



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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CO-ORDINATED SCIENCES

0654/53

Paper 5 Practical Test

October/November 2010

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in Instructions to Supervisors

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 a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Chemistry practical notes for this paper are printed on page 16.

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 **13** printed pages and **3** blank pages.



- 1 (a) This experiment is to investigate heat loss from water. The tubes represent animals in different conditions.

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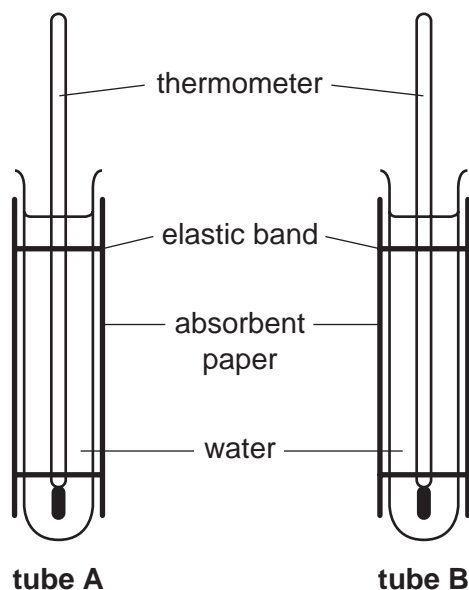


Fig. 1.1

- Wrap the same number of layers of absorbent paper around two tubes. You need at least eight layers. Secure the paper using elastic bands. See **tube A** and **tube B** in Fig. 1.1.
- Using cold water wet the paper around **tube B** only, then place both **tube A** and **tube B** in a test-tube rack.
- Mix some of the hot water provided with cold water in a beaker. Measure the temperature with a thermometer until you have about 200 cm³ water at a temperature of 50 °C. This is the temperature at 0 minutes.
- Pour the same amount of water at 50 °C into **tube A** and **tube B**. Do not completely fill the tubes. Leave about 3 cm unfilled at the top. Add thermometers to both tubes and start timing.
- Take the temperature of both tubes every minute for 5 minutes. Record your readings in Table 1.1. [2]

Table 1.1

time/min	temperature/°C			
	tube A	tube B	tube C	tube D
0	50	50	50	50
1				
2				
3				
4				
5				

(b)

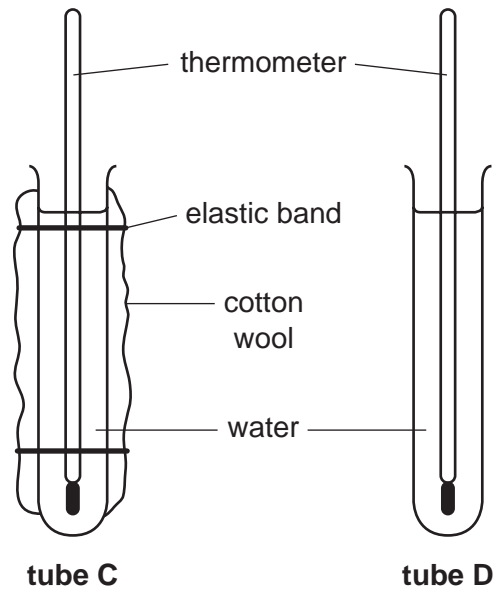


Fig. 1.2

- Take two new tubes.
- Prepare **tube C** by wrapping cotton wool around it and securing it using elastic bands. See Fig. 1.2. **Tube D** is uncovered.
- Place **tube C** and **tube D** into the test-tube rack.
- Add sufficient hot water to the beaker to return the temperature of the water to 50 °C. This is the temperature at 0 minutes.
- Pour the same amount of water at 50 °C into **tube C** and **tube D**. Do not completely fill the tubes. Leave about 3 cm unfilled at the top. Add thermometers to both tubes and start timing.
- Take the temperature of both tubes every minute for 5 minutes. Record your readings in Table 1.1. [2]

(c) (i) For each tube, subtract the temperature of the water after **5 minutes** from 50, to give **T**, the total temperature drop. Record the results in Table 1.2.

(ii) For each tube, divide **T** by 5 to give the average temperature drop per minute.

Record the results in Table 1.2.

