Surname	Centre Number	Candidate Number
Other Names		2

GCE A LEVEL – NEW

1410U50-1A

S17-1410U50-1A

CHEMISTRY – A2 unit 5

Practical Examination

Experimental Task

TEST 1

WEDNESDAY, 3 MAY 2017

3 hours

For Teacher's use only Award a mark of 0 or 1 for each of the following	
Making up a solution **(Part A)**	
Efficient use of time **(Part B)**	
Working safely **(Parts A & B)**	

For Examiner's use only	
Mark Awarded	
Total	

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INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Pencil may be used to draw tables and graphs.
Write your name, centre number and candidate number in the spaces at the top of this page.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The total number of marks available for this task is 30.
Your teacher will directly assess your practical skills in **Parts A** and **B**.
The number of marks is given in brackets at the end of each question or part question.
You are reminded of the necessity for orderly presentation in your answers.

This practical examination is in two parts.

Part A – Quantitative analysis of "Moss Killer"

A redox titration of acidified potassium manganate(VII) solution against a solution containing iron(II) ions. You will make up the iron(II) solution prior to the titration.

Part B – Qualitative analysis of active ingredients in "Moss Killers"

A series of inorganic tests to identify three solutions.

The apparatus and chemicals required are listed opposite.

Part A – Quantitative analysis of "Moss Killer"

Apparatus

You will need eye protection and the following apparatus:

1 × weighing bottle + lid [containing approximately 10 g of the "Moss Killer"]
1 × 50 cm^3 burette
1 × 25 cm^3 pipette
1 × 250 cm^3 standard (volumetric) flask
2 × 250 cm^3 conical flasks
1 × 250 cm^3 beaker
1 × 25 cm^3 measuring cylinder
1 × filter funnel
1 × spatula
1 × stirring rod
1 × wash bottle (deionised water)
1 × dropping pipette
1 × clamp & stand
1 × pipette filler
1 × white tile

Ready access to ideally a 3 decimal place weighing balance (although 2 is acceptable)

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Chemicals

You will need:

300 cm^3 of 0.5 mol dm^{-3} dilute sulfuric acid
200 cm^3 of potassium manganate(VII) solution of concentration of approximately 0.0200 mol dm^{-3} – exact concentration to be confirmed by teacher
deionised water

Part B – Qualitative analysis of active ingredients in "Moss Killers"

Apparatus

You will need eye protection and the following apparatus:

dropping pipettes
test tubes & rack
sticky labels or marker pen suitable for writing on glass

Chemicals

You will need:

20 cm^3 of three solutions in beakers labelled **X**, **Y** and **Z**

10 cm^3 of sodium hydroxide solution
10 cm^3 of potassium iodide solution
10 cm^3 of barium chloride solution

Part A – Quantitative analysis of "Moss Killer"

The growth of moss in their lawns is a problem for many gardeners. Iron(II) sulfate, $FeSO_4$, is an active ingredient in some of the common "Moss Killer" brands. The amount present in a particular brand can be determined by titrating a known solution of potassium manganate(VII) in acid against the iron(II) ions present in a made up solution of the "Moss Killer". You will analyse a popular brand, which states on the box that it:

"...contains a minimum of 35% of the active ingredient...".

Procedure

- **Wear eye protection at all times.**
- **Assume that all solutions are toxic and corrosive.**

1. Accurately weigh the sample bottle provided and record the total mass of the solid, weighing bottle and lid on your Results Sheet. Empty the solid from the bottle into a beaker and re-weigh the bottle and lid without washing it out. Record the mass of the bottle and lid and hence the actual mass of solid used to make up the solution.

2. Dissolve the solid using around 100 cm^3 of 0.5 mol dm^{-3} sulfuric acid and transfer quantitatively to your standard (volumetric) flask. Rinse the beaker to ensure that all of the "Moss Killer" is transferred. Make up to the mark with more of the sulfuric acid solution.

3. Titrate 25.0 cm^3 volumes of your "Moss Killer" solution against the potassium manganate(VII) solution provided. Determine the volume of manganate(VII) solution required to just turn the solution a permanent pink. Draw a table to record all burette readings and titre values on the **Results Sheet for Part A**.

4. Wash your conical flask and rinse with deionised water. Repeat your titration until you have **two** concordant titre values. Do **not** carry out more than five titrations. Alert your teacher if you do not have concordant results.

   As a guideline, the accurate titres should lie between 22 cm^3 and 30 cm^3.

