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Centre Number

[ ]

Candidate Name \_\_\_\_\_

**International General Certificate of Secondary Education  
CAMBRIDGE INTERNATIONAL EXAMINATIONS  
CO-ORDINATED SCIENCES  
PAPER 5 Practical Test**

**0654/5**

**OCTOBER/NOVEMBER SESSION 2002**

2 hours

Candidates answer on the question paper.  
Additional materials:  
As listed in Instructions to Supervisors.

**TIME** 2 hours

**INSTRUCTIONS TO CANDIDATES**

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

You will need to set up the experiment for Question 1 at the start of the examination. While the experiment is left for at least 30 minutes you are advised to proceed with another question.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets [ ] at the end of each question or part question.

Chemical practical notes for this paper are printed on page 12.

FOR EXAMINER'S USE	
1	
2	
3	
<b>TOTAL</b>	

Before you begin the examination please make sure you have read the instructions on the front cover of the question paper.

1 This question is about osmosis. Osmosis is the net (overall) movement of water from a solution of higher water potential into a solution of lower water potential through a partially permeable membrane.

Prepare four chips, from the potato provided, of length 8.0 cm and approximately 0.5 cm wide (see Fig. 1.1). Use a sharp knife or scalpel and a suitable cutting surface. You must cut the length as accurately as you can to 8.0 cm.

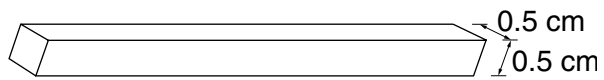


Fig. 1.1

- Put four test-tubes into a test-tube rack.
- Put each chip into a separate test-tube.
- Add solution **A** to your first two test-tubes. Add enough of the solution to cover your chips. Do not worry if your chips float. Label these tubes with the letter **A**.
- In the same way add solution **B** to your remaining two test-tubes. Label these tubes with the letter **B**.

- You must leave these chips for **at least 30 minutes**. It does not matter if they are left for longer than this. During this time move on to another question.

(a) After at least 30 minutes remove your chips from solution **A**, quickly dry them with a paper towel, and measure their new length.

(i) new length of first chip .....cm  
 new length of second chip .....cm [2]

(ii) Work out the average length of the chips after being in solution **A**.  
 .....  
 ..... [1]

(iii) Using this average length, calculate the percentage change in size.  
 .....  
 .....  
 .....  
 ..... [1]

3

(b) Now remove your chips from solution **B**. Dry them quickly with a paper towel and carefully measure their length.

new length of third chip .....cm

new length of fourth chip .....cm [2]

(c) (i) Using your knowledge of osmosis, and the results of your experiment, decide how the water potentials of the solutions **A** and **B** compare with the water potentials of the potato cells. Give your reason in each case.

solution **A**

.....  
.....  
.....

solution **B**

.....  
.....  
.....[4]

(ii) Use the results of your experiment to explain why soil water should always have a higher water potential than plant cells in a root.

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

(d) (i) Take one of your chips that was immersed in solution **A** and one from solution **B**. Try to bend them but do not break the chips. In the space below, draw a sketch of your chips to show the maximum bending you can achieve with each chip.

chip from solution **A**

chip from solution **B**

[1]

(ii) Use your observation to explain why a plentiful supply of water is needed for the mechanical support of a plant.

.....

.....

.....[2]

2 You are going to find the energy change when a certain mass of solid **Z** dissolves in a beaker. The first step is to find how much heat is stored by the 100 cm<sup>3</sup> glass beaker.

(a) (i) Weigh the 100 cm<sup>3</sup> glass beaker to the nearest gram. Record the mass in the space provided and convert this mass into kilograms.

mass of beaker in grams = .....g

mass of beaker in kilograms = .....kg [1]

(ii) Multiply the mass of the beaker in kg by 670. This gives the heat energy, **X** joules, for each degree Celsius change.

**X** = .....J/°C [1]

(b) (i) Weigh between 2.5 g and 3.5 g of solid **Z**. This must be accurately weighed to the nearest 0.1 g. Write down all weighings you make and record the accurate mass of **Z**.

mass of **Z** = .....g [2]

(ii) Using a measuring cylinder, measure out 25 cm<sup>3</sup> of cold water and pour into the 100 cm<sup>3</sup> beaker.

Measure and record the temperature  $T_1$  of this water, to the nearest 0.5 °C.

