Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

PHYSICAL SCIENCE **0652/06**

Paper 6 Alternative to Practical

October/November 2003

1 hour

Candidates answer on the Question Paper.
No Additional Materials are required.

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 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.

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	
4	
5	
6	
Total	

This document consists of **16** printed pages.

SP (NF/SLM) S42209/3

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

1 A student investigated the relationship between the volume of a beaker containing a burning candle and the time for which it continued to burn.
She set up the apparatus as shown in the diagram, Fig. 1.1.

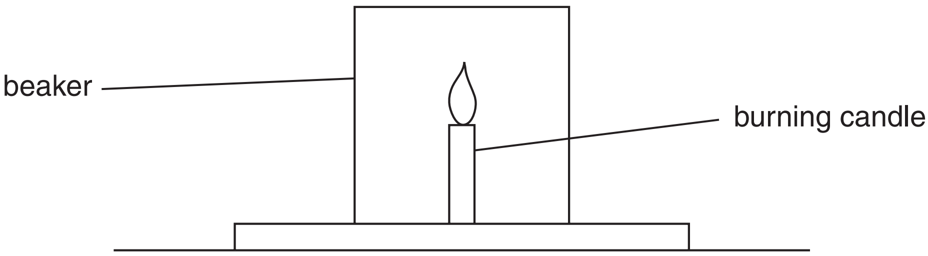

Fig. 1.1

The student lit the candle and placed a 100 cm^3 beaker over it. She used a stopclock to find out how long the candle burned. She then repeated the experiment with beakers of volumes 500 cm^3 and 1000 cm^3.

The burning times for the candles are shown on the stopclocks in Fig. 1.2.

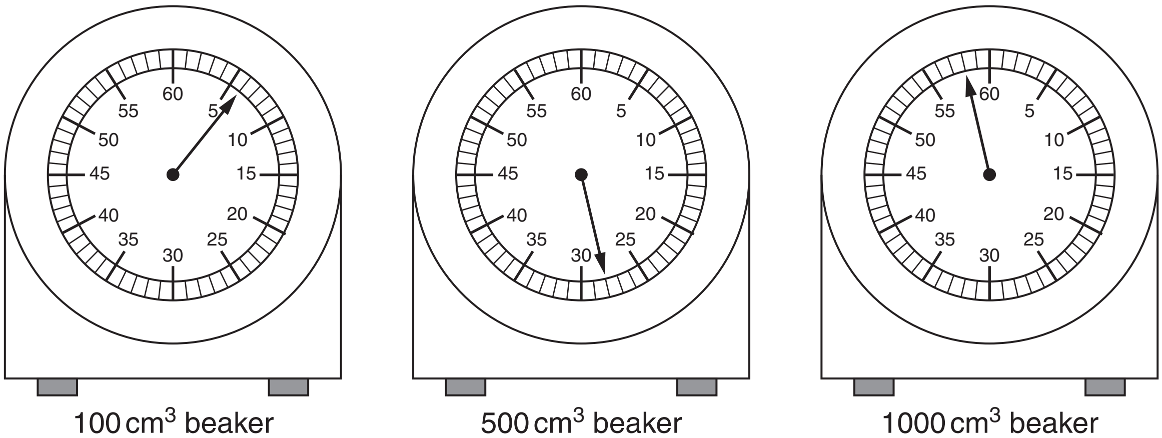

Fig. 1.2

(a) Record the times in the table, Fig. 1.3.

volume of beaker / cm^3	time / s
100	
500	
1000	

[3]

Fig. 1.3

For Examiner's Use

(b) What is the relationship between the volume of the beaker and the burning time of the candle? Explain your answer.

relationship ....

....

explanation ....

....[2]

(c) After the candle flame had gone out the student added limewater to the 100 cm^3 beaker. The limewater turned milky. Name the gas present in the beaker which caused the limewater to turn milky.

