Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/05**

Paper 5 Practical Test

October/November 2003

2 hours

Candidates answer on the Question Paper.
Additional Materials: As listed in Instructions to Supervisors

READ THESE INSTRUCTIONS FIRST

Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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.
Chemistry practical notes for this paper are printed on page 12.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **11** printed pages and **1** blank page.

University of Cambridge
Local Examinations Syndicate

[Turn over

1 This question is about heat loss in animals. During cold weather some animals group together (huddle) to keep warm.

Your experiment is to find how effective such huddling is.

You will use test-tubes of hot water to represent the animals. One tube, tube **A**, will be put in the middle of six others. Another tube, tube **B**, will be put by itself.

- Put eight test-tubes into a test-tube rack. You may need two racks.
- Label one test-tube '**A**' and another one test-tube '**B**'.
- Arrange a stand and clamp to hold tube **B** in the middle of an empty beaker (see Fig. 1.1(a)).
- Now return tube **B** to the rack. Ask your supervisor to put hot water into one of your beakers. (The water will be at a temperature above 90 °C, be careful).
  This is your supply of hot water and is to be used to put water in the test-tubes.

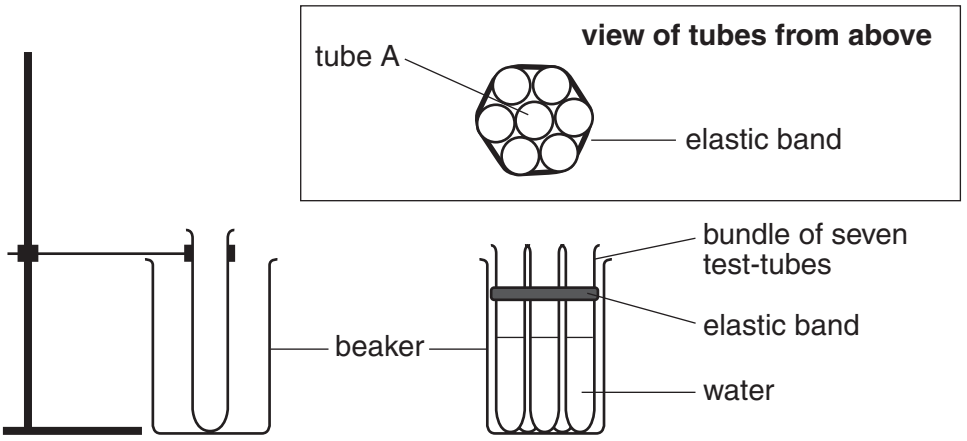


Fig. 1.1

- Half-fill each test-tube with the hot water provided.
- Replace tube **B** in the clamp so that it is by itself in the beaker.
- Put seven of your test-tubes into a different empty beaker. Group them so that tube **A** is in the middle surrounded by the six remaining tubes. Hold them together with an elastic band. This is shown in Fig. 1.1(b).
- Put a thermometer into test-tubes **A** and **B**.

(a) Take the temperature of both test-tubes, (time 0 minutes), and then record the temperatures every minute for ten minutes in the table, Fig. 1.2.

