Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8794105923

PHYSICS **5054/31**

Paper 3 Practical Test **May/June 2021**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

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.
- For each of the questions in Section A, you will be allowed to work with the apparatus for a maximum of 20 minutes. For the question in Section B, you will be allowed to work with the apparatus for a maximum of 1 hour.
- You should record all your observations in the spaces provided in the question paper as soon as these observations are made.
- 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 [ ].

For Examiner's Use	
1	
2	
3	
4	
Total	

This document has **12** pages. Any blank pages are indicated.

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Section A

Answer all the questions in this section.

1 *In this experiment you will investigate reflection and refraction of light.*

You are provided with:

- a transparent block
- an illuminated slit or ray box
- a ruler
- a protractor.

(a) Fig. 1.1 is on page 3 of your question paper. On Fig. 1.1:

- switch on the lamp or ray box and position the slit **at the top of the page** so that a single ray of light lines up with the line **A A**
- place the block on Fig. 1.1 and **line up the corner of the block with the corner at B** so that the ray of light passes through the **long edge** of the block at the point labelled **C**
- mark with the letter D the point where the **refracted** ray emerges from the other side of the block
- mark with the letter E the point where this refracted ray passes through line **F F**
- draw a line from point D to point E
- mark with the letter G the point where the **reflected** ray from point **C** passes through line **F F**
- draw a line from point **C** to point G. [1]

(b) Measure and record the distance *d* between point E and point G.

d = ... cm [1]

(c) Remove the block.

On Fig. 1.1, draw the normal to the surface of the block at point **C** and label with an *i* the angle of incidence of the ray of light with the block.

Measure and record the angle of incidence *i*.

i = ... ° [2]

(d) Place the block again on page 3 with its corner lined up at corner **B**. Carefully rotate the long edge of the block about the point **C** and observe how this changes the position of the refracted and reflected rays that pass through **F F**. Switch off the lamp.

Describe the relationship between *i* and *d*.

.....

..... [1]

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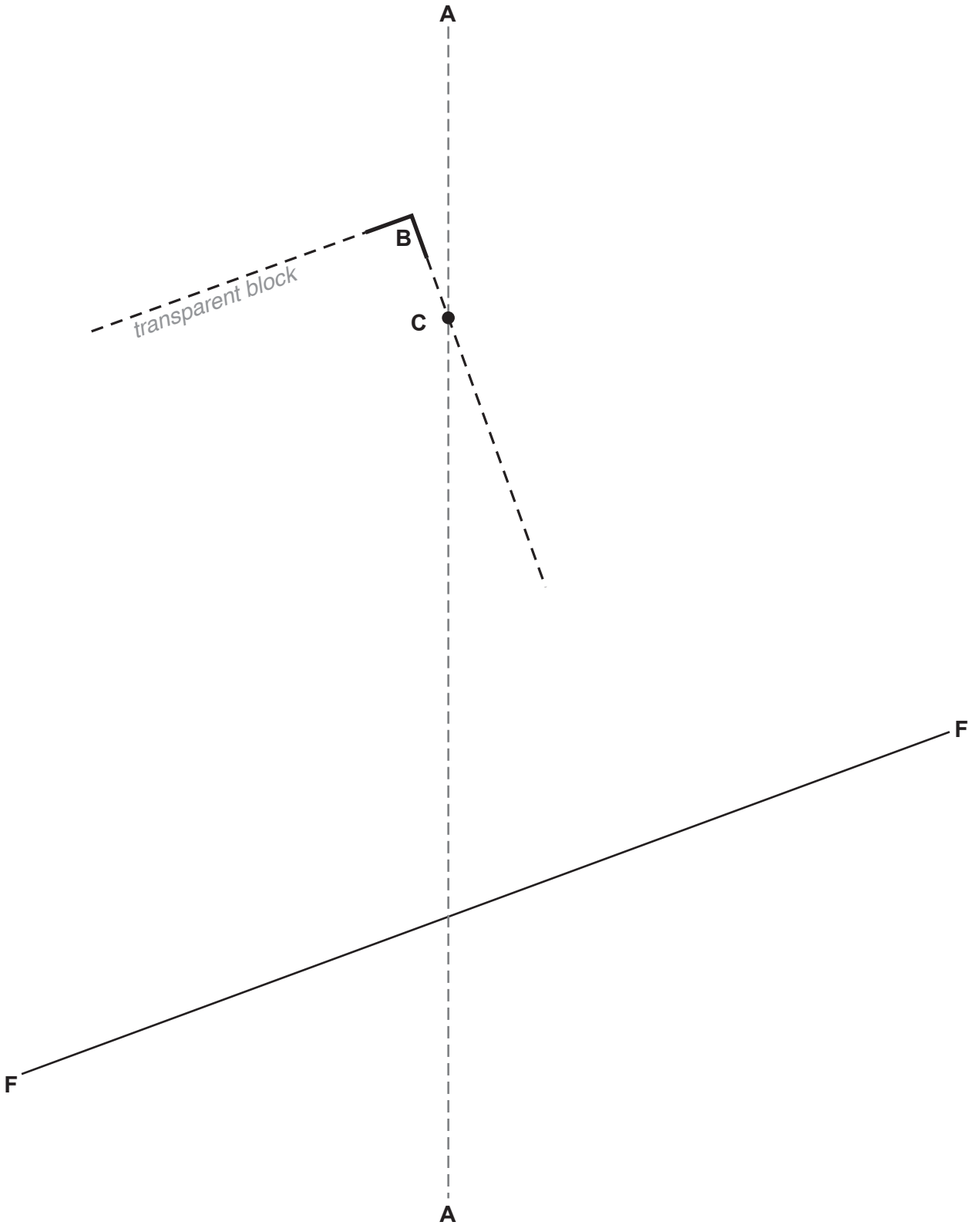