....[1]

(d) The student also noted that a few droplets of a colourless liquid collected on the inside of the beaker as the candle was burning. What test could the student do to show that the liquid contained water and what is the result of this test?

test ....

....

result ....

....[2]

(e) Explain how the products named in **(c)** and **(d)** were formed by the burning of the candle in air.

....

....

....[2]

[Turn over

For Examiner's Use

2 A student was asked to find the mass of a metre rule using the apparatus shown in Fig. 2.1.

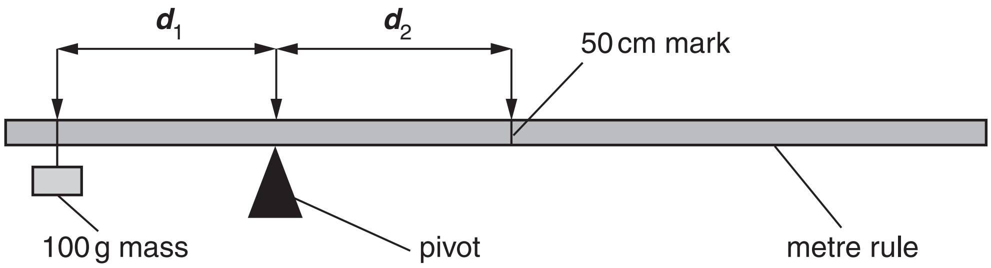

Fig. 2.1

The student hung the 100 g mass from the 2 cm mark of the metre rule. She moved the position of the pivot until the rule balanced, see Fig. 2.1. She did this four more times with the mass hanging at the 4, 6, 8 and 10 cm marks. The position of the pivot changed each time the mass was moved. She recorded the position of the pivot in the table, Fig. 2.3.

(a) The positions of the pivot when the mass was hanging at 4 cm and 8 cm are shown in Fig. 2.2 Record these readings in the table, Fig. 2.3.

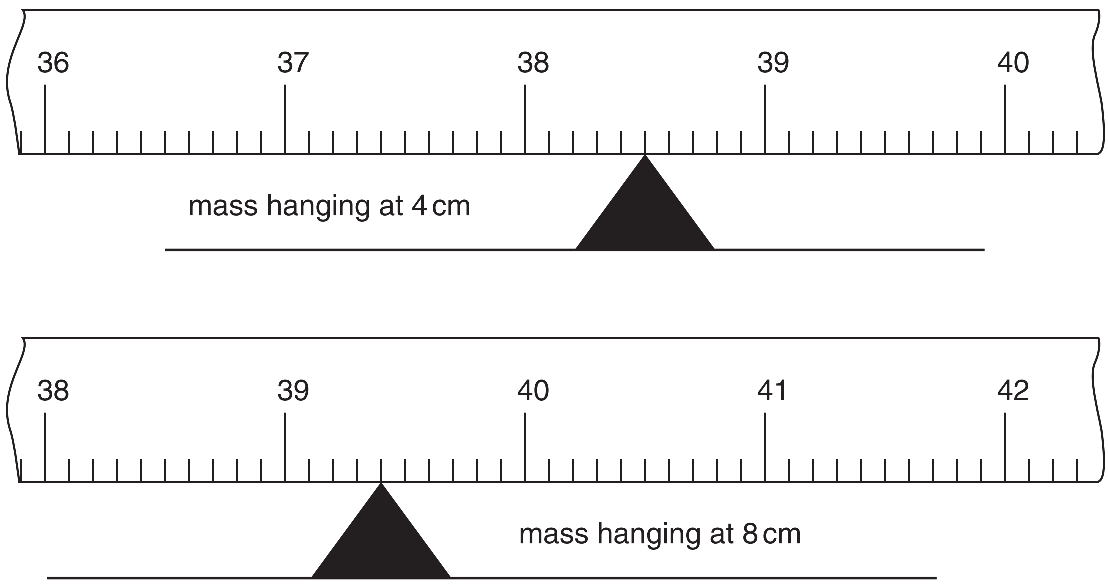

Fig. 2.2

position of mass / cm	position of pivot / cm
2	37.9
4	
6	39.1
8	
10	40.0

[2]