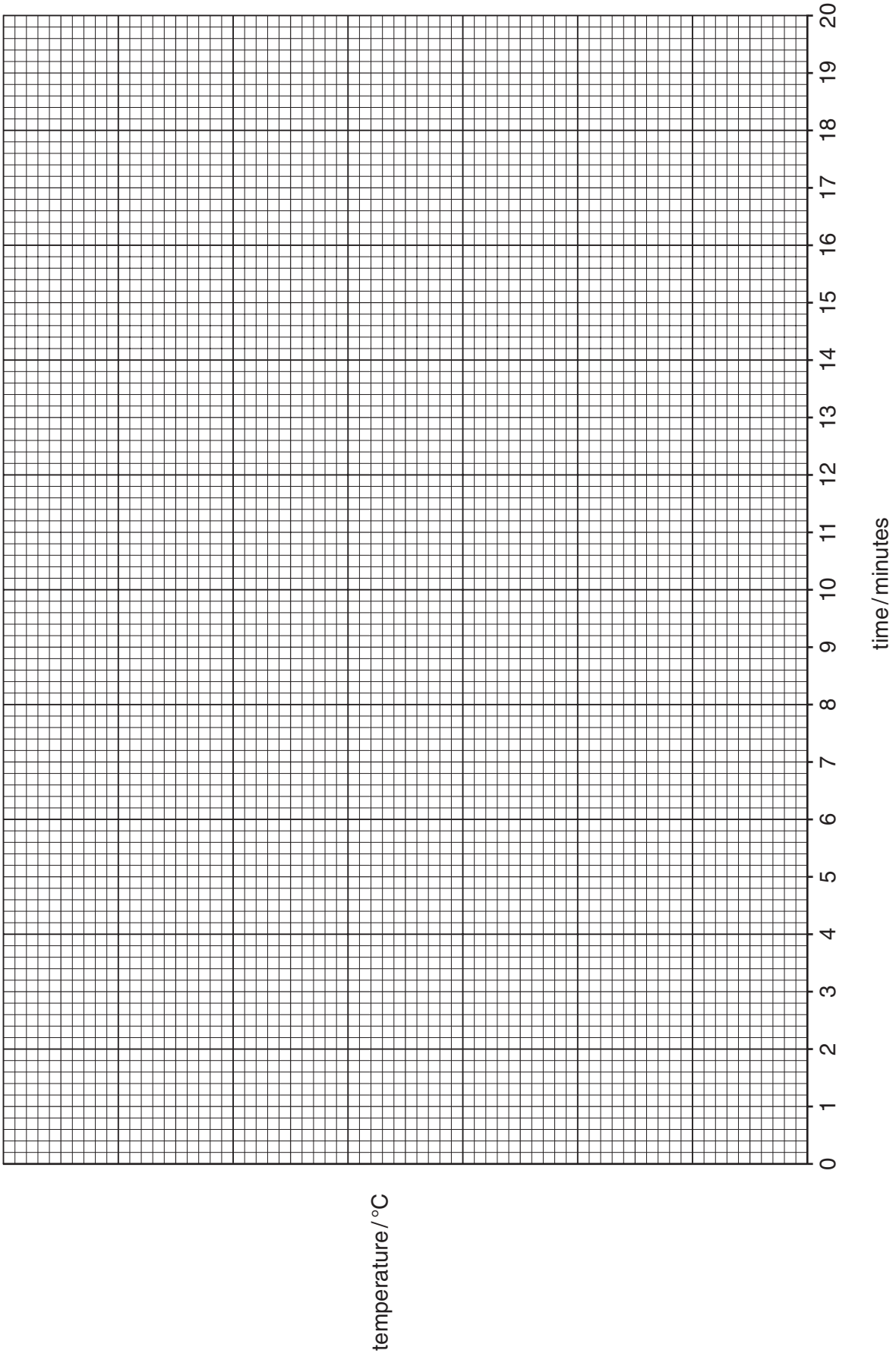
time/minutes	temperature of tube **A**/°C	temperature of tube **B**/°C

[3]

Fig. 1.2

[Turn over

(b) (i) Plot temperature (vertical axis) against time for each tube.
Draw smooth curves through the points and label the lines 'tube **A**' and 'tube **B**'



[3]

(ii) Which test-tube, **A** or **B**, cooled down more slowly?

.....[1]

(c) Is huddling effective? Use your results and your knowledge of heat transfer to explain your answer.

.....

.....

.....

.....[3]

(d) Assuming that all seven test-tubes in the bundle with tube **A** had the same starting temperature, suggest the temperature for one of the outer tubes after ten minutes. Explain your answer.

suggested temperature after ten minutes ..... °C

explanation .....

.....[2]

(e) Continue the lines for tube **A** and tube **B** on your graph to show how you would expect the readings to change over the next ten minutes. [1]

(f) Suggest **two** ways in which you could improve the accuracy of the experiment.

.....

.....

.....[2]

2 Substance **X** is a mixture of a simple salt and a metal oxide. You are going to carry out tests to identify the salt and the metal oxide.

(a) Place a small amount of **X** in a test-tube and add about 5 cm^3 dilute nitric acid. Warm carefully. Record your observation.

observation .....[1]

(b) Prepare a solution for testing as follows.

Warm the remainder of **X** with about 15 cm^3 water in a large test-tube or beaker. Filter and use portions of the filtrate for testing as indicated below. Keep the filter paper containing the solid residue in the filter funnel, for part **(c)**.

