Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1347941399

PHYSICS **5054/41**

Paper 4 Alternative to Practical **October/November 2020**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 30.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

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[Turn over

1 A student investigates how the strength of a bridge varies with its width. Fig. 1.1 shows the apparatus that the student uses.

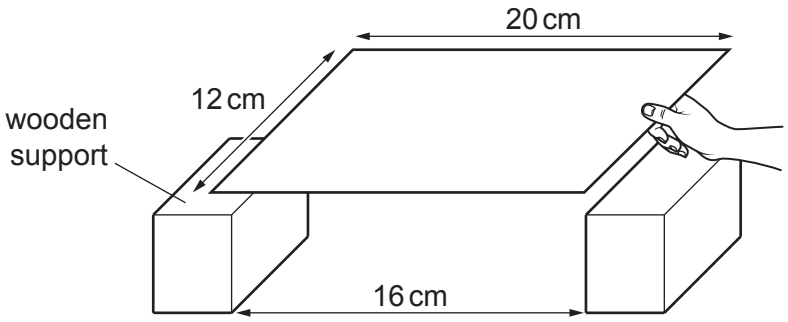


Fig. 1.1

(a) The student is given a rectangular piece of card which is 20 cm long and 12 cm wide. The card represents the bridge. The length of the card does not change but the width is reduced during the experiment.

She also has two identical wooden supports which are placed so that the gap between them is 16 cm.

- She places the card on the supports to make a bridge.
- She loads the bridge by placing identical coins, one at a time, onto it.
- She places the coins on top of each other on the middle of the card.

Suggest why she places the coins in the middle of the card.

.....

.....

..... [1]

(b) She needs to know the mass of each coin. The balance available measures mass to the nearest gram.

(i) Describe how the student uses this balance to find the mass of a coin to the nearest 0.1 g.

.....

.....

..... [1]

(ii) Each coin has a mass of 3.4 g.

- She adds coins carefully, one at a time, onto her bridge until the bridge collapses.
- She records the number of coins that the bridge holds just before it collapses.
- She repeats this four more times.

The number of coins needed is:

16 15 16 14 15

Find the average mass m in grams that the card can support. Give your answer to 2 significant figures.

m = ... g [2]

(c)

- She cuts a 2 cm wide strip from the long side of her card.
- The width w of the card remaining is 10 cm.
- She repeats the experiment.
- She compares the results for the two widths of card.

(i) Suggest **one** way in which her method allows a fair comparison to be made.

.....

.....

..... [1]

(ii) • She repeats this procedure until there is only a 2 cm wide piece of card left.

Her results are recorded in Table 1.1.

Table 1.1

width w/cm	mass m/g
12	
10	37
8	26
6	18
4	11
2	5

Add your value m for w = 12 cm from **1(b)(ii)** to Table 1.1.

On Fig. 1.2, plot a graph of m on the y-axis against w on the x-axis. Start both axes from the origin. Draw the smooth curve of best fit. [4]

(iii) Extend your curve to estimate the mass of coins that collapse the bridge for a card that is 13 cm wide.

Show your working on the grid in Fig. 1.2.

mass of coins = ... g [2]

(d) Suggest how the student can alter the apparatus so that the bridge holds more mass for all widths of card.

.....

.....

..... [1]

(e) Each student in the class has only one piece of card at the start of the experiment. A second student decides to carry out the experiment starting with a 2 cm wide piece of card and then increasing the width.

Suggest why this causes a problem.

.....

.....

..... [1]

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Fig. 1.2

[Total: 13]

2 A student carries out an experiment to find a value for the specific latent heat of fusion of ice.

He needs to find the mass of ice melted by the heater in time *t*.

He uses the apparatus shown in Fig. 2.1.