Fig. 2.3

(b) The student calculated the mass of the metre rule using the formula below. Fig. 2.1 shows the distance $\boldsymbol{d}_1$ and $\boldsymbol{d}_2$.

$$\text{mass} = \frac{\boldsymbol{d}_1 \times 100}{\boldsymbol{d}_2}$$

$\boldsymbol{d}_1$ = position of pivot – position of mass
$\boldsymbol{d}_2$ = 50 – position of pivot

(i) Use data from Fig. 2.3 to calculate $\boldsymbol{d}_1$ and $\boldsymbol{d}_2$ when the position of the mass is 10 cm.

$\boldsymbol{d}_1$ = ... cm

$\boldsymbol{d}_2$ = ... cm [2]

(ii) Calculate the mass of the metre rule using the values of $\boldsymbol{d}_1$ and $\boldsymbol{d}_2$ from **(b)(i)**.

mass of metre rule = ... [2]

(c) How could the student use all five of the results to produce a more accurate value for the mass of the metre rule?

....

....[1]

(d) Describe how the student could use the **same** apparatus to find the mass of a small rock.

....

....

....

....

....

....

....

....[3]

3 Three students each set up an experiment using the apparatus shown in the diagram, Fig. 3.1.

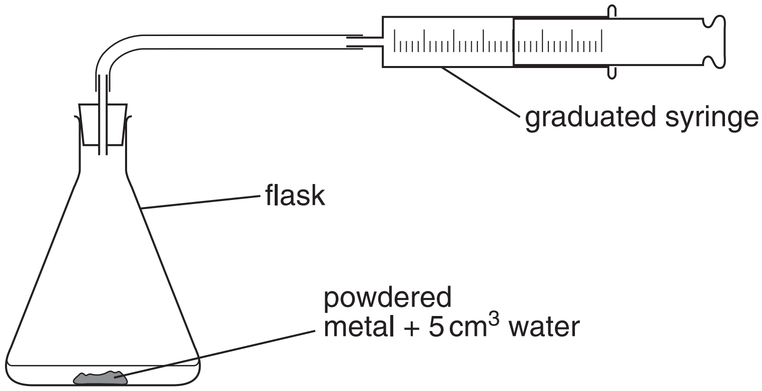

Fig. 3.1

- Each of the 100 cm^3 flasks contained a small mass of one of the metals **X**, **Y** or **Z** with 5 cm^3 of water.
- At first, all the syringes were set at the 25 cm^3 mark.
- The flasks were left for one week.
- The students recorded their results in the table, Fig. 3.3.

(a) Fig. 3.2 shows the scales of the syringes after one week.

