Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0291542055

PHYSICAL SCIENCE **0652/51**

Paper 5 Practical Test **October/November 2015**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Notes for Use in Qualitative Analysis for this paper are printed on page 8.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **8** printed pages.

CAMBRIDGE International Examinations

1 Potassium iodide can be converted to iodine by an oxidising agent.
The presence of starch produces a blue-black colour when the iodine is formed.
The time for the blue-black colour to appear depends on the rate of the reaction between potassium iodide and the oxidising agent.

You are going to investigate whether certain metal ions can catalyse this reaction. You will also identify the metal ion $\mathbf{X}^{2+}$.

A is potassium iodide solution.

B is a solution of the oxidising agent.

(a) (i)
- Using the measuring cylinder labelled **B**, place 10 cm^3 of **B** in a conical flask or beaker.
- Add five drops of starch to the flask.
- Using a second measuring cylinder labelled **A**, add 10 cm^3 of **A** to the flask and swirl once, starting the stopclock at the same time.
- Stop the stopclock when the solution turns blue-black. Record the time *t* in seconds to the nearest second in the second row of Table 1.1. [1]

Table 1.1

volume of **B** / cm^3	drops of starch	volume of **A** / cm^3	1 cm^3 of solution of metal ion	time *t* / s	$\frac{1}{t}$ / $\frac{1}{\text{s}}$
10.0	5	10.0	none added		
10.0	5	10.0	none added		
10.0	5	10.0	Fe^{2+}		
10.0	5	10.0	Fe^{3+}		
10.0	5	10.0	$\mathbf{X}^{2+}$		

(ii) Repeat **(a)(i)** and record the time *t* in seconds to the nearest second in the next row of Table 1.1. [2]

(b) (i)
- Using the measuring cylinder labelled **B**, place 10 cm^3 of **B** in a conical flask or beaker.
- Add five drops of starch to the flask.
- Using the measuring cylinder labelled **C** add 1 cm^3 of the solution containing the Fe^{2+} ion to the flask.
- Using the measuring cylinder labelled **A**, add 10 cm^3 of **A** to the flask and swirl once, starting the stopclock at the same time.
- Stop the stopclock when the solution turns blue-black. Record the time *t* in seconds to the nearest second in the appropriate row of Table 1.1. [1]

(ii) Repeat **(b)(i)**, replacing the solution containing the Fe^{2+} ion with the solution containing the Fe^{3+} ion.

Record the time *t* in seconds to the nearest second in the appropriate row of Table 1.1. [1]

(iii) Repeat **(b)(i)**, replacing the solution containing the Fe^{2+} ion with the solution containing the $\mathbf{X}^{2+}$ ion.

Record the time *t* in seconds to the nearest second in the appropriate row of Table 1.1. [1]

(c) (i) Calculate the values of $\frac{1}{t}$ for each reading of time *t*. Enter the values in Table 1.1. These represent the rates of the reaction.

[1]

(ii) Using your results in Table 1.1, state and explain whether the metal ions are acting as catalysts for this reaction.

.....

.....

.....

..... [2]

(d) Use the two results obtained when no metal ion was added to comment on the reliability of the experiment. You must show how you use these two results.

.....

.....

..... [1]

(e) (i) The addition of the metal ion in **(b)** increases the total volume of the solution in the experiment.

Suggest a modification to the method in **(a)(i)** which would result in the overall experiment being a fairer test.

Explain why you have chosen this modification.

.....

.....

..... [2]

(ii) A student suggests that the reaction involving the solution containing the $\mathbf{X}^{2+}$ ion is a completely different reaction and that $\mathbf{X}^{2+}$ ions reacts with iodide ions.

Carry out **(b)(iii)** again using the solution containing the $\mathbf{X}^{2+}$ ion but carefully observe the reaction mixture instead of timing the reaction.

Suggest what observations may have led the student to think that this was a different reaction.

.....

..... [1]

(f) Use ammonia solution to identify metal **X** in the solution containing the $\mathbf{X}^{2+}$ ion.

Record your observations.

observations .....

.....

metal **X** is ..... [2]

2 You are going to measure the capacity and the outer surface area of the walls of a plastic cup.

(a) The capacity of a cup is the maximum volume of liquid that it can hold. The volume will be estimated by finding the average diameter of the cup and then considering the cup to be an approximate cylinder.

(i) Measure, to the nearest 0.1 cm, the height *h* of the cup as shown in Fig. 2.1.

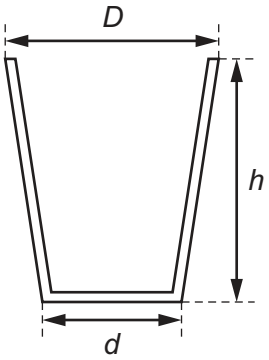

Fig. 2.1

h = ... cm

(ii) Measure the diameter *D* of the top of the cup. *D* = ... cm

(iii) Measure the diameter *d* of the bottom of the cup. *d* = ... cm

(iv) Calculate the average diameter d_A using your results from **(a)(ii)** and **(a)(iii)** and the equation

$$d_A = \frac{(D+d)}{2}$$

d_A = ... cm

(v) Calculate the approximate volume *V* of the cup using the equation

$$V = \frac{\pi d_A^2 h}{4}$$

V = ... cm^3 [6]

(b) (i) Fill the measuring cylinder with water up to a mark in excess of 200 cm^3.

Record this reading R_1. R_1 = ... cm^3

Pour water from the measuring cylinder into the cup until it is full.

Record the new reading R_2. R_2 = ... cm^3

Determine the volume of water V_W that the cup can hold. Show your working.

V_W = ... cm^3 [2]

(ii) Suggest **one** possible source of inaccuracy in this procedure.

.....

..... [1]

(iii) State which of the two values, V obtained in **(a)(v)** or V_W obtained in **(b)(i)** is the more accurate.

Explain your answer.

.....

..... [1]

(c) Empty the water from the cup. Use the string and the metre rule provided to determine the average circumference C of the cup.

(i) Describe the method that you used and show your working.

.....

.....

.....

.....

C = ... cm [3]

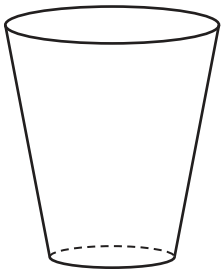

Fig. 2.2

(ii) Show on Fig. 2.2 where you placed the string to measure the average circumference. [1]

(iii) Calculate the approximate curved surface area A of the cup using the equation

$$A = Ch$$

A = ... cm^2 [1]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Test for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify then add aqueous barium chloride *or* aqueous barium nitrate	white ppt.

Test for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	-
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Test for gases

gas	*test and test results*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	“pops” with a lighted splint
oxygen (O_2)	relights a glowing splint