Physical Quantities & Measurement Techniques

Question Paper

Course	CIE IGCSE Physics
Section	1. Motion, Forces & Energy
Topic	Physical Quantities & Measurement Techniques
Difficulty	Medium

Time Allowed	40
Score	/33
Percentage	/100

Question 1a

A student is determining the acceleration of free fall g using a pendulum. Fig. 1.1 shows the pendulum. Fig. 1.2 shows one complete oscillation of the pendulum.
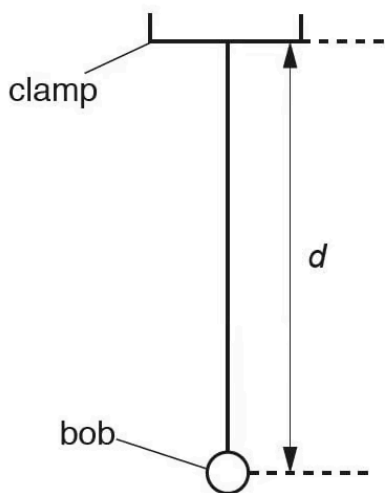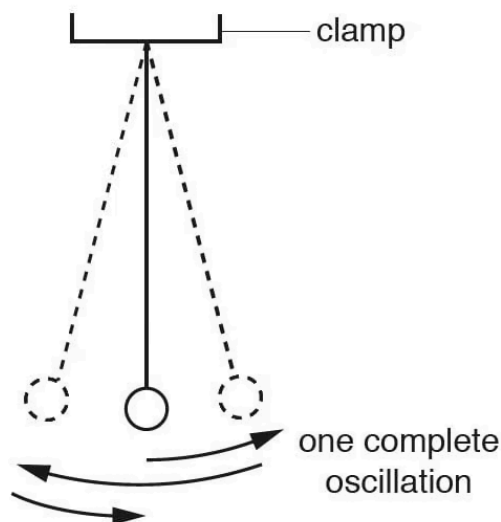

Fig. 1.1

Fig. 1.2

On Fig. 1.1, measure the distance d.

d = ... cm

[1 mark]

Question 1b

Fig. 1.1 is drawn 1/10th actual size. Assume that distance d from part (a) is 5.0 cm.

(i)   Calculate the actual distance D from the bottom of the clamp to the centre of the bob.

D = ... cm [1]

The student displaces the bob slightly and releases it so that it swings. He measures the time t for 10 complete oscillations. The time t is shown on the stopwatch in Fig. 1.3.

Fig. 1.3

(ii)   Write down the time t shown in Fig. 1.3.

t = ... [1]

(iii)   Calculate the period T of the pendulum. The period is the time for one complete oscillation.

T = ... [1]

(iv)   Calculate T^2.

T^2 = ... [1]

(v)

Calculate the acceleration of free fall g using the equation $g = \dfrac{20}{T^2}$.

g = ... [1]

[5 marks]

Question 1c

The student adjusts the pendulum until the distance *D* measured to the centre of the bob is 100.0cm.

He repeats the procedure and obtains another value of T^2.

$T^2 = 3.92$

(i)   On the dotted line above, write the unit for T^2.

[1]

(ii)

Calculate the acceleration of free fall *g* using the equation $g = \dfrac{40}{T^2}$ and the value of T^2 from (c). Give your answer to a suitable number of significant figures for this experiment.

g = ... [1]

[2 marks]

Question 1d

Another student states that repeating the experiment improves the reliability of the value obtained for *g*.

Suggest **two** changes that you would make to improve the reliability. The stopwatch cannot be changed.

[2 marks]

Question 1e

State **one** precaution that you would take in this experiment in order to obtain accurate readings.

[1 mark]

Question 2

A student is investigating the factors that affect the size of the crater (hole) a ball makes when it is dropped into sand.

Plan an experiment which would enable you to investigate one factor which might affect the size of the crater.

The apparatus available includes

- metal balls of different sizes
- a tray of sand

Write a plan for the experiment.

In your plan you should:

- state which factor is being investigated,
- state the key variables that you would control,
- list any additional apparatus needed,
- explain briefly how you would carry out the experiment including what would be measured and how this would be done,
- state the precautions which should be taken to obtain reliable results,
- suggest a suitable graph which could be drawn from the results.

You may draw a diagram if it helps to explain your plan.

