Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0147263963

CO-ORDINATED SCIENCES **0654/51**

Paper 5 Practical Test **October/November 2017**

2 hours

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 12.

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	
3	
Total	

This document consists of **10** printed pages and **2** blank pages.

CAMBRIDGE International Examinations

1 You are going to investigate the action of four different concentrations of an enzyme solution on milk protein.

Milk contains a protein that makes it look white (opaque). When the protein is broken down, the milk becomes clear.

(a) Read through the whole question and then complete the last heading in Table 1.1. [1]

(b) (i)
- Label three syringes **E** (for enzyme), **M** (for milk) and **W** (for water).
- Label two test-tubes **A** and **B**.
- Use syringe **E** to add 5.0 cm^3 enzyme solution to test-tube **A**.
- Use the same syringe to add 2.0 cm^3 enzyme solution to test-tube **B**.
- Use syringe **M** to add 2.0 cm^3 milk to test-tube **B** and immediately start the stopclock.
- Using the stirring rod, mix the contents of test-tube **B** well.
- Time how long it takes for the protein to break down by observing test-tube **B** until the milk is clear. Use test-tube **A** as a comparison to help you.

  Record your result to the nearest whole second in row two, column four of Table 1.1. [1]

(ii)
- Rinse out test-tube **B**.
- Use syringe **W** to add 0.5 cm^3 distilled water to test-tube **B**.
- Use syringe **E** to add 1.5 cm^3 enzyme solution to test-tube **B** and mix well.
- Use syringe **M** to add 2.0 cm^3 milk to test-tube **B** and immediately start the stopclock.
- Using the stirring rod, mix the contents of test-tube **B** well.
- Time how long it takes for the protein to break down by observing test-tube **B** until the milk is clear. Use test-tube **A** as a comparison to help you.

  Record, in Table 1.1, your result to the nearest whole second.
- Rinse out test-tube **B**.
- Repeat experiment **(ii)** twice more, using the volumes of distilled water and enzyme solution shown in Table 1.1.

  Record, in Table 1.1, your results to the nearest whole second. [3]

Table 1.1

volume of enzyme solution / cm^3	volume of distilled water / cm^3	concentration of enzyme %	..... / .....
2.0	0.0	4	
1.5	0.5		
1.0	1.0		
0.5	1.5	1	

(c) The original enzyme solution has a concentration of 4%.

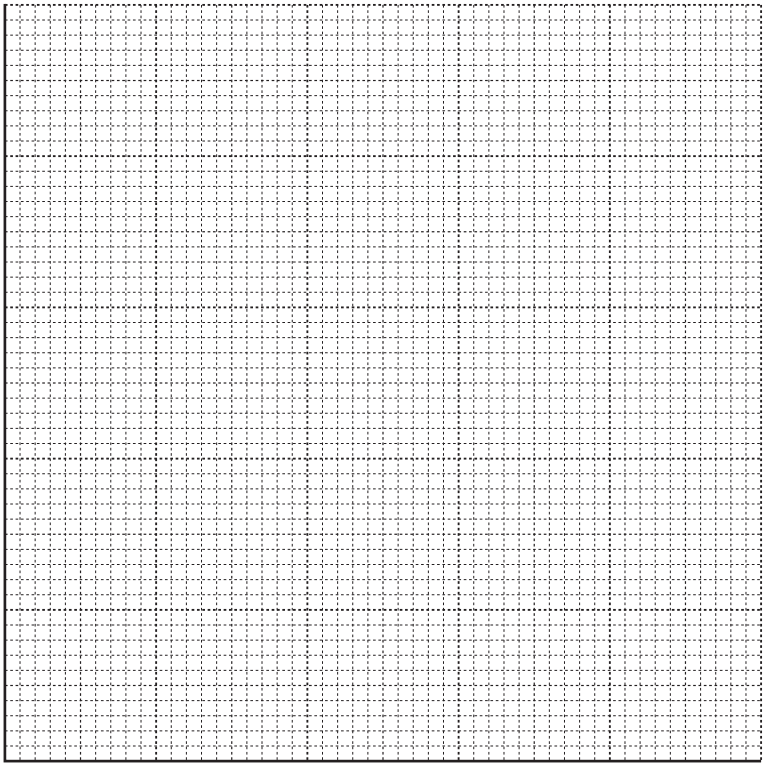
In Table 1.1, use the values given for volume of enzyme solution and volume of distilled water to calculate the new concentrations of enzyme.

