Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

5346782142

PHYSICS **5054/31**

Paper 3 Practical Test **October/November 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 **16** pages. Any blank pages are indicated.

DC (PQ/FC) 210625/4

Section A

Answer **all** the questions in this section.

1 *In this experiment you will investigate angles of reflection.*

You are provided with:

- an illuminated slit
- a pair of mirrors joined together
- a small amount of adhesive putty
- a protractor.

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

Measure and record angle *a* on Fig. 1.1.

angle a = ... ° [1]

(b) On Fig. 1.1:

- place the illuminated slit plate or the slit plate of the ray box on the line **PP**. If you are using the small lamp with the slit plate, you will need to turn the lamp upside down so that the glass is touching the paper next to the slit. Adjust the position of the slit plate so that, when the lamp or ray box is switched on, a single ray of light emerging from the slit lines up with the centre line marked on Fig. 1.1
- place the pair of mirrors so that the corner where they are joined together is at point **C** and one mirror lines up with the marked area (▨▨▨▨), as shown on Fig. 1.1. A small amount of adhesive putty may be used to fix this mirror into place. This mirror is mirror 1.

The angle between the two mirrors is angle *b*.

- Switch on the lamp.

(i) Observe the ray reflected from mirror 1. Without moving mirror 1, adjust the position of mirror 2 so that the ray also reflects from this mirror.

Without moving mirror 1, rotate mirror 2 so that the reflected ray from this mirror passes through point **X**.

Draw a line along the face of mirror 2. Label this line X.

Measure and record angle b_X between this line and mirror 1.

angle b_X = ... ° [1]

(ii) Repeat the procedure in **(b)(i)** for points **Y** and **Z** labelling the lines Y and Z respectively.

angle b_Y = ... °

angle b_Z = ... °
[1]

Switch off the lamp.

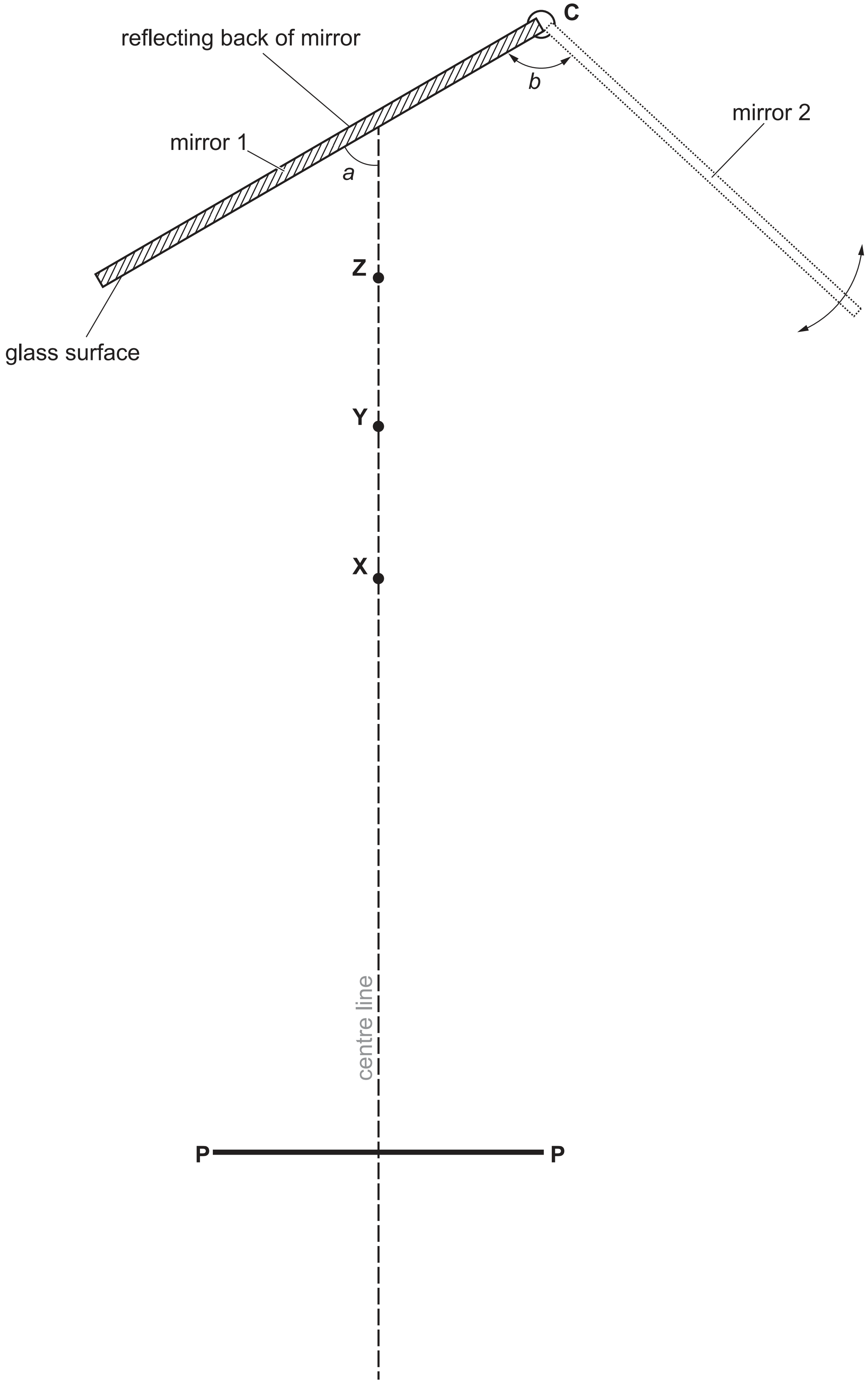
C
reflecting back of mirror
b
mirror 2
mirror 1
a
Z
glass surface
Y
X
centre line
P
P