$T_1$  .....°C

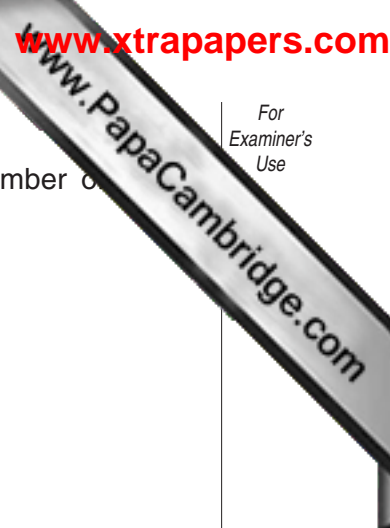
Add the weighed solid **Z** to the water and stir until it completely dissolves.

Read and record  $T_2$ , the lowest temperature reached.

$T_2$  .....°C

Calculate the temperature change,  $\Delta T$ .

$\Delta T$  = .....°C [4]



(iii) Use your results from (a)(ii) and (b)(ii) to calculate the total number of moles of **Z** absorbed by the dissolving of **Z** in water, using the formula below.

$$\text{total heat energy absorbed} = \Delta T (X + 105)$$

.....J [1]

(c) Suggest **one** way in which you could improve the experiment.

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

(d) Is the dissolving of **Z** in water endothermic or exothermic? Explain your answer.

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

(e) (i) Empty and rinse the beaker. Measure out 20 cm<sup>3</sup> of the liquid **L** into the same beaker. Measure its temperature,  $T_3$ , as accurately as you can and record its value.

$$T_3 = \text{.....}^\circ\text{C}$$

You are now required to pour into this liquid 50 cm<sup>3</sup> of water at exactly 60 °C, and stir thoroughly. Record the final temperature,  $T_4$ , of the mixture. The way in which you make the temperature of the water exactly 60 °C is for you to decide.

$$T_4 = \text{.....}^\circ\text{C} \quad [2]$$

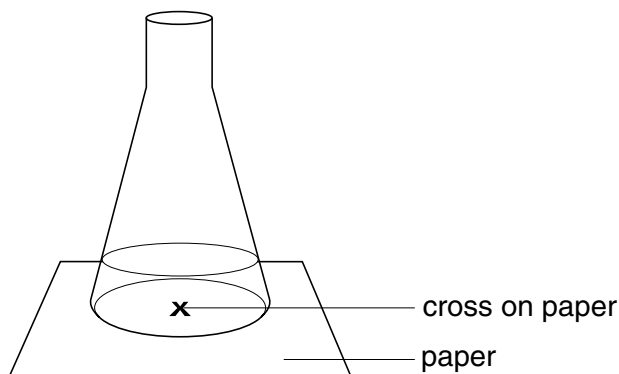
(ii) Describe how you made the temperature of the 50 cm<sup>3</sup> of water exactly 60 °C.

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

- 3 You are going to find out how the time taken for a reaction varies with temperature. The reaction produces a precipitate which will make the solution cloudy. See Fig. 3.1.

**Take care when handling hot liquids**

- (a) Mark a large cross in the centre of a piece of paper. The flask will be placed on this paper. You will look down at the cross through the solution. When the cross disappears, the reaction has finished.



**Fig. 3.1**

- (b)
- Using the larger measuring cylinder, measure 50 cm<sup>3</sup> of the solution labelled **H** and pour it into the flask.
  - Warm the contents of the flask to 35 °C (this will only take a few seconds). Place the flask over the cross on the paper.
  - Using the smaller measuring cylinder, measure 5 cm<sup>3</sup> of the solution labelled **J** and add it to the flask containing solution **H**. Start the clock and swirl the flask to mix the contents.
  - When you can no longer see the cross on the paper, stop the clock.
  - Record the starting temperature and time in seconds, in the table Fig. 3.2.