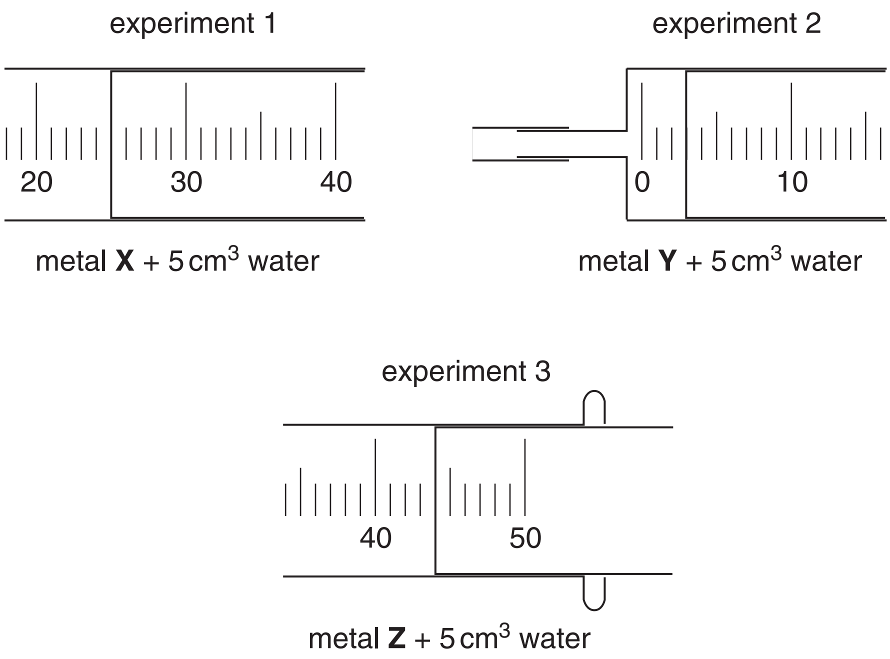

Fig. 3.2

Record the readings of the syringes in the table, Fig. 3.3.

experiment number	flask contained	syringe reading on day 1 / cm^3	syringe reading after one week / cm^3
1	metal **X** + 5 cm^3 of water	25	
2	metal **Y** + 5 cm^3 of water	25	
3	metal **Z** + 5 cm^3 of water	25	

[3]

Fig. 3.3

(b) Suggest the names of the metals used in the experiments 1–3. Choose from the following list of metals. (there may be more than one correct answer each time)

calcium copper iron magnesium zinc

Explain your answers.

(i) Metal **X** could be ....

explanation ....

....[1]

(ii) Metal **Y** could be ....

explanation ....

....[2]

(iii) Metal **Z** could be ....

explanation ....

....[2]

(c) Name the gas made by the reaction in experiment 3.

....[1]

4 A student did an experiment to investigate the solubility of potassium nitrate in water at different temperatures.
The student placed 7.0 g of potassium nitrate and 4.0 cm^3 of water in a large test-tube.

- He heated the test-tube in a water bath until all the crystals had dissolved.
- He allowed the test-tube to cool and gently stirred the contents with the thermometer.
- When he saw small shiny crystals in the solution, he recorded the temperature in the results table, Fig. 4.2.
- He added 1.0 cm^3 of water to the test-tube and stirred the mixture.

Then the steps shown above were repeated to find another temperature at which crystals began to appear.

He added 1.0 cm^3 portions of water to the tube until the total volume of water was 12.0 cm^3. Each time he found the temperature at which crystals began to appear.

Fig. 4.1 shows the scale of the thermometer for three of the experiments.

