Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

7222111301

PHYSICS **5054/41**

Paper 4 Alternative to Practical **October/November 2016**

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.
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.

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.

DC (NF/SW) 120109/2

CAMBRIDGE International Examinations

1 A student investigates how surface area affects the rate of evaporation of water at room temperature.

(a) She places a beaker of water on a top-pan balance, as shown in Fig. 1.1.

Fig. 1.2 shows the beaker on the balance 14 days later.

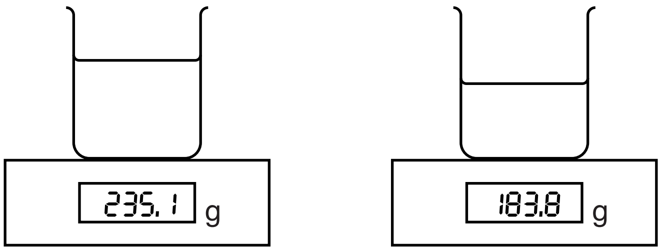

Fig. 1.1 **Fig. 1.2**

Some water has been lost due to evaporation.

Calculate the average loss of mass per day by evaporation.

loss of mass per day = ... [2]

(b) A second student carries out the same experiment with a beaker of larger diameter. The students compare their results and conclude that the rate of evaporation increases with surface area.

State two other quantities that must have been the same in the two experiments if they can be sure of their conclusion.

1. ....

....

2. ....

....
[2]

(c) The experiment took 14 days to complete.

In order to carry out the experiment in a shorter time, suggest a piece of apparatus that increases the rate of evaporation.

.... [1]

2 A student investigates how the height of a ramp affects the distance travelled by a toy car along the floor, as shown in Fig. 2.1.

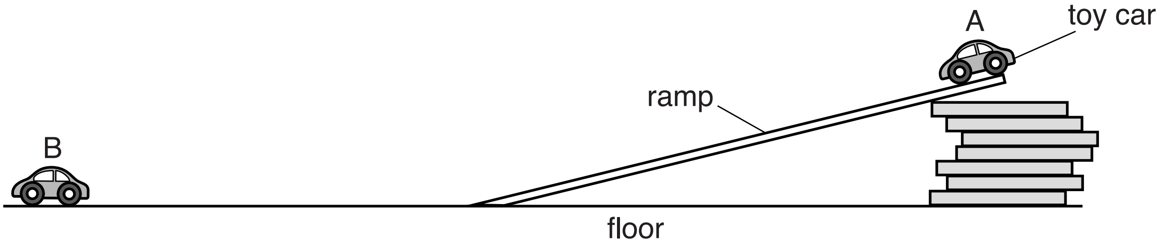

Fig. 2.1 (not to scale)

The car is placed at the top of the ramp in position A and then released. The car travels down the ramp and along the horizontal floor. It stops at position B.

The car falls a vertical distance h when travelling down the ramp. It then travels a distance l along the floor.

(a) On Fig. 2.1,

- draw the car immediately after it has completely left the ramp,
- mark the distance l,
- mark the height h.

[2]

(b) The student measures the height h and then measures the distance l three times. He then changes the height of the ramp and repeats the experiment.

Describe how the student can measure h accurately. You may draw on the diagram if you wish.

....

....

.... [2]

(c) Fig. 2.2 is the table of results.

h/cm	l/cm			l_{av}/cm
	1	2	3	
1.0	54.8	52.5	54.0	54
1.5	70.6	73.7	73.7	73
2.0	95.2	93.7	92.8	94
2.5	123.2	124.3	121.6	
3.0	149.9	151.2	158.7	
3.5	189.7	181.8	191.1	

Fig. 2.2

(i) For the first three heights, the student calculates the average distance l_{av}. l_{av} is written to the nearest cm. Suggest a reason for writing l_{av} to the nearest cm.

....

.... [1]

(ii) Complete Fig. 2.2 to include l_{av} for all his results. Give l_{av} to the nearest cm in each case. [2]

(iii) On Fig. 2.3 opposite, plot the graph of l_{av}/cm on the y-axis against h/cm on the x-axis. Start your axes from (0,0). Draw the line of best fit. [4]

(iv) Describe the relationship between l_{av} and h.

....