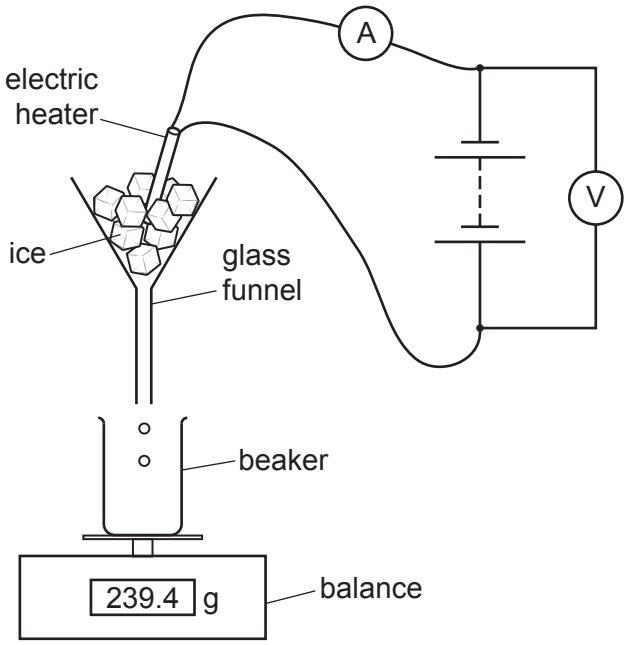


Fig. 2.1

The electric heater is placed in the ice inside the glass funnel.

(a) State what the student must do before switching on the heater.

.....

.....

..... [1]

(b) The heater is switched on and water drips into the beaker. The student switches off the heater after time *t*.

(i) Suggest why the student waits a further minute after switching off the heater before taking a reading from the balance.

.....

.....[1]

(ii) The scales on the voltmeter and ammeter when the heater is switched on are shown in Fig. 2.2.

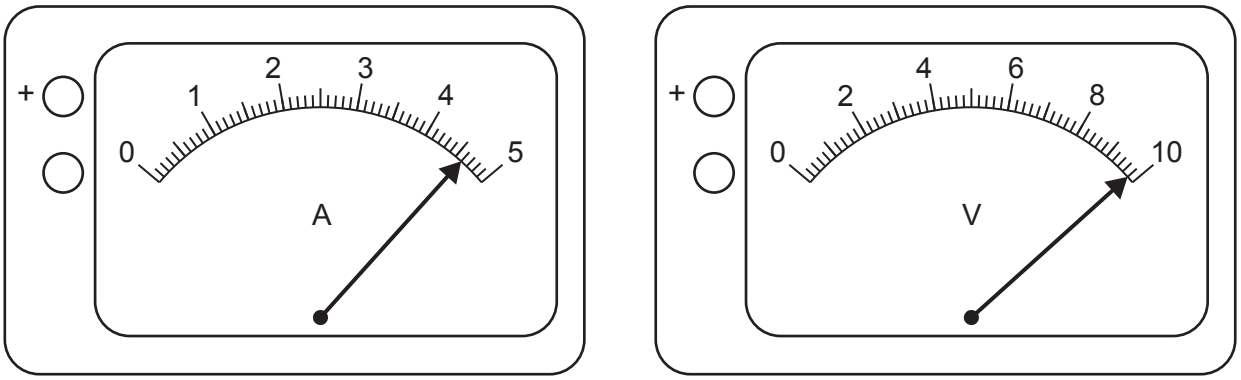


Fig. 2.2

State the reading of current I and voltage V when the heater is switched on.

I = ... A

V = ... V
[2]

(iii) Using the equation

$$E = I \times V \times t$$

calculate the energy E that has been supplied by the heater when t = 5.0 minutes.

E = ... J [1]

(iv) The mass m of ice melted in 5.0 minutes is 36.2 g.

The specific latent heat of fusion L of ice is given by

$$L = \frac{E}{m}$$

Calculate a value for L and give a unit for your answer.

L = ... unit ..... [2]

(c) The teacher tells the student that his value is different from the accepted value.

Apart from your answer in **(a)**, suggest **two** improvements to the experiment.

1. .....

.....

2. .....

.....

[2]

[Total: 9]

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3 A student uses a ray box to investigate the path of light through the transparent plastic block shown in Fig. 3.1.