Fig. 1.1

[Total: 5]

2 *In this experiment you will investigate an electrical circuit.*

You are provided with:

- components connected together in an electrical circuit
- an ammeter
- a voltmeter.

The supervisor has set up the circuit.

(a) Close the switch and record the reading on the voltmeter.

voltmeter reading = ... V [1]

(b) One component in the circuit is resting on the piece of card labelled X.

Carefully move your hand over the surface of this component.

State and explain what happens to the component on the piece of card labelled Y.

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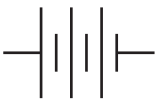
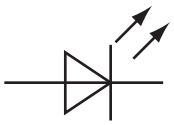
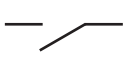
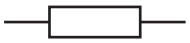
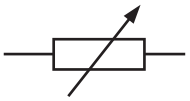
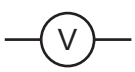
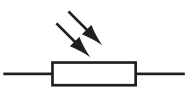
.....

..... [1]

Open the switch.

(c) Some electrical symbols are shown in Table 2.1.

Table 2.1

battery of cells		light-emitting diode	
switch		fixed resistor	
ammeter		variable resistor	
voltmeter		thermistor	
junction of conductors		light-dependent resistor	

Using some or all of the symbols in Table 2.1, draw a circuit diagram of the circuit.

[3]

[Total: 5]

3 *In this experiment you will investigate the power developed by a falling mass.*

You are provided with:

- a pulley attached to a stand
- two 100 g mass hangers
- a length of string
- a metre rule
- a stop-watch
- a set-square
- heavy weight or G-clamp to keep stand in position.

The supervisor has set up the apparatus as shown in Fig. 3.1.

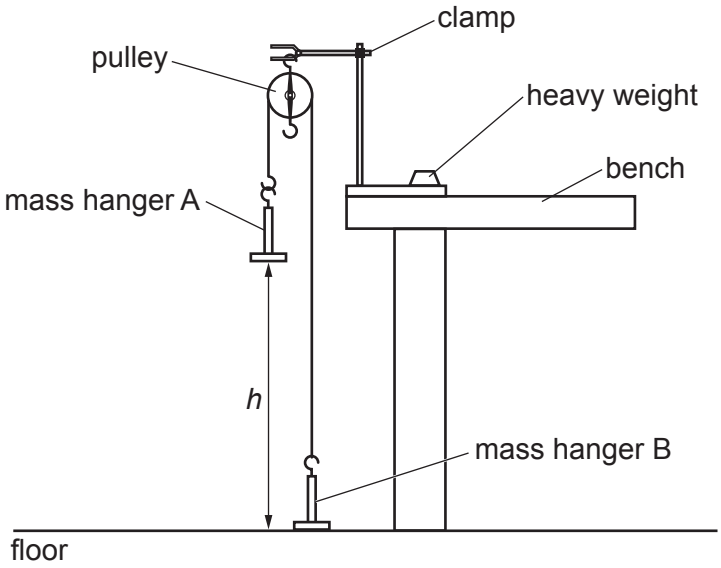


Fig. 3.1

Adjust the position of the clamp so that h = 1.000 m and mass hanger B is at rest on the floor.