.... [1]

(d) In another experiment using the same apparatus, l_{av} is measured as 140 cm. Using your graph, suggest the value of h that was used.

h = ... [1]

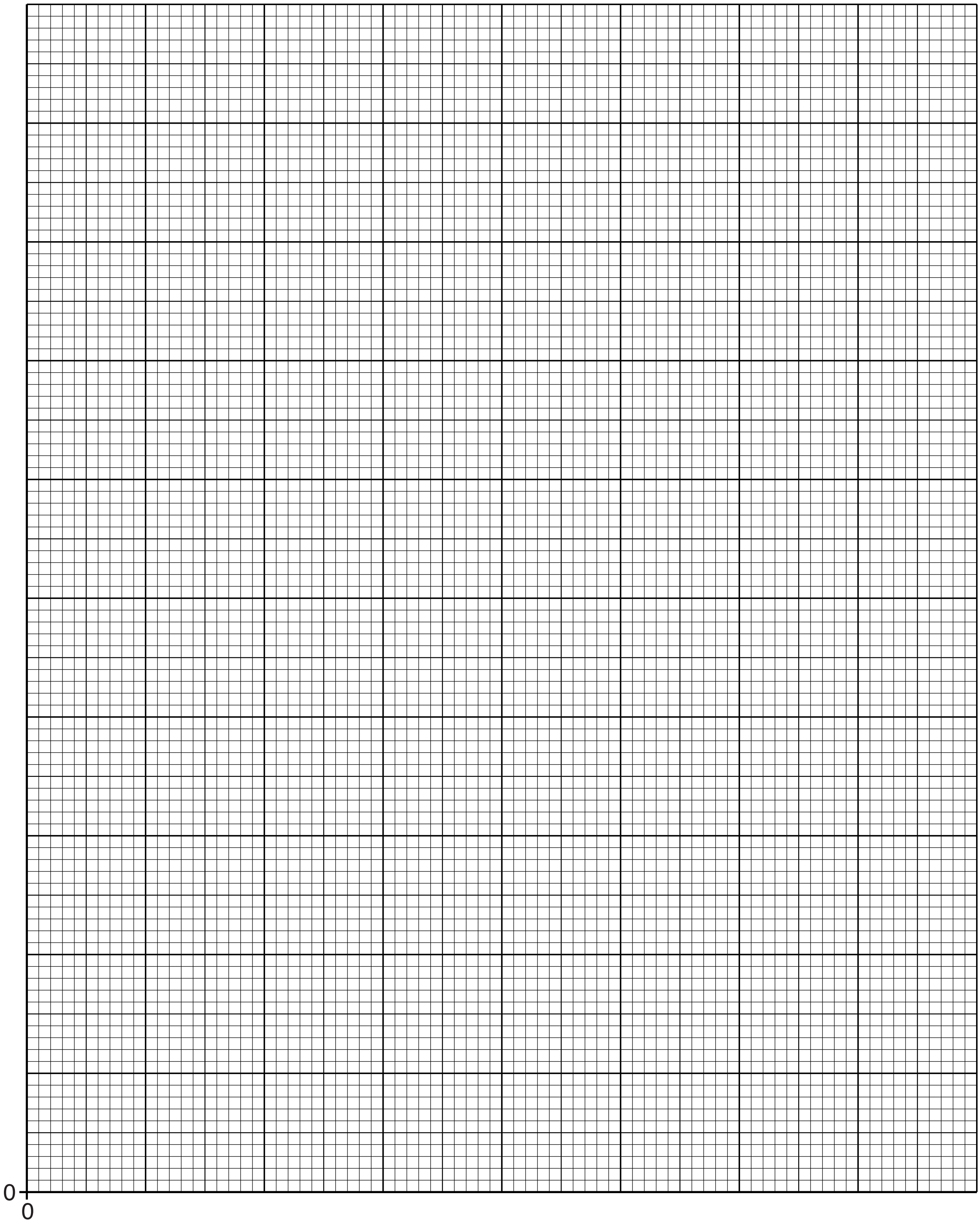

Fig. 2.3

3 A student determines the specific heat capacity of aluminium. The student has been provided with

- a thermometer,
- a heater,
- an aluminium block of mass 1.00 kg with holes for the heater and thermometer,
- a d.c. power supply,
- an ammeter,
- a voltmeter,
- a stop-clock.