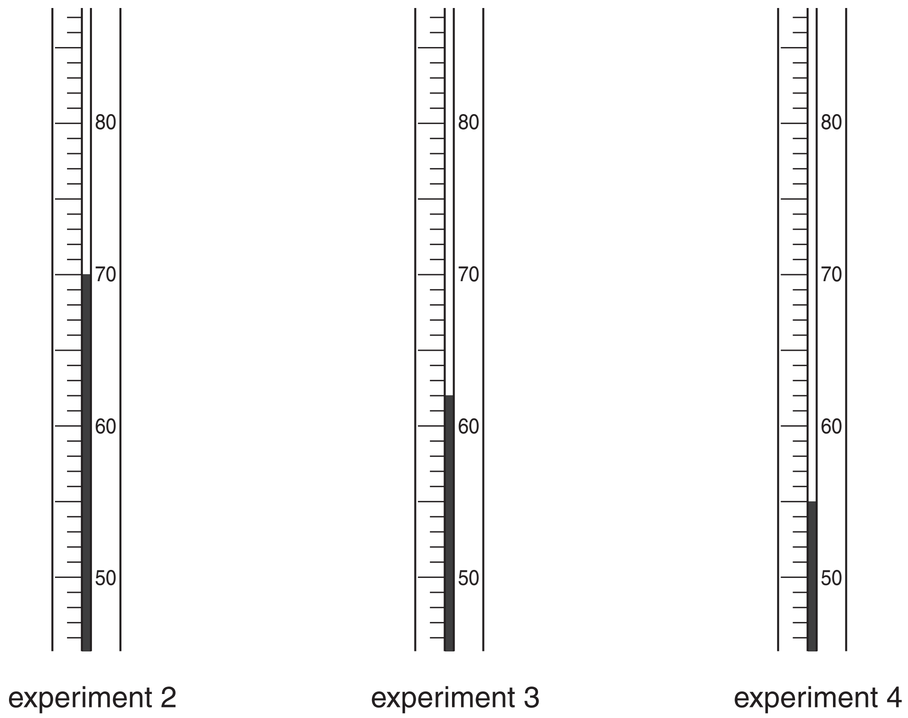

Fig. 4.1

(a) Read the thermometers in Fig. 4.1 and record the results in the table, Fig. 4.2.

experiment number	total volume of water / cm^3	mass of potassium nitrate / g	mass of potassium nitrate per 100 cm^3 of water / g	temperature / °C
1	4.0	7.0	175.0	78
2	5.0	7.0		
3	6.0	7.0	117.0	
4	7.0	7.0	100.0	
5	8.0	7.0	87.5	50
6	12.0	7.0	58.3	38

[3]

Fig. 4.2

(b) Complete Fig. 4.2 by calculating the missing value for the mass of potassium nitrate in 100 g water. [1]

[Turn over

(c) On the graph grid provided, Fig. 4.3, plot a graph of mass of potassium nitrate per 100 g water (vertical axis) against temperature. Draw a smooth curve. [3]