(a) Describe how you ensured an accurate measurement of h.

.....

.....

.....

..... [2]

(b) You are also provided with a small piece of modelling clay.

Carefully place the piece of modelling clay on mass hanger A and hold this mass hanger in position.

Release the mass hanger and start the stop-watch. (You may have to give the mass hanger a gentle push downwards to start the movement.)

Measure and record an accurate value for the time t for the mass hanger to fall to the floor.

t = ... s [1]

(c) The mass m of the piece of modelling clay is written on the piece of card.

Record the total mass M in kilograms of the mass hanger and the modelling clay.

M = ... kg [1]

(d) Calculate the power P produced as mass hanger A falls, using the equation:

$$P = \frac{Mgh}{t}$$

where g = 10 N / kg.

P = ... J / s [1]

[Total: 5]

Section B

4 *In this experiment you will investigate the speed of a ball on a track.*

You are provided with:

- a glass ball
- a sloping track made from two metre rules
- a half-metre rule
- a stop-watch.

The supervisor has set up the track as shown in Fig. 4.1.

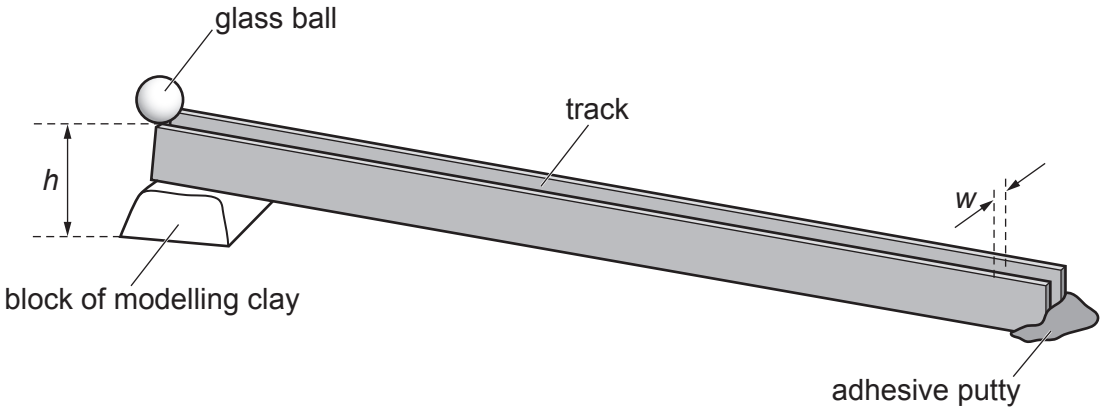


Fig. 4.1

(a) (i) Measure and record

the height *h* of the track above the bench at the 100 cm mark

h = ... mm

the width *w* of the track at the 5 cm mark.

w = ... mm
[1]

(ii) As the ball rolls down the track, *h* and *w* remain constant.

Describe **two** features of the apparatus that enable *h* and *w* to remain constant.

1. .....

.....

2. .....

.....
[2]

(b) Release the ball from rest at the top of the track at the 100 cm mark.

Determine an accurate average time t_{av} from two readings for the ball to reach the 0 cm mark at the bottom of the track.

Show your working.

t_{av} = ... s [1]

(c) (i) The distance d is the distance travelled by the ball as it rolls down the track.

In Table 4.1 on page 10, record the height of the track h from **(a)(i)**, your two time readings and t_{av} from **(b)** for d = 100 cm.

Calculate and record, in a separate column of Table 4.1 on page 10, the average speed v of the ball using the equation:

$$v = \frac{d}{t_{av}}$$

Add appropriate headings with units to each column of Table 4.1 on page 10. [1]

(ii) Continue the procedure in **(c)(i)** by measuring and recording the value of h at the 90 cm mark, the 80 cm mark and so on until the 10 cm mark on the metre rule.

Release the ball from rest at each of these positions and record two time readings and t_{av} for each position.

Calculate and record the average speed v for each starting position.

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[Turn over

Table 4.1

d					
100					
90					
80					
70					
60					
50					
40					
30					
20					
10					

[3]

(d) Using the grid on page 11, plot a graph of *v* on the *y*-axis against *h* on the *x*-axis.