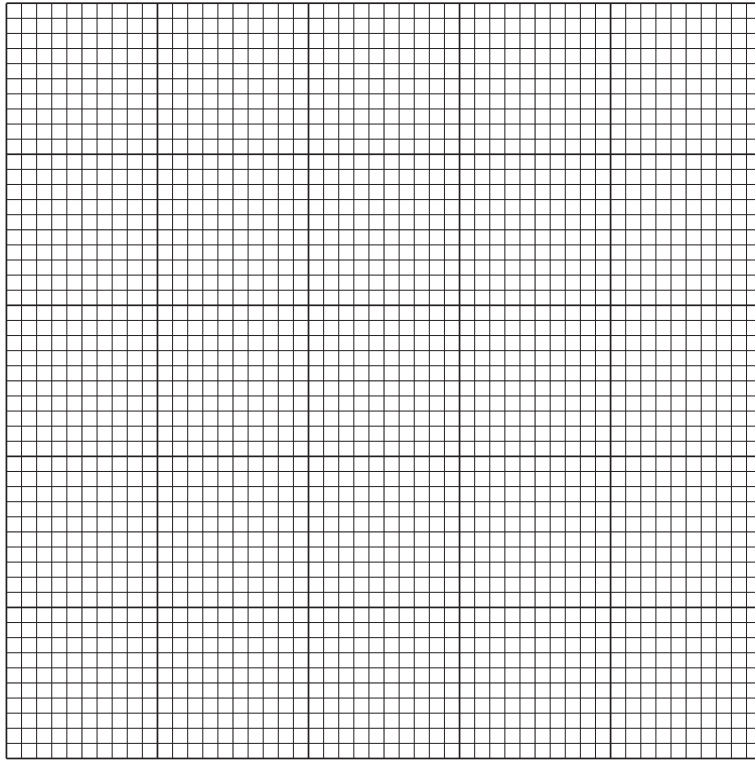
[2]

Table 1.2

tube	total temperature drop, T/°C	average temperature drop/°C per min
A		
B		
C		
D		

(d) On the grid provided draw a bar chart of the average temperature drop per minute (vertical axis) for the four tubes.

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[3]

(e) (i) The absorbent paper represents skin. Compare the results of **tube A** and **tube B** to describe the benefits of sweating.

.....
.....

Explain your answer in terms of heat transfer.

.....
..... [2]

(ii) The cotton wool represents fur. Compare the results for **tube C** and **tube D** to describe the benefits of a fur coat.

.....
.....

Explain your answer.

.....
..... [2]

- (f) (i) Suggest a reason for the relatively large drop in temperature between 0 and 1 minutes for all four tubes.

.....
.....

- (ii) Explain the purpose of **tube D**.

.....
..... [2]

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2 You are going to determine the relative density of the unknown object **P**. The mass **M**, which is a bag of sand, will help you to carry out this experiment.

(a) Clamp the pivot at a height about 300 mm from the bench top. Place the ruler on the pivot at about the 500 mm mark. Adjust the position of the ruler until it is balanced.

Read and record the value of the balance point.

balance point mm [1]

- (b) (i)
- Hang the object **P** from the 100 mm (10 cm) mark on the ruler.
 - Hang the mass **M** on the other side of the ruler and adjust its position so that the ruler is balanced.
 - Measure the distances **d** and **d₁**, using your balance point value (see Fig. 2.1) and record them in Table 2.1.

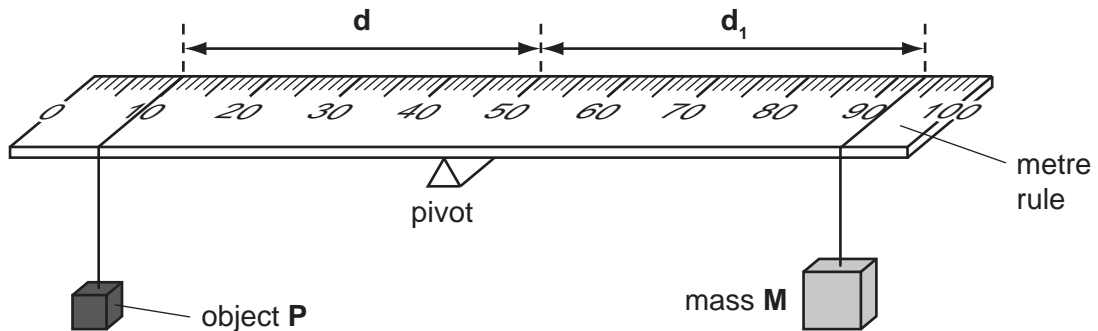


Fig. 2.1

(ii) Hang the object **P** from the 150 mm mark of the ruler and balance the ruler again. Measure the new value of **d** and **d₁**. Record these in Table 2.1.

(iii) Repeat part (ii), moving the object **P** 50 mm nearer the pivot each time, to obtain two more sets of values for **d** and **d₁**. Record the values in Table 2.1.

- (c) (i) You are now going to repeat the experiment with the object **completely** immersed in water. See Fig. 2.2. Hang the object **P** at the 100 mm mark on the ruler so that the object is immersed in water. Adjust the position of the mass **M** to restore balance. Measure and record the distances **d** and **d₂**. Make sure the balance point of the ruler is maintained. The value for **d** is the same as your first value for **d** measured in (b)(i).