Fig. 1.1

(c) Describe the trend in angle *b* as the reflected ray moves from point **X** to point **Z**.

....

.... [1]

(d) Suggest one practical reason why it is difficult to obtain accurate results with this experiment.

....

.... [1]

[Total 5]

Question 2 begins over the page

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

You are provided with:

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

The supervisor has set up the circuit.

(a) Some electrical symbols are shown in Fig. 2.1.

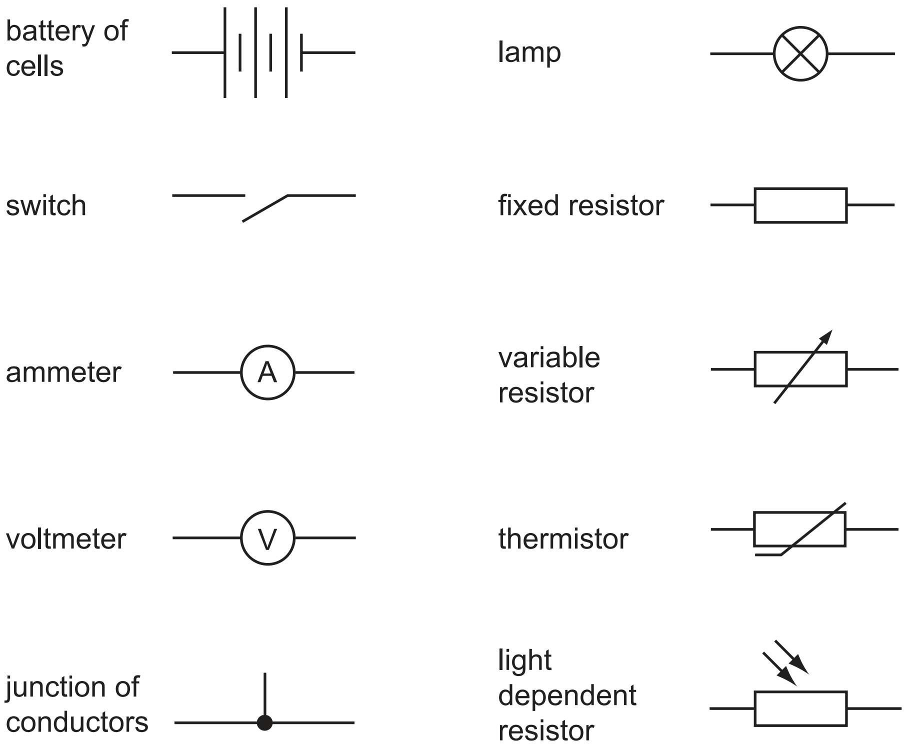

Fig. 2.1

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

[3]