Record these concentrations in Table 1.1.

[1]

(d) **(i)** On the grid provided, plot a graph of time taken for the milk to clear (vertical axis) against concentration of enzyme.

Draw the best-fit straight line.



[4]

(ii) Use your graph to predict the time it would take for the milk to clear with a 1.5% enzyme solution.

.....[1]

(iii) Use your graph to describe the relationship between the concentration of enzyme and the time taken for the milk to clear.

.....[1]

(e) A student uses a similar method to investigate how the rate of this enzyme-catalysed reaction varies with temperature.

(i) Suggest suitable temperatures for the student to use.

.....[2]

(ii) State **two** variables that the student should keep constant in this experiment.

variable 1 .....

variable 2 .....
[1]

Please turn over for Question 2.

2 Notes for use in Qualitative Analysis for this question are printed on page 12.

You are going to investigate the temperature change in a reaction and identify compounds **H** and **J**.
H is an oxide. **J** is a nitrate salt.

(a) (i) You must wear safety glasses for this experiment.

- Place 15 cm^3 distilled water into a beaker.
- Measure the temperature of this water and record, in Table 2.1, the temperature T_1 to the nearest 0.5 °C.
- Add the sample of solid **H** to the water in the beaker.
- **Stir well** and record, in Table 2.1, the highest temperature T_2 of the mixture to the nearest 0.5 °C.
- Keep the mixture for **(a)(ii)**, **(a)(iii)** and **(b)(ii)**.

Record, in Table 2.1, your observations of the reaction. [3]

Table 2.1

	T_1 / °C	T_2 / °C	change in temperature / °C
temperature			
observations			

(ii)
- Filter the mixture from **(a)(i)** into a large test-tube. This is filtrate **F**.
- Test filtrate **F** with Universal Indicator paper.
- Keep filtrate **F** for **(a)(iii)** and **(b)(ii)**.

Record the final colour of the paper and the pH of the filtrate.

final colour .....

pH .....
[1]

(iii)
- One-third fill a test-tube with filtrate **F**. Keep the remainder of **F** for **(b)(ii)**.
- Place ten marble chips (calcium carbonate) in another test-tube.
- Add about one third of a test-tube of dilute hydrochloric acid to the marble chips.
- Immediately attach a delivery tube to the test-tube with the acid and marble chips and pass any gas produced into the test-tube containing filtrate **F**.

Record your observations of the filtrate.

.....

.....[1]

(b) (i) Test a small amount of solution **J** in a test-tube by adding ammonia solution to it.

Remember to add the ammonia solution slowly until it is in excess.

Record your observations **and** identify **J**.

observations .....

.....

J is ..... nitrate.

[3]

(ii) Place about 2 cm^3 solution **J** in a test-tube and slowly add the remainder of filtrate **F** from **(a)(iii)** until there is no further change.

Record your observations.

.....

.....[1]

(c) (i) Calculate the change in temperature in the reaction in **(a)(i)**.

Record, in Table 2.1, the value with a plus or minus sign as appropriate. [1]

(ii) Using your answer to **(c)(i)**, state which type of reaction has been observed in **(a)(i)**.

.....[1]

(iii) In **(b)(ii)**, filtrate **F** is behaving like a reagent used in Qualitative Analysis.

Name this reagent.