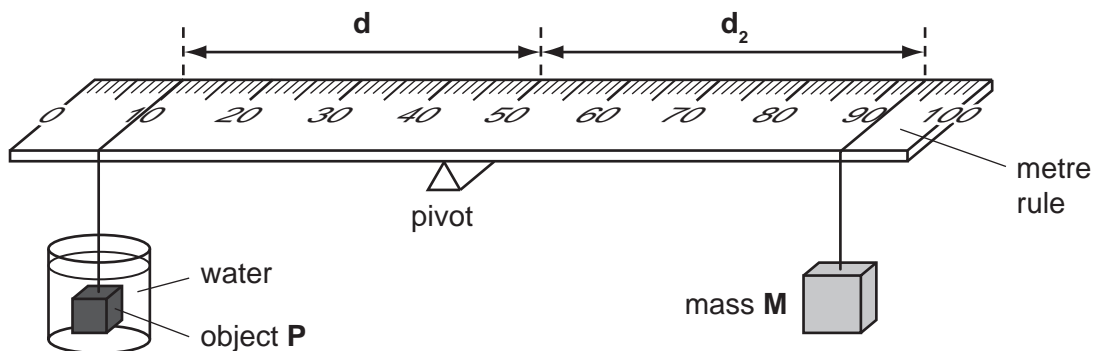


Fig. 2.2

- (ii) Obtain three more values for d_2 , hanging object **P** at the same distances from the pivot in part (b) so that the values of d are the same.

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Table 2.1

d/mm	d_1/mm	d_2/mm	$(d_1 - d_2)/\text{mm}$

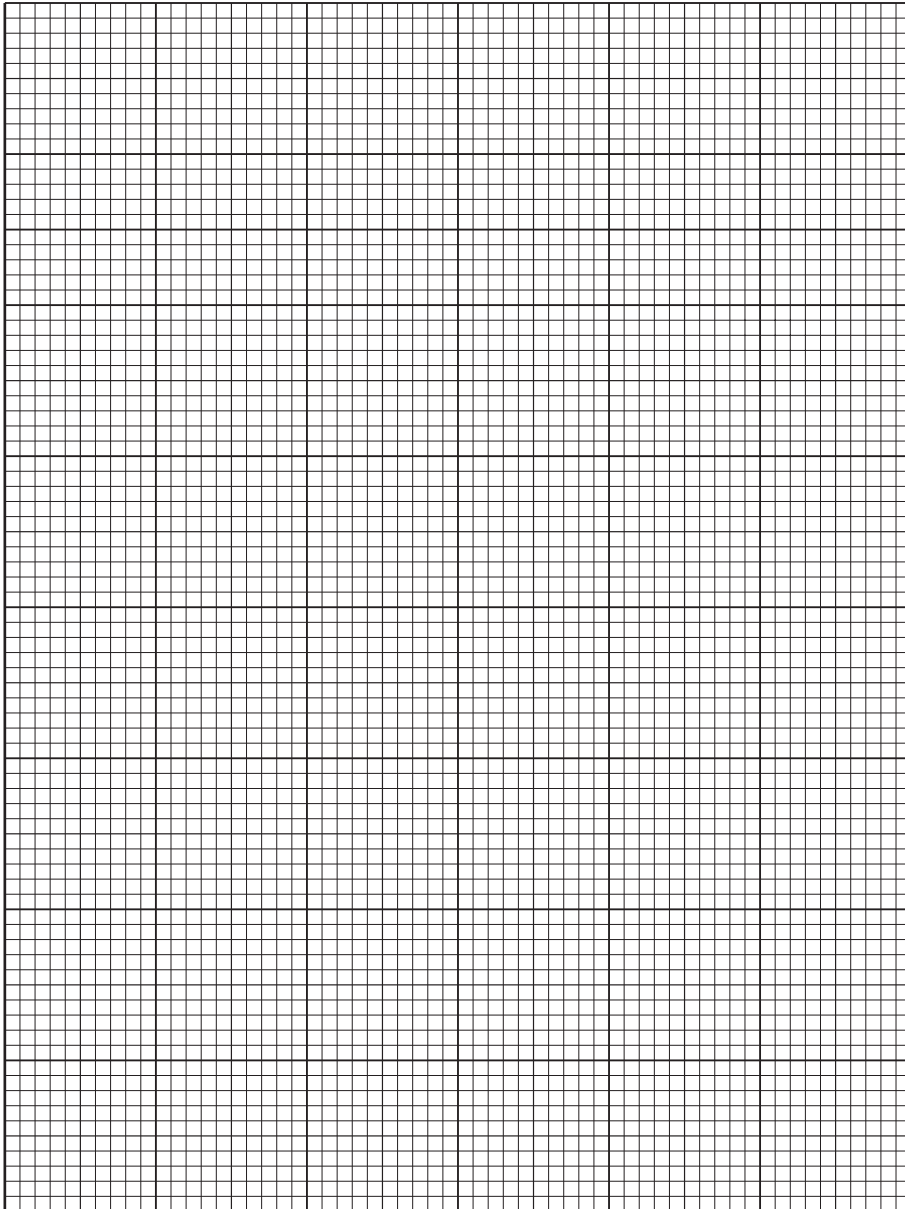
[4]

- (iii) Complete the last column in the table.