(a) On Fig. 3.1, complete the circuit diagram to connect the heater to the power supply, the ammeter and the voltmeter.

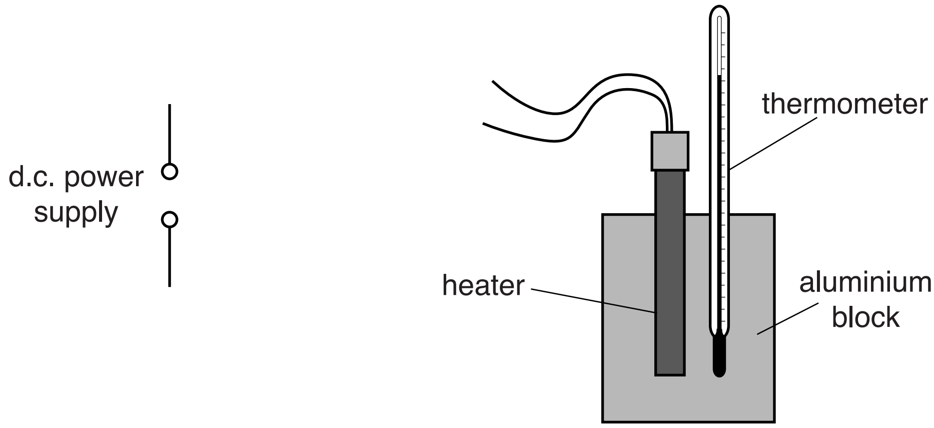

Fig. 3.1

[2]

(b) Initially the block is at room temperature which is 23.5 °C. The student switches on the power supply and starts the stop-clock at the same instant. The ammeter and voltmeter readings are shown in Fig. 3.2.

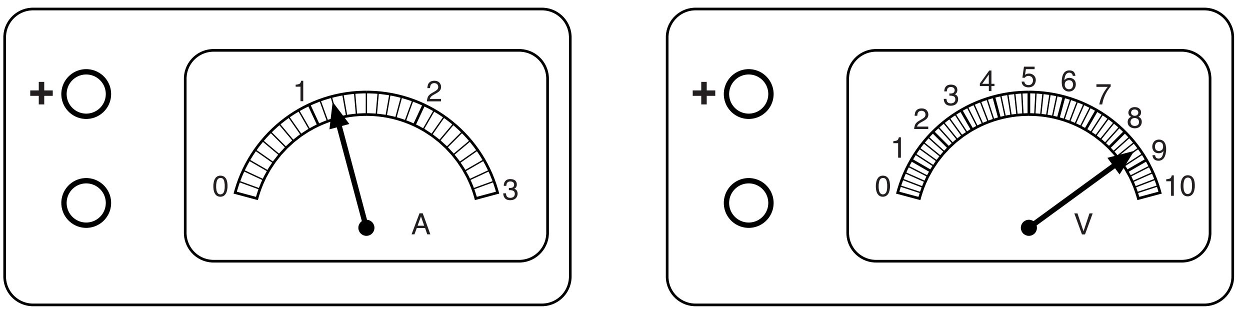

Fig. 3.2

(i) Record these readings.

I = ...

V = ...

[1]

(ii) After 10 minutes, the power supply is switched off. The maximum temperature reading on the thermometer is 29.0 °C.

The specific heat capacity c of the aluminium block is given by

$$c = \frac{IVt}{m\Delta\theta}$$

where t is the time in seconds during which the heater is switched on, m is 1.00 kg and $\Delta\theta$ is the rise in temperature of the block.

Calculate c. Give your answer correct to two significant figures.

c = ... [2]

(c) The accepted value for c is different to the value obtained. Suggest two reasons why this is so.

1. ....

....

2. ....

....
[2]

4 A student is given a box containing ten similar plastic drinking straws, a 30 cm ruler and two set-squares.

(a) Explain how the student determines an average value for the external diameter of the straws using this apparatus. Draw a diagram to illustrate your answer.

....

....

....

....

....

....

.... [3]

(b) Each straw holds an average volume of 4.0 cm^3 of water when full. Suggest how this value could be checked.

....

....

....

....

.... [2]