.....[1]

(iv) Use the results from **(a)(ii)**, **(iii)** and **(b)(ii)** to classify the oxide **H**.

classification of oxide **H** .....[1]

(v) Use all of the evidence in **(a)**, **(b)** and **(c)** to suggest a chemical name for **H**.

State how you have used the evidence to arrive at your answer.

H is ..... oxide.

reason .....

.....

.....

[2]

3 You are going to investigate how the resistance R of a filament lamp and the power P of the filament lamp depend upon the current I flowing through it.

The circuit shown in Fig. 3.1 has been set up for you.

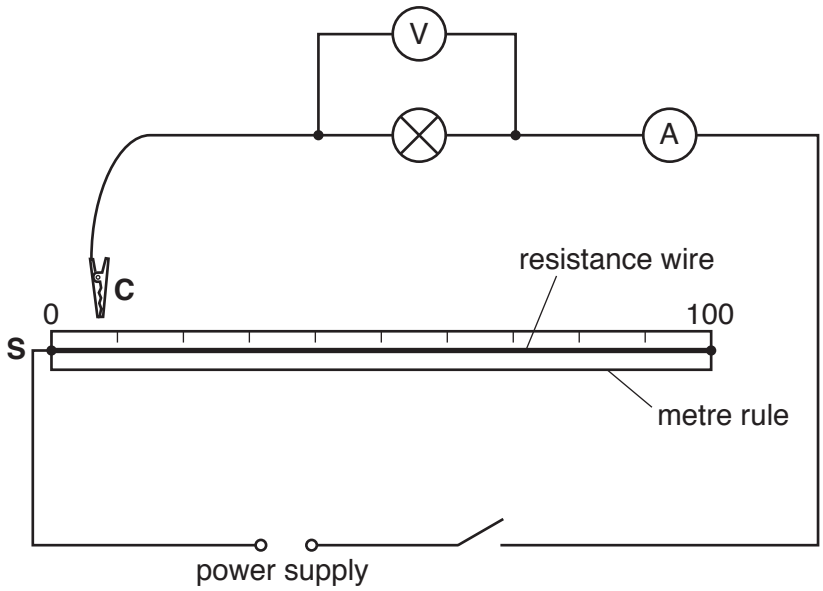


Fig. 3.1

(a) (i)
- Connect the crocodile clip **C** to the end **S** (0 cm) of the resistance wire.
- Switch on.
- Use the voltmeter and the ammeter to measure the potential difference V across the lamp and the current I flowing through the lamp.

  Record, in Table 3.1, your values of V and I.
- Switch off. [2]

Table 3.1

position of crocodile clip **C** / cm	potential difference V / V	current I / A	resistance R / Ω	power P / .....
0				
20.0				
40.0				
60.0				
80.0				

(ii) Repeat the steps in **(a)(i)** for different positions of the crocodile clip **C**, by connecting it at 20.0 cm, 40.0 cm, 60.0 cm and 80.0 cm from end **S**.

Record, in Table 3.1, your values of V and I.

Remember to switch off between readings. [4]

(b) If the filament lamp becomes too dim to see while you are carrying out the investigation, state how you would know that the lamp is not broken.

.....[1]

(c) **(i)** Calculate the resistance R of the filament lamp for each pair of readings using the equation shown.

$$R = \frac{V}{I}$$

Record, in Table 3.1, your values of R to 3 significant figures. [2]

(ii) Explain why it is important to switch the current off between taking readings.

.....

.....[1]

(d) **(i)** Add the unit of power to the heading of the fifth column in Table 3.1. [1]

(ii) Calculate the power P of the filament lamp for each pair of readings using the equation shown.

$$P = V \times I$$

Record, in Table 3.1, your values of P. [2]

(e) A student suggests that the power P of the filament lamp is directly proportional to the current I flowing through it.

State whether your experimental results support this suggestion and justify your statement **by reference to your results** in Table 3.1.

statement .....

justification .....

.....
[2]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests 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 with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Tests 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

Tests for gases

gas	*test and test result*
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