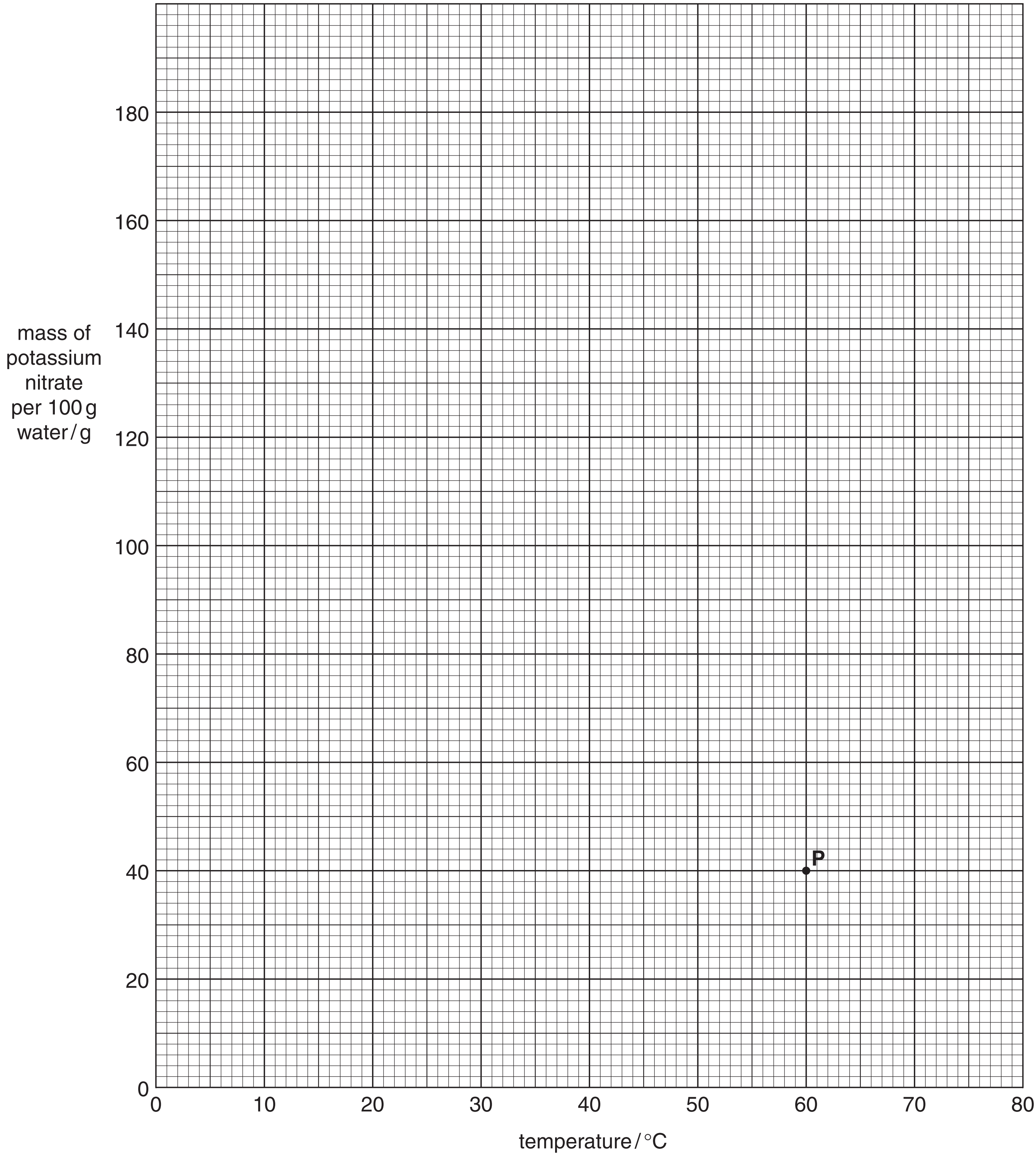

Fig. 4.3

For Examiner's Use

(d) A point **P** has already been marked on the graph grid. Study the graph and then complete the following sentence about point **P**.

The point P represents a solution of .... g potassium nitrate in .... g of water at a temperature of .... °C. [1]

(e) The student wants to get solid potassium nitrate from the solution. Explain carefully how he can do this.

....

....

....[2]

[Turn over

5 A student is given substance **X**, which is a mixture of a salt and a metal oxide. Substance **X** is a black solid.
She does the following tests and writes her observations.

(a) Complete the table, Fig. 5.1, by writing the conclusions.

test	observation	conclusion
1. To a small amount of **X**, add 5 cm^3 dilute nitric acid and warm.	blue solution formed	[1]
2. Warm a portion of **X** with 15 cm^3 water in a large test-tube. Filter the mixture and use 2 cm^3 of the filtrate for each of the **tests 3–5**.	black residue in filter paper and a colourless filtrate	
3. To 2 cm^3 of the filtrate from **test 2**, 5 cm^3 hydrochloric acid was added.	colourless solution, no bubbling seen	[1]
4. To 2 cm^3 of the filtrate from **test 2**, a few drops of nitric acid were added, followed by silver nitrate solution.	white precipitate	[1]
5. To 2 cm^3 of the filtrate from **test 2**, about 1 cm^3 aqueous sodium hydroxide was added. The mixture was warmed.	pungent-smelling gas given off, turns red litmus blue	[1]
6. About 10 cm^3 warm dilute nitric acid was poured on to the residue from **test 2**. The filtrate was collected.	blue solution formed	

Fig. 5.1

(b) Suggest another test the student might use to confirm the presence of the gas from **test 5**.
What result can she expect for your test?

test ....

result ....[2]

For Examiner's Use

(c) The student thinks that the filtrate from **test 6** might contain copper ions. She tries adding ammonia solution to some of the filtrate.

(i) What will she **see** when she adds a few drops of ammonia solution, if copper is present?

....

....

(ii) What will she **see** when she adds an excess of ammonia solution, if copper is present?

....

....[3]

(d) Suggest what substances are present in substance **X**.

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

6 Two students do an experiment to determine the speed of sound in air.
The first student fires a gun at point **X**, 1000 metres away from the second student at point Y.