[1]

- (iv) Plot a graph of d_1 (vertical axis) against $(d_1 - d_2)$. You do not need to start the axes at zero. Draw the best straight line through these points.

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[4]

- (v) The gradient of your graph is equal to the relative density of object **P**.
Calculate the gradient, clearly showing on your graph how you did this.

gradient = [3]

(d) The density is mass per unit volume and there is an easier method for finding the density of object **P** than the experiment carried out. Briefly describe such a method.

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.....
.....
..... [2]

Please turn over for Question 3.

- 3 You are going to investigate the reaction between hydrochloric acid and marble (calcium carbonate).

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You are going to react solutions of different concentrations of hydrochloric acid with a marble chip. All the marble chips are about the same size.

- (a) Place 5 test-tubes in the rack. Place a narrow strip of graph paper behind each test-tube so that you can see the grid when viewed through the test-tube.
- (i) Using the measuring cylinder, pour 3 cm^3 of **solution A** into the first test-tube. Pour 3 cm^3 of **solution B** into the second test-tube. Repeat using 3 cm^3 of **solutions, C, D and E** in the third, fourth and fifth test-tubes.
- (ii) Quickly place one marble chip into each test-tube and start the timer. Shake the tubes from time to time.

Record the reading on the timer in seconds for each tube when the lines on the graph paper can be clearly seen through the acid in the tube. **Do not stop the timer until all the reactions have finished.**

Record the times in Table 3.1.

Table 3.1

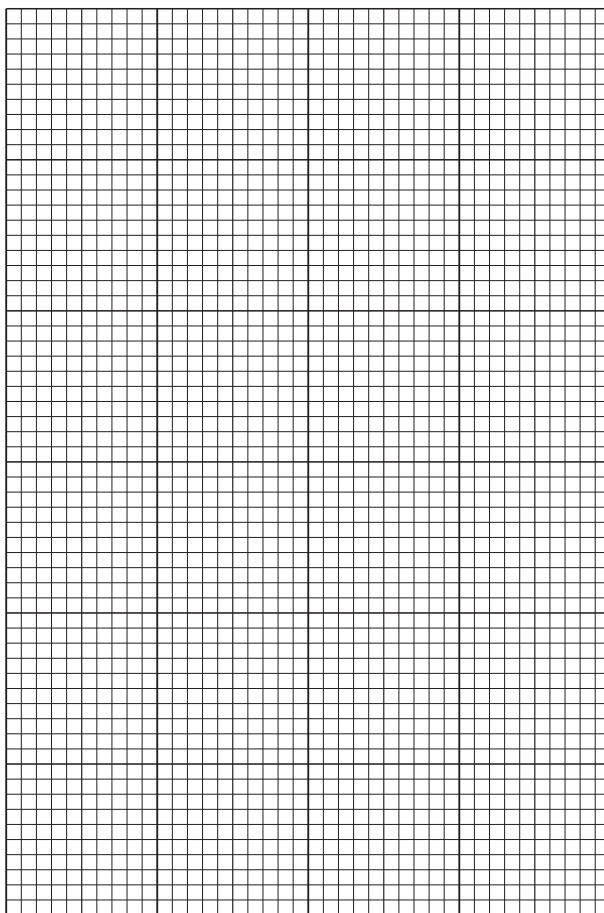
experiment	solution of hydrochloric acid	concentration of acid mol/dm^3	time / s
1	A	0.25	
2	B	0.50	
3	C	1.0	
4	D	1.5	
5	E	2.0	

[3]

- (b) Plot your results on the grid. Put **time** on the vertical axis and **concentration of hydrochloric acid** on the horizontal axis.

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Draw the best straight line.



[4]

- (c) Explain why it is difficult to see through the tubes at the beginning of the reaction.

.....
.....
..... [2]

- (d) Draw on the grid a line to represent a set of results produced if the temperature of the acid is increased. Label this line **T**. [1]

(e) Which of the reactants is in excess in these experiments?

Explain your answer.

.....
.....
..... [2]

(f) State **two** sources of error in the experiments.

1
.....
2
..... [2]

(g) Suggest an improvement to reduce the source of **one** of the errors.

.....
.....
..... [1]

CHEMISTRY PRACTICAL NOTES

Test for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
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 <i>or</i> aqueous barium nitrate	white ppt.

Test for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
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

<i>gas</i>	<i>test and test results</i>
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

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