(i) To about 2 cm^3 of the filtrate, add about 5 cm^3 of dilute hydrochloric acid. Record your observation and any conclusion.

observation .....

conclusion .....[2]

(ii) To another 2 cm^3 of the filtrate, add a few drops of nitric acid followed by a few drops of silver nitrate solution. Record your observation and any conclusion.

observation .....

conclusion .....[2]

(iii) To another 2 cm^3 of the filtrate, add about 1 cm^3 of aqueous sodium hydroxide and warm the mixture. The solution should be hot but do **not** boil. Test any gas given off with moist red litmus paper. Record your observation and identify the gas.

observation .....

name of gas given off .....[2]

(c) Warm about 10 cm^3 of dilute nitric acid in a test-tube until it is very hot, and pour onto the solid residue in the filter paper from **(b)**. Collect the filtrate in a test-tube. You are required to carry out two tests of your own on this filtrate which enables you to identify the metal in the metal oxide. You are advised to use about 2 cm^3 of the filtrate for each test. Describe fully each test you carry out. Include any relevant observations.

test 1 .....

.....

.....[3]

test 2 .....

.....

.....[3]

(d) Complete the following:

The salt in **X** is ..... .

The metal oxide in **X** is ..... oxide. [2]

3 You are going to show how the solubility of potassium nitrate varies with temperature.

(a) The large test-tube contains 7.0 g of potassium nitrate and 5.0 cm^3 of water.

- Clamp the tube in the stand.
- Lower the tube into a beaker of water so that the level of the water in the beaker comes above the level of the water in the tube as shown in Fig. 3.1.
- Heat the beaker of water, stirring the contents of the tube until all the potassium nitrate has dissolved.
- Remove the tube from the beaker of water.
- Allow the tube to cool, stirring gently all the time.
- Small shiny crystals will appear. Note the temperature at which these crystals appear and record it in the table, Fig. 3.2.

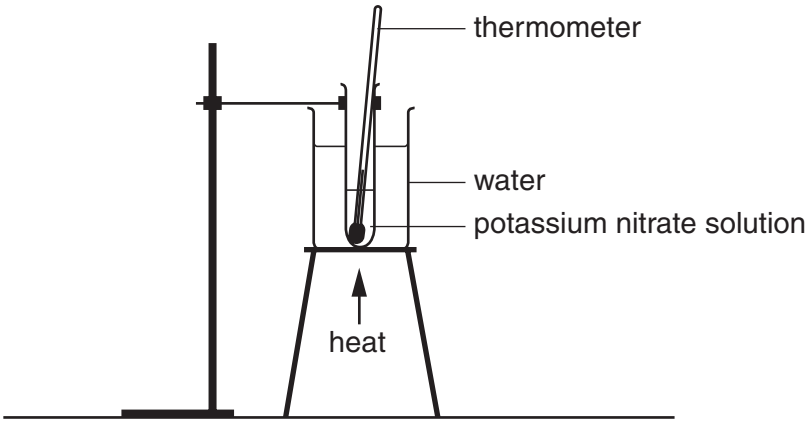


Fig. 3.1

[Turn over

(b) Use a burette or calibrated dropper to add 1.0 cm^3 of water to the tube, making a total of 6.0 cm^3. Replace the tube in the beaker of water.
Warm the water again, stirring until all the solid has dissolved. Remove from the beaker and note the temperature at which crystals appear. Record this temperature in the table, Fig. 3.2.

(c) Repeat the procedure, adding 1.0 cm^3 of water each time to obtain two more readings. Record the temperatures in the table, Fig. 3.2.

Two more sets of readings are provided for you.

mass of potassium nitrate / g	total vol water / cm^3	mass of potassium nitrate per 100 g of water / g	temperature at which crystals form / °C
7.0	4.0	175	78
7.0	5.0		
7.0	6.0		
7.0	7.0		
7.0	8.0		
7.0	12.0	58.3	38