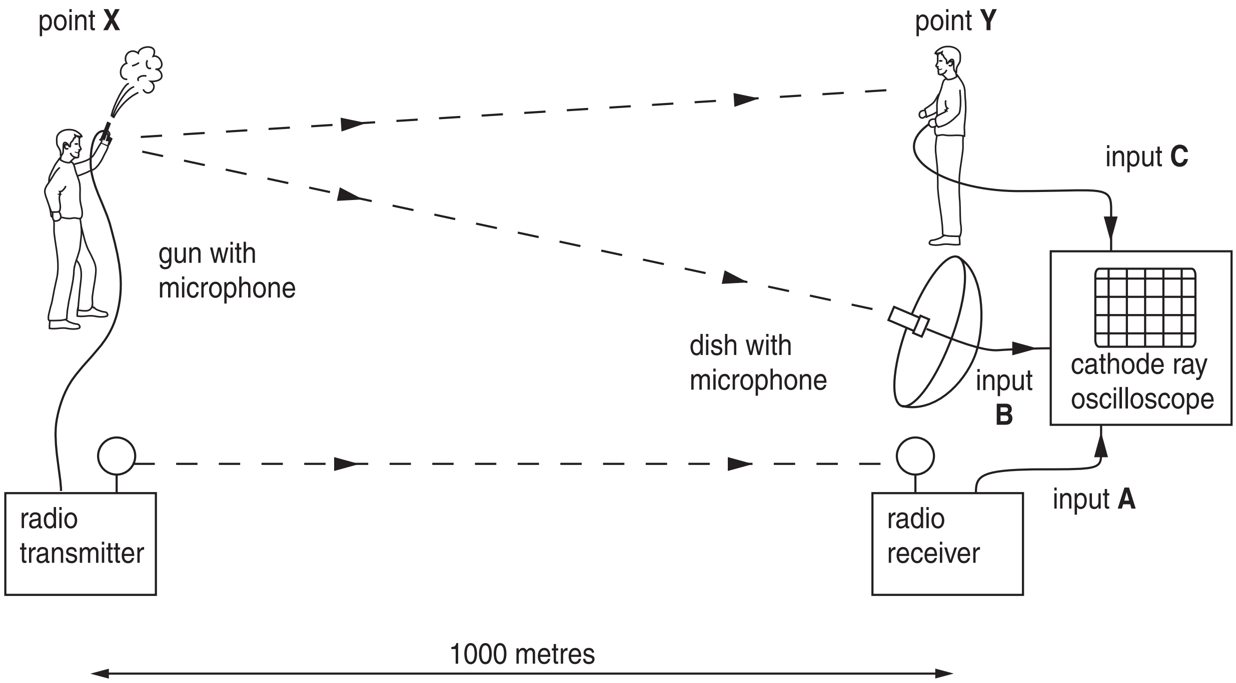

Fig. 6.1

- A microphone on the gun picks up the sound. It sends a signal to a radio transmitter. This signal is sent to the radio receiver at point **Y**. The receiver sends **input A** to a cathode ray oscilloscope (c.r.o.).
- A dish at point **Y** reflects the sound to a microphone in the dish. This sends **input B** to the c.r.o.
- The sound of the gun travels through the air. When the second student hears the sound of the gun at point **Y**, he presses a switch to send **input C** to the c.r.o.

(a) The inputs to the c.r.o. are pulses of energy.
State how the energy travels **from point X to point Y** in each case.

(i) **input A** ....

(ii) **input B** ....[2]

(b) Explain why the microphone at point **Y** needs a reflector dish but the microphone at point **X** does not need one.

....

....[1]

(c) The screen of the c.r.o. is saved and displayed. This is shown in Fig. 6.2.

