M sulphuric acid using a measuring cylinder, followed by 10cm³ of 5% potassium iodide solution.

Titrate the iodine liberated with FA1, using starch solution as indicator. Repeat the titration until you obtain consistent results.

i) Record your results in Table I below.

Results:

Table I

Final burette reading (cm ³)		
Initial burette reading (cm ³)		
Volume of FA1 used (cm ³)		

ii) Volumes of FA1 used for calculating average volume.....cm3

iii) Average volume of FA1 used......m3

Questions:

a) Calculate the number of moles of iodine liberated by FA2 (O=16; K=39; I= 127)

b) Determine the concentration of FA1 in mol dm⁻³

PROCEDURE:

b) Weigh accurately about 1.2g of Y. Dissolve it in a minimum amount of distilled water and transfer the solution into a 250cm³ volumetric flask. Make the solution up to the mark with distilled water and label it FA3. Pipette 25.0 (or 20.0) cm³ of FA3 into a conical flask and add an equal volume of 1M sulphuric acid using a measuring cylinder, followed by 10cm3 of 5% potassium iodide solution.

Titrate the iodine liberated with FA1 using starch as indicator. Repeat the titration until you obtain consistent results. i) Record your results in table II below. **RESULTS** Mass of weighing bottle +Yg Mass of empty weighing bottle......g Mass of Y used......g

TABLE II

Final burette reading (cm ³)		
Initial burette reading (cm ³)	-	
Volume of FA1 used (cm ³)		•

ii) Volumes FA1 used for calculating average volume......cm²

iii) Average volume of FA1 usedcm3

Questions:

a) Calculate the number of moles of iodine liberated by FA3

b) Determine the:

i) concentration of FA3 in mol dm^{-3}

ii) mass of chromium in Y and hence its percentage. (Cr = 52)

2. You are provided with substance Q, which contains two cations and two anions. You are required to carry out tests below on Q and identify the cations and anions in Q.

Identify any gas(es) evolved.

Record your observations and deductions in the table below

TESTS	OBSERVATIONS	DEDUCTIONS
a) Heat two spatula end-fuls of Q		
strongly in a dry test tube until there		
is no further change		
b) To about 6cm3 of water, add		
2 spatula end-fuls of Q and shake		
well.		
Filter the mixture and keep both the		
filtrate and residue		
c) Divide the filtrate into six parts.		
1) To the first part of the filtrate, add		
dilute sodium hydroxide solution		
dropwise until in excess		
11) To the second part of the filtrate,		
add dilute ammonia solution		
dropwise until in excess		
111) 10 the third part of the filtrate,		
and 2-3 drops of diffue support		
acid and near the first of the filterate		
iv) Use the forth part of the liftrate		
to carry a test of your own choice so		
as to commune first cation in Q		
v_{10} the fifth part of the filtrate add 2.2 drops of load(II) pitrots called in		
2-5 drops of lead(II) nitrate solution		
vi) Use the sixth part of the filtrate		
to carry out a test of your own		

choice sa as to confirm the first		
d) Add dilute nitric acid in small portions to the residue until there is no further change. Divide		0
portions.		
1) To the first portion of the solution, add dilute sodium, hydroxide solution dropwise until in excess		O
ii) To the second portion of the solution, add dilute ammonia solution dropwise until in excess	Ş	
iii) Use the third portion of the solution to carry out a test of your own choice so as to confirm the second action in Q		
Questions:		

Identify the

i) cations in Q

ii) anions in Q

3. You are provided with an organic compound W. You are required to carry out tests below in W and describe the nature of W.

Record your observations and deductions in the table below.

TESTS	OBSERVATIONS	DEDUCTIONS
a) Burn a small amount of W on		
a spatula end or in a dry porcelain		
dish.		
b)To about 0.5cm ³ of W, add		
1cm ³ of water, shake and test the		
mixture with litmus paper		
c) To about 1cm ³ of W, add 2-3		
drops of neutral iton(III) chloride		
solution.		
d) To about 1cm3 of W,		
add 3-4 drops of 2, 4 -		
dinitrophenylhydrazine		
e) To about 2cm3 of W, add 4-5		
drops of acidified potassium		
dichromate (VI) solution, heat,		
allow to cool and use in part (f)		
f) To the mixture from \in ,		
add 3-4 drops of 2, 4 –		
dinitrophenylhydrazine		
g) To about 2cm ³ of Luca's reagent,		
add about 1cm3 of W		
\mathbf{D}		-

h) Describe the nature of W.