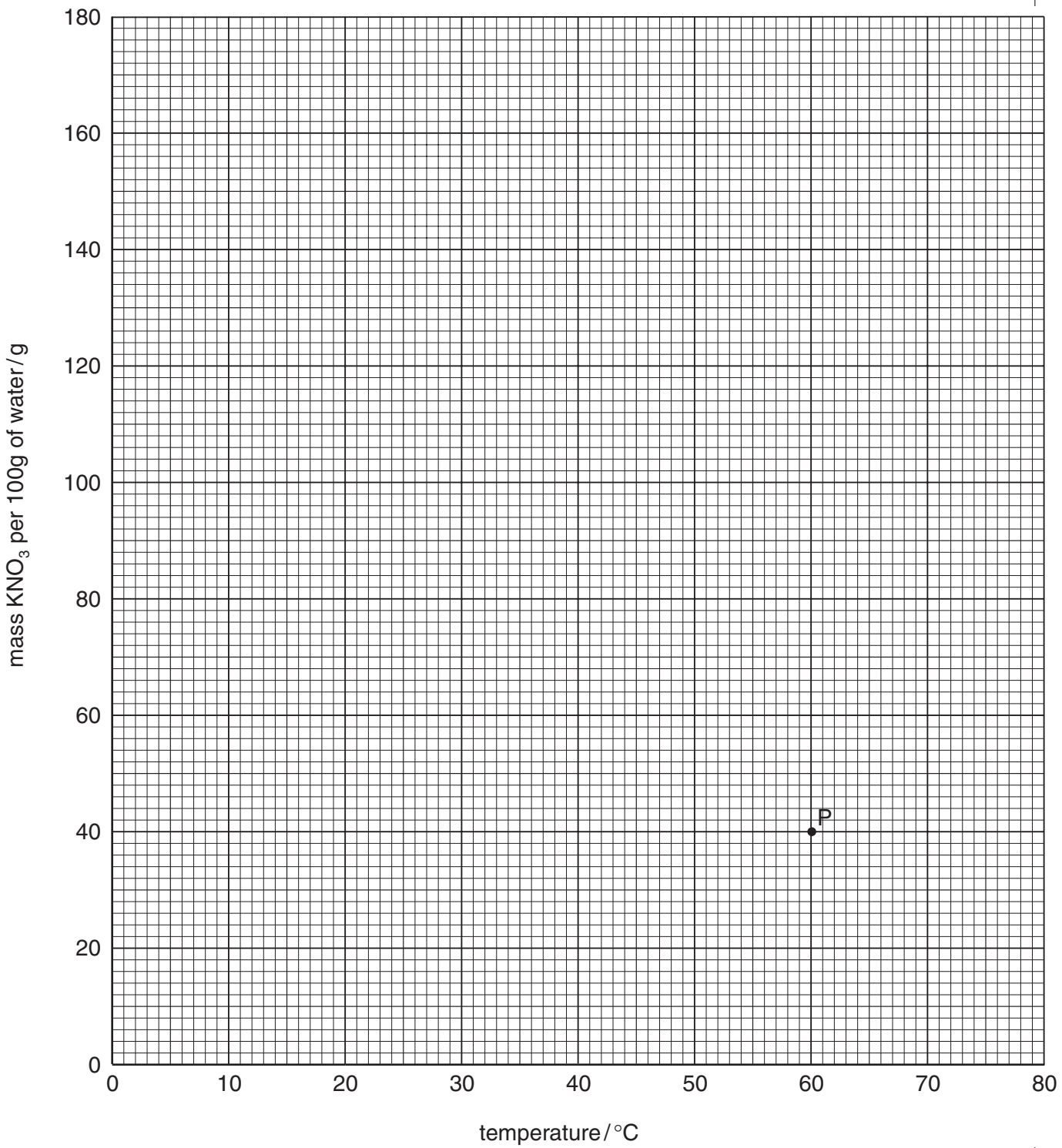
[5]

Fig. 3.2

(d) Complete the table by calculating the mass of potassium nitrate in 100 g water in each line. Assume that 1 cm^3 of water has a mass of 1 g. [1]

For Examiner's Use

(e) Plot a graph of mass of potassium nitrate per 100 g water (vertical axis) against temperature at which crystals form. [3]



(f) Use your graph to answer the following:

(i) If a solution of potassium nitrate containing 100 g of the salt per 100 g water at 70 °C is cooled, at what temperature will crystals start to appear?

.....[1]

(ii) Estimate the solubility of potassium nitrate in water at 0 °C.

..... g per 100 g water. [1]

[Turn over

(g) Why was the temperature taken when the crystals appeared on **cooling** rather than when they disappeared when **heating**?

.....

.....

.....[1]

(h) Note the point **P** on the graph and then complete the following sentence.

The point **P** represents a solution of ..... g potassium nitrate in ..... g water at a temperature of ..... °C. [3]

BLANK PAGE

CHEMISTRY PRACTICAL NOTES

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
sulphate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium chloride *or* 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