[7 marks]

Question 3a

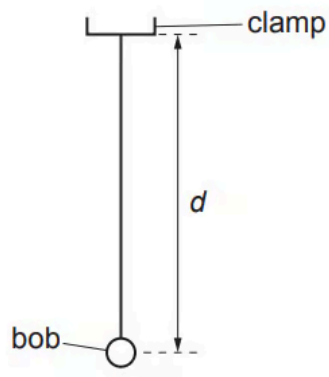A student investigates the period of a pendulum. Fig. 1.1 and Fig. 1.2 show the apparatus she uses.
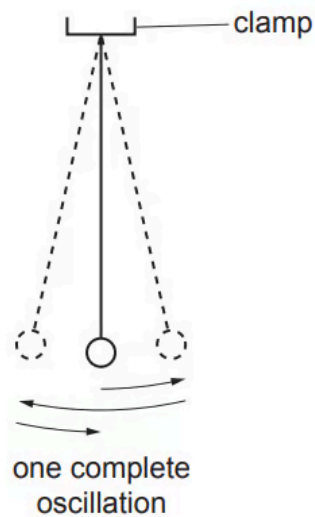

Fig. 1.1   **Fig. 1.2**

Explain briefly, with the help of a diagram, how you would use a metre rule and set square to measure the length d of a pendulum as accurately as possible.

[3 marks]

Question 3b

The student adjusts the pendulum so that d = 50.0 cm. She displaces the bob slightly and releases it so that it swings. Fig. 1.2 shows one complete oscillation of the pendulum. She measures the time t_1 for 20 complete oscillations.

Fig. 1.3

(i)   Record the time t_1 shown in Fig. 1.3.

[1]

(ii)   Calculate the period T_1 of the pendulum. The period is the time for one complete oscillation.

[1]

[2 marks]

Question 3c

The student adjusts the pendulum until the distance d is 100.0 cm.

She repeats the procedure and records the time t_2 for 20 oscillations and the period T_2.

- $t_2 = 39.80$s
- $T_2 = 1.99$s

She measures the mass m_A of the pendulum bob. The reading on the balance is shown in Fig. 1.4.

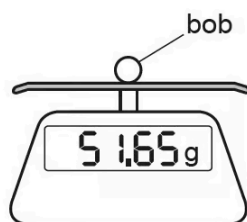**Fig. 1.4**

Record mass m_A of the pendulum bob to the nearest gram.

m_A = ... g

[1 mark]

Question 3d

The student repeats the procedure using a pendulum bob of mass m_B.

- m_B = 109 g

    She obtains these results:

    - distance d = 50.0 cm.
    - period T_3 = 1.39 s
    - distance d = 100.0 cm
    - period T_4 = 2.02 s

    (i)   Using the results T_1, T_2, T_3 and T_4, for the period of each of the pendulums, tick (✔) the response that matches your results within the limits of experimental accuracy.
    ☐ the period T is affected by d only
    ☐ the period T is affected by both d and m
    ☐ the period T is affected by m only
    ☐ the period T is not affected by both d or m

[1]

    (ii)   Justify your answer to (d)(i) by reference to the results.

[1]

[1 mark]

Question 3e

The student now investigates the effect of the size of the oscillations on the period of the pendulum.

(i)   Suggest briefly how you would measure the size of an oscillation. You may draw a diagram.

[2]

(ii)   State one variable that you would keep constant during this part of the investigation.

[1]

[3 marks]

Question 4a

An IGCSE student is investigating the average speed of a toy car travelling down a slope.

She releases the toy car on the slope. She uses a stopwatch to measure the time taken for the car to travel down part of the slope. Fig. 5.1 shows the slope.
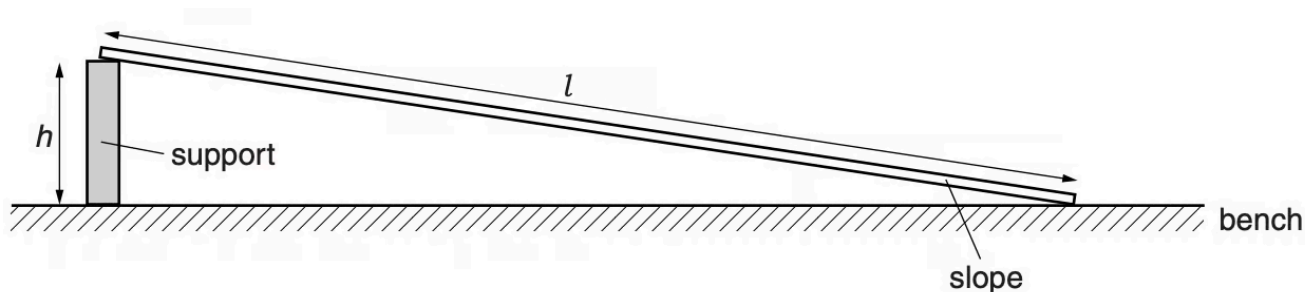

Fig. 5.1

(i) Suggest a suitable length l for the slope used in this school laboratory experiment.

(ii) Suggest a suitable height h, above the laboratory bench, for one end of the slope.

[2]
[2 marks]

Question 4b

The student tries to determine the time that the toy car takes to travel a distance down the slope.

Make three suggestions about what she could do to ensure that the distance travelled and the time taken by the toy car are measured as reliably as possible.

[3 marks]