(b) Close the switch and record the readings on the ammeter and the voltmeter. State the unit of each reading.

ammeter reading = ... unit ....

voltmeter reading = ... unit ....
[1]

Open the switch.

(c) Describe how you can obtain steady voltmeter readings.

....

....

.... [1]

[Total 5]

3 *In this experiment you will investigate the speed of a ball on a slope.*

You are provided with:

- a table tennis ball
- a slope made from two metre rules kept in place using adhesive putty
- a stop-watch
- piece of cloth to stop the table tennis ball from rolling away.

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

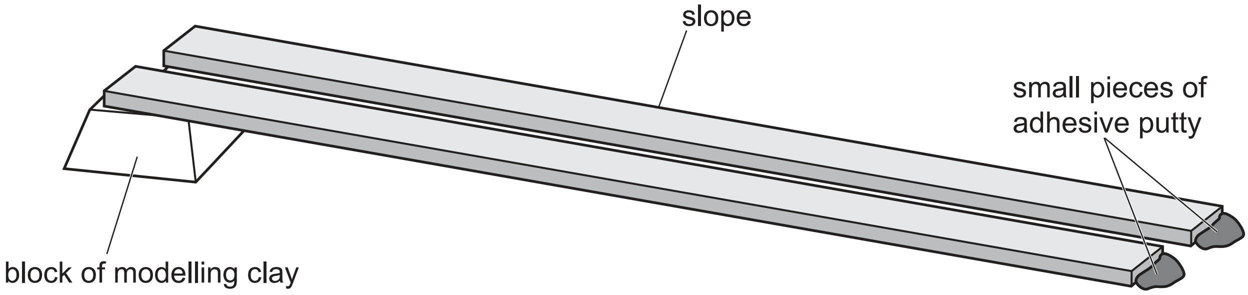

Fig. 3.1

(a) Let the ball roll from the top of the slope at the 100 cm mark to the bottom of the slope at the 0 cm mark.

(i) Determine an accurate average time t_1 for the ball to roll from the top of the slope to the half-way point at the 50 cm mark on the rule.

t_1 = ... s [1]

(ii) With the ball continuing to start its roll from the top of the slope, now determine an accurate average time t_2 for the ball to roll from the half-way point at the 50 cm mark to the bottom of the slope at the 0 cm mark.

t_2 = ... s [1]

(b) Calculate the average speed v_1 of the ball in the top half of the slope and the average speed v_2 of the ball in the bottom half of the slope using the equations

$$v_1 = \frac{50}{t_1} \qquad \text{and} \qquad v_2 = \frac{50}{t_2}$$

v_1 = ... cm/s

v_2 = ... cm/s
[1]

(c) A student claims that the average speed v_3 of the ball along the whole length of the rule can be calculated using the equation

$$v_3 = \frac{2\,v_1 v_2}{v_1 + v_2}$$

Make and record, using appropriate symbols, **one** further measurement that can be used to test the student's claim.

State and explain whether your results support the student's claim.

....

....

....

.... [2]

[Total 5]

Section B

4 *In this experiment you will investigate the oscillation of a mass on a spring.*

You are provided with:

- safety goggles
- two stands, bosses and weights
- a piece of adhesive putty moulded to a spring
- a rod
- a small piece of adhesive putty
- a stop-watch
- a rule

Please wear eye protection while doing this experiment.