Draw the straight line of best fit. [4]

(e) **(i)** A student suggests that, in theory, the average speed *v*, in m / s, of the ball when it rolls from the 100 cm mark to the 0 cm mark can be calculated using the equation:

$$v = 10\,h\,t_{av}$$

where *h* = your value of *h* from **(a)(i)**, expressed in metres, and t_{av} = your value from **(b)** in seconds.

Calculate the average speed *v* using this equation.

v = ... m / s [1]

(ii) Determine whether the student is correct by comparing the average speed *v* calculated in **(e)(i)** with your value of *v* for *d* = 100 cm calculated in **(c)(i)**.

Explain your reasoning.

The student's theory is .....

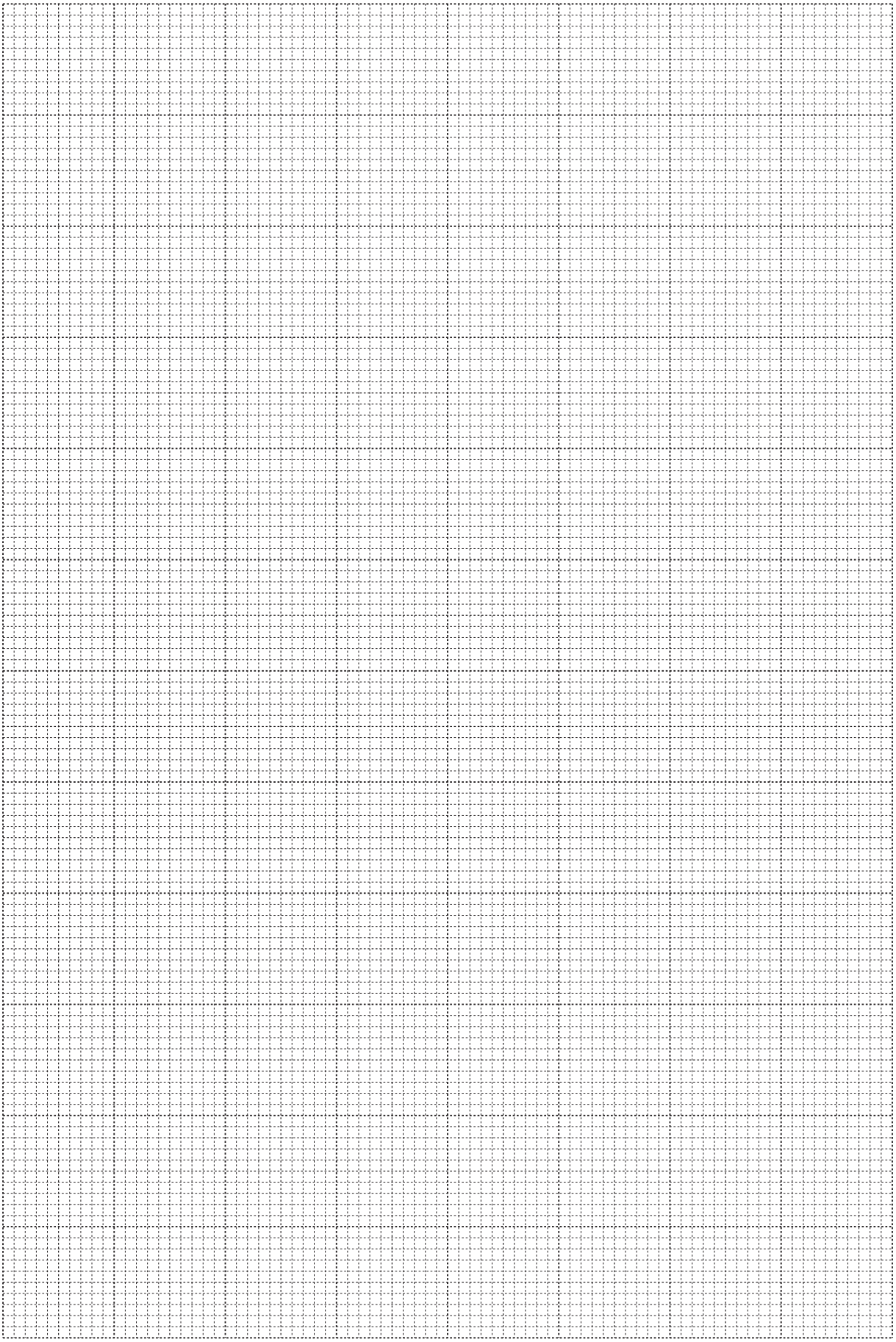
explanation .....

.....

.....

[2]

[Total: 15]



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