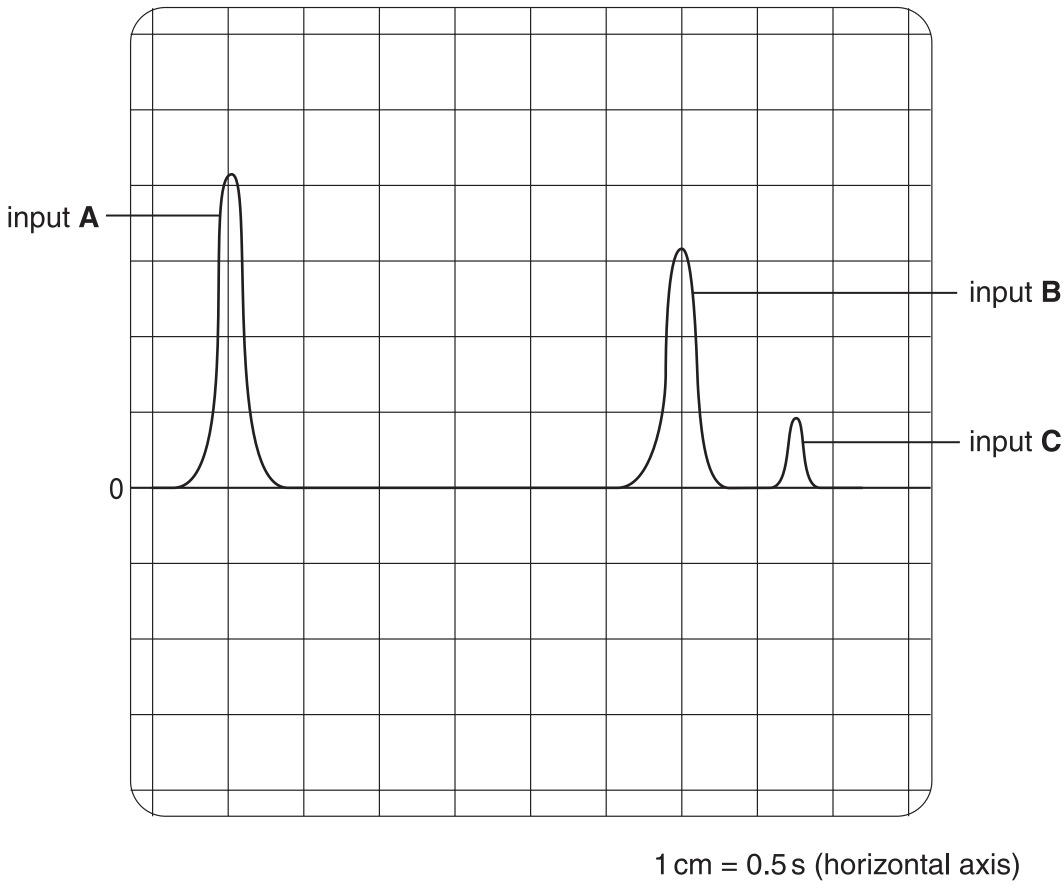

Fig. 6.2

The c.r.o. is set so that 1 cm on the horizontal axis = 0.5 seconds.

Use the information in Fig. 6.2 to determine

(i) the length of time, $\mathbf{t_1}$, between **input A** and **input B**,

$\mathbf{t_1}$ = ...s [1]

(ii) the length of time, $\mathbf{t_2}$, between **input A** and **input C**,

$\mathbf{t_2}$ = ...s [1]

For Examiner's Use

(d) Calculate the speed of sound in metres per second as it travels from point **X** to point **Y**

(i) using $\mathbf{t_1}$ from **(c)(i)**,

speed of sound = ...m / s [1]

(ii) using $\mathbf{t_2}$ from **(c)(ii)**,

speed of sound = ...m / s [1]

(e) Which result, **(d)(i)** or **(d)(ii)**, for the speed of sound is more reliable? Explain your answer.

....

....[2]

(f) How can **all** of the results from this experiment be made more reliable?

....

....[1]