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

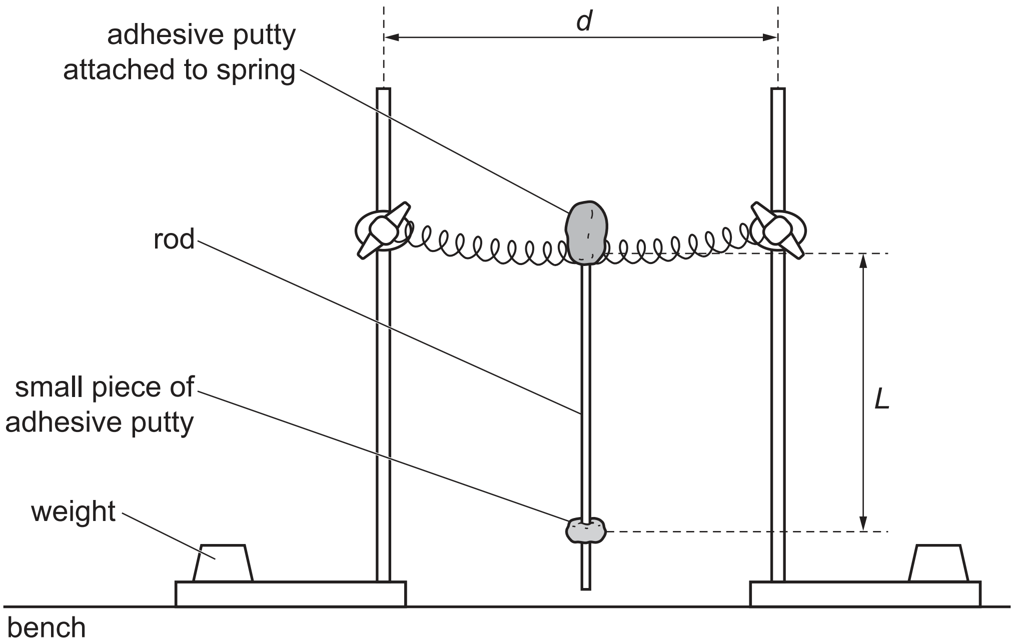

Fig. 4.1

(a) Describe **two** ways that the apparatus is arranged to reduce the risk of the stands toppling over.

1. ....

....

2. ....

....
[2]

(b) Adjust the position of the stands so that d = 26 cm. While moving the stands, take care that the spring does not become loose.

Adjust the position of the small piece of adhesive putty so that it is approximately 3 cm from the lower end of the rod. Press it firmly to the rod to ensure that it does not slip off.

Measure and record the distance L from the centre of the spring to the centre of the small piece of adhesive putty.

L = ... cm [1]

(c) **(i)** Pull the bottom tip of the rod towards you by approximately 20 cm.

Release the rod and observe it as it swings. One oscillation is the movement of the rod from release, away from you and back to the position from which it was released.

Describe a technique for determining an accurate time T for one oscillation.

....

.... [1]

(ii) Determine T.

T = ... s [1]

(d) In Table 4.1, record your measurement of L from **(b)** and your value of T from **(c)(ii)**.

Calculate $\frac{L^2}{100}$ and T^2. Record your values in separate columns of Table 4.1.

Add appropriate headings with units to each column. One has been done for you.

Determine T for seven more values of L and calculate $\frac{L^2}{100}$ and T^2 for each value.

Record all of your measurements and calculations in Table 4.1.

Table 4.1

	$L^2/100$ / cm^2		

[4]

(e) Using the grid opposite, plot a graph of T^2 on the y-axis against $\frac{L^2}{100}$ on the x-axis.

Draw a straight line of best fit. [4]

(f) A student suggests that the best fit line should be a curve.

State and explain whether the points on your graph support this suggestion.

....

.... [1]

(g) Another student suggests that the measurement of T when L is large is more accurate than when L is small.

Explain whether your observations support this suggestion.

....

.... [1]

[Total 15]

BLANK PAGE

BLANK PAGE

BLANK PAGE