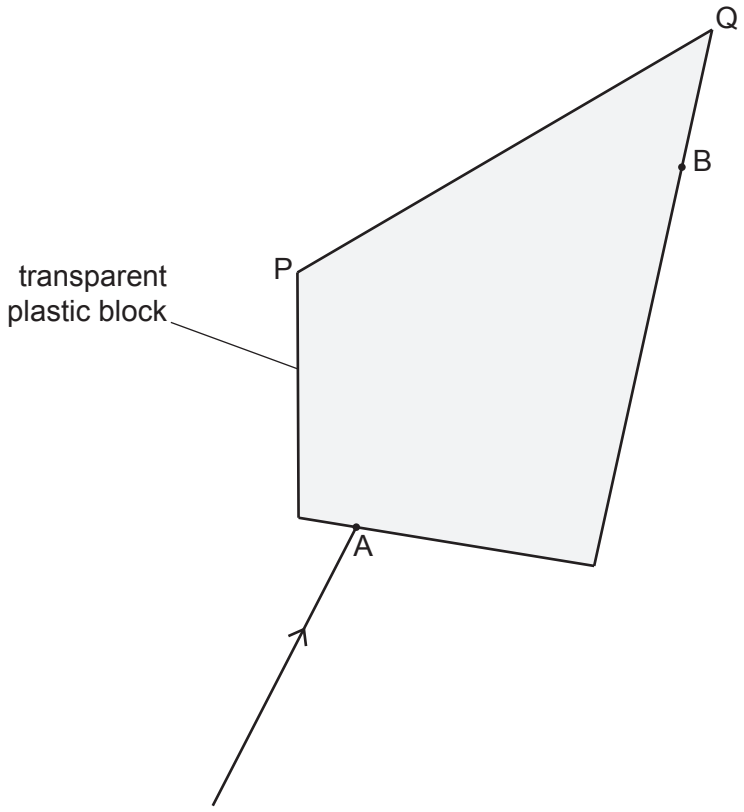


Fig. 3.1

The ray of light enters the block at A, reflects at surface PQ and then leaves the block at B.

(a) On Fig. 3.1, draw the normal at A. [1]

(b) Measure the angle of incidence *i* at A.

i = ... ° [1]

(c) On Fig. 3.1 draw a possible path of the ray from A to B.
(No measurements need to be taken or calculated) [1]

[Total: 3]

4 Two students determine the speed of sound in air by an echo method. One student stands a long distance away from a tall building, as shown in Fig. 4.1.

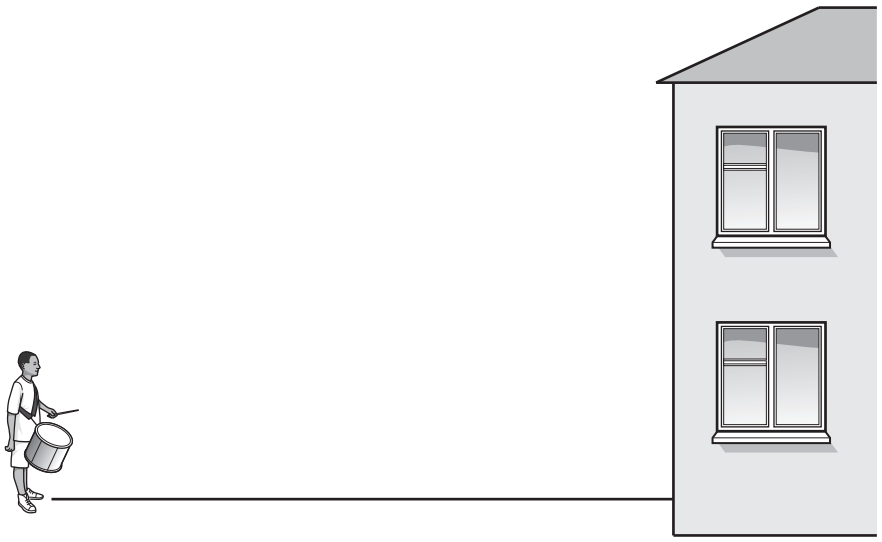


Fig. 4.1

This student bangs a drum to make a loud sound and both students listen for the echo.

(a) State **two** additional pieces of apparatus that are needed in order to determine the speed of sound.

1. .....

2. ..... [2]

(b) State the measurements that the students make and how they carry out the experiment to find a value for the speed of sound in air. State any equation used.

.....

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.....

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..... [3]

[Total: 5]

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