5. Calculate and record your mean titre indicating clearly which values you have selected to carry out your calculation.

6. Use this value in the **Analysis of Results** section after you have completed **Part B** of this practical examination.

Examiner only

Results Sheet for Part A – Quantitative analysis of "Moss Killer"

Weighing data

Mass of pre-weighed sample of "Moss Killer" and weighing bottle and lid	g
Mass of weighing bottle and lid	g
Mass of "Moss Killer"	g

Titration data

Draw your own table to record all burette readings and titre values. Record your mean titre in the box below.

Exact concentration of potassium manganate(VII) solution = ... mol dm^{-3}

Mean titre	**cm^3**

Examiner Only

Mark awarded for titration recording	

[6]

Expected titre (based on teacher values)	**cm^3**
Mark awarded for titration accuracy	

[5]

Turn over.

Part B – Qualitative analysis of active ingredients in "Moss Killers"

You will be given solutions of three different brands of "Moss Killer" labelled **X**, **Y** and **Z**. One brand contains copper(II) sulfate, one contains iron(II) sulfate and the other contains zinc sulfate. It is your task to identify which of the salts is present in which solution by testing each one with each of the reagents given below.

Record your observations in the table provided on the **Results Sheet for Part B**.

Where no change is observed write 'no visible change'.

You are **not** required to identify solutions **X**, **Y** and **Z** until the **Analysis of Results** section.

Procedure

- **Wear eye protection at all times.**
- **Assume that all solutions are toxic and corrosive.**

Test with sodium hydroxide solution

1. Place about 1 cm^3 of solution **X** in a clean test tube.
2. Add sodium hydroxide solution drop-wise with shaking, until no further change is seen. Do **not** fill more than half the test tube.
3. Allow to stand for a few minutes.
4. Repeat the test with solutions **Y** and **Z**.

Test with potassium iodide solution

1. Place about 1 cm^3 of solution **X** in a clean test tube.
2. Add about 10 drops of potassium iodide solution and shake the mixture.
3. Allow to stand for a few minutes.
4. Repeat the test with solutions **Y** and **Z**.

Test with barium chloride solution

1. Place about 1 cm^3 of solution **X** in a clean test tube.
2. Add about 5 drops of barium chloride solution.
3. Repeat the test with solutions **Y** and **Z**.

Examiner only

Results Sheet for Part B – Qualitative analysis of active ingredients in "Moss Killers"

Record your observations in the table.

Reagents	Solution X	Solution Y	Solution Z
sodium hydroxide			
potassium iodide			
barium chloride			

Use these observations in the **Analysis of Results** section.

Examiner Only

Mark awarded for observations	

[6]

Examiner only

Analysis of Results

Part A – Quantitative analysis of "Moss Killer"

(i) Calculate the number of moles of manganate(VII) ions in your mean titre. [1]

$n(MnO_4^-)$ = ... mol

(ii) Use the two half-equations below to work out the overall balanced equation for the titration reaction. [1]

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

$$Fe^{2+} \rightarrow Fe^{3+} + e^-$$

.....

(iii) Use this equation to determine the number of moles of iron(II) ions in the 25.0 cm^3 of solution used in your titration, and hence the number of moles in the 250 cm^3 solution made up in the standard flask.

[If you cannot work out the balanced equation, assume that 3 moles of Fe^{2+} react with 1 mol of MnO_4^-. This is **not** the actual ratio.] [2]

$n(Fe^{2+})$ = ... mol

Examiner only

(iv) Calculate the mass of iron(II) sulfate present in the 250 cm^3 flask. [1]

Mass = ... g

(v) Determine the percentage of iron(II) sulfate in the "Moss Killer" using your answer from part (iv). Comment on the claim that it: [1]

"...contains a minimum of 35% of the active ingredient...".

Percentage of iron(II) sulfate = ... %

.....

.....

.....

Turn over.

Examiner only

Part B – Qualitative analysis of active ingredients in "Moss Killers"

(vi) Solutions **X**, **Y** and **Z** are:

- copper(II) sulfate
- iron(II) sulfate
- zinc sulfate (which contains the amphoteric metal zinc)

State which solution contains which metal ion. Give reasons for your answers. [3]

Solution	Metal ion present	Reason
X		
Y		
Z		

(vii) Write a balanced **ionic** equation for the reaction that identifies the presence of sulfate ions in each solution. [1]

.....

END OF PAPER

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