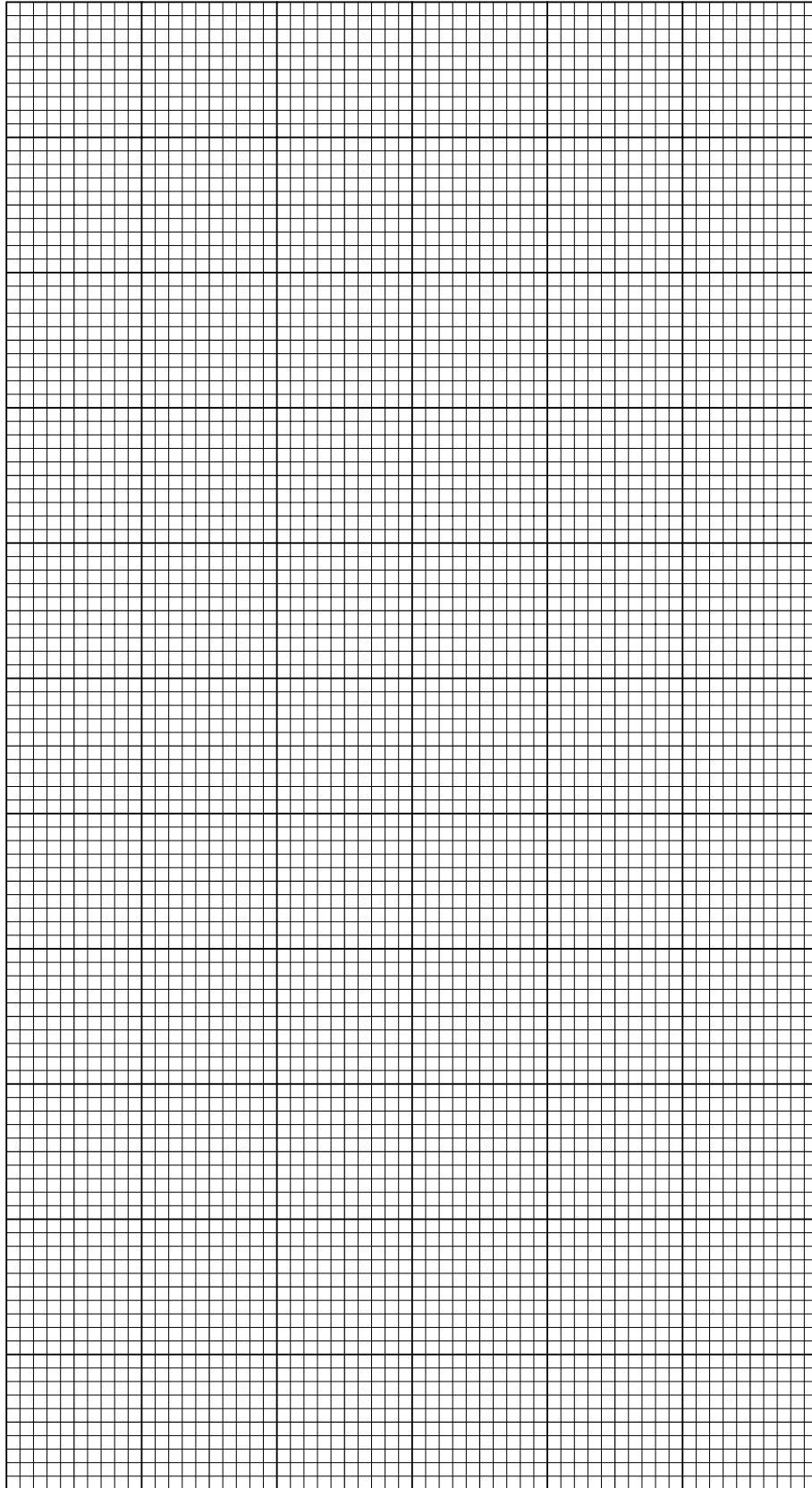
starting temperature/°C	time for cross to disappear/s

**Fig. 3.2**

[5]

- (c)
- Wash out the flask with water.
  - Repeat the above procedure but heat solution **H** to 40 °C.
  - Record the starting temperature and time in the table.
  - Repeat three more times using an increased starting temperature each time. Do **not** exceed a starting temperature of 70 °C

- (d) Plot a graph on the grid provided of time (vertical axis) against temperature. Label the temperature axis from 0 °C to 100 °C. Draw a smooth curve through your points.





(e) Use your graph to answer the following questions:

(i) Find the time for the reaction at 10 °C.

time = .....s

(ii) Find the temperature required to produce a reaction time of 50 seconds.

temperature = ..... °C [2]

(f) Describe the relationship between the temperature and the time taken for the reaction to occur.

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

(g) The graph you have plotted does not show the relationship between **rate of reaction** and temperature. Briefly explain what you would do with your results to show such a relationship.

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

(h) Briefly describe how you would carry out an experiment at 0 °C to find the reaction time.

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



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## CHEMISTRY PRACTICAL NOTES

## Test for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
carbonate ( $\text{CO}_3^{2-}$ )	add dilute acid	effervescence, carbon dioxide produced
chloride ( $\text{Cl}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate ( $\text{NO}_3^-$ ) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulphate ( $\text{SO}_4^{2-}$ ) [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 ( $\text{NH}_4^+$ )	ammonia produced on warming	—
copper(II) ( $\text{Cu}^{2+}$ )	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) ( $\text{Fe}^{2+}$ )	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) ( $\text{Fe}^{3+}$ )	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc ( $\text{Zn}^{2+}$ )	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 result</i>
ammonia ( $\text{NH}_3$ )	turns damp litmus paper blue
carbon dioxide ( $\text{CO}_2$ )	turns lime water milky
chlorine ( $\text{Cl}_2$ )	bleaches damp litmus paper
hydrogen ( $\text{H}_2$ )	'pops' with a lighted splint
oxygen ( $\text{O}_2$ )	relights a glowing splint