

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

PHYSICS

5054/03

Paper 3 Practical Test

October/November 2003

Additional Materials: As specified in the Confidential Instructions

2 hours

READ THESE INSTRUCTIONS FIRST

Follow the instructions on the front cover of the Answer Booklet.
Write your answers in the spaces provided in the Answer Booklet.

Answer **all** questions.

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 are expected to record all your observations as soon as these observations are made.

An account of the method of carrying out the experiment is **not** required.

At the end of the examination, hand in only the Answer Booklet.

This document consists of **5** printed pages, **3** blank pages and an inserted Answer Booklet.

Section A

Answer **all** questions in this section.

- 1** *In this experiment, you will determine the energy changes of a toy car as it moves down a ramp.*

You have been provided with a ramp, a toy car, a half-metre rule, a stopwatch and a set square.

- (a)** The two lines on the ramp are a distance s of 0.90 m apart. Place the front of the car level with the line at the top of the ramp. Release the car and determine an average value for the time t taken for the car to travel to the lower line. Record your measurements and calculations on page 2 of your Answer Booklet.

- (b)** Calculate the final speed v of the car as it reaches the lower line on the ramp given that

$$v = \frac{2s}{t}.$$

- (c)** Measure the vertical height h through which the car descends as it moves a distance of 0.90 m along the ramp. Draw a diagram to explain how you did this.

- (d)** Record the mass m of the car, which is given on the card.

- (e)** Calculate

- (i)** the potential energy E_p lost by the car as it descends through the height h , given that

$$E_p = mgh,$$

where $g = 9.8 \text{ N/kg}$,

- (ii)** the kinetic energy E_k gained by the car as it moves through the 0.90 m distance, given that

$$E_k = \frac{1}{2}mv^2.$$

- (f)** Comment on the results you have obtained in **(e)**.

2 In this experiment, you will determine the density of the material from which a metre rule is made.

You have been provided with a metre rule, a knife edge, a 100 g mass and a small rule with mm graduations.

- (a) Balance the metre rule on the knife edge in order to determine the position of the centre of mass of the rule. On page 3 of your Answer Booklet, record the distance d of the centre of mass from the 0.0 cm end of the rule.
- (b) Set up the apparatus as shown in Fig. 2.1, with the 100 g mass placed close to the 0.0 cm end of the rule.

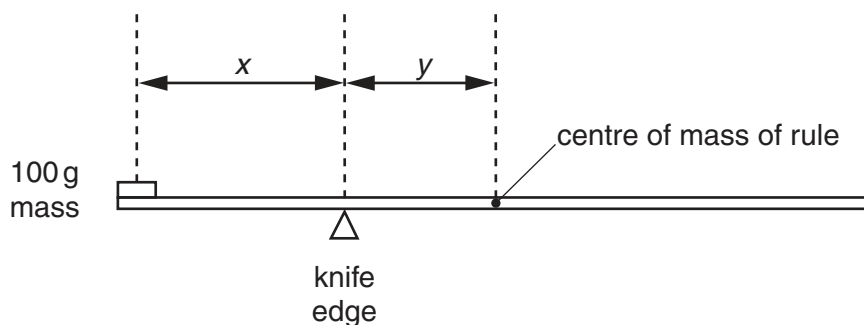


Fig. 2.1

The knife edge should be placed at a point between 0.0 cm and 50.0 cm so that the system balances. Determine the distances x and y , showing clearly how these were obtained.

- (c) Calculate the mass m of the metre rule given that $m = \frac{100x}{y}$ grams.
- (d) Determine the average width w and the average thickness t of the metre rule. Also record the length l of the metre rule.
- (e) Calculate
- the volume V of the metre rule given that $V = lwt$,
 - the density ρ of the material of the rule given that $\rho = \frac{m}{V}$.

- 3 In this experiment, you will investigate the frictional force opposing the motion of a block of wood to which masses have been added.

You have been provided with a block of wood with a hook at one end, a newton-meter and some 50 g masses.

- (a) Place a 50 g mass on top of the block of wood. Pull the block horizontally across the bench at constant speed by means of the newton-meter, as shown in Fig. 3.1.

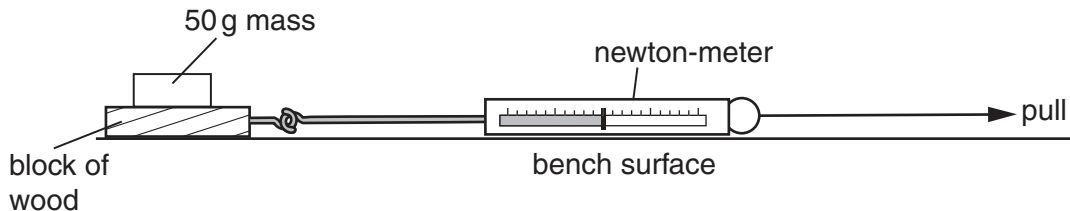


Fig. 3.1

Determine an average value for the force F required to move the block across the bench at constant speed. Record all your measurements on page 4 of your Answer Booklet.

- (b) Record the mass M_B of the block, which is given on the card. Also record the total mass M_T of the block with the added mass.
- (c) Calculate the total weight W of the block with the added mass given that

$$W = M_T g,$$

where $g = 9.8 \text{ N/kg}$.

- (d) Calculate a value for the coefficient of friction μ between the block and the bench given that

$$\mu = \frac{F}{W}.$$

- (e) It is expected that, when different masses are placed on the block, the value of μ will remain constant. Repeat the experiment with two 50 g masses and then with three 50 g masses placed on the block. Comment on the results that you obtain.

Section B

4 *In this experiment, you will investigate the power dissipated in a length of resistance wire.*

You have been provided with a metre rule to which a length of resistance wire has been attached, an ammeter, a voltmeter, a switch, a power supply, a fixed resistor and two crocodile clips.

- (a) On page 5 of your Answer Booklet, draw a diagram of the circuit that has been set up by the Supervisor.
- (b) Adjust the positions of the crocodile clips on the wire so that a length l of 80.0 cm of resistance wire is connected in the circuit. Close the switch and record the current I in the circuit and the potential difference V across the length of wire. Open the switch. Take care not to touch the fixed resistor because it may be hot.
- (c) Calculate the power P dissipated in the wire given that $P = IV$.
- (d) For a range of lengths l of wire, record the current I in the circuit and the corresponding potential difference V across the wire. Tabulate your results on page 6 of your Answer Booklet. Include in your table a column for values of P and your results from (b) and (c).
- (e) Switch off the circuit.
- (f) Using the grid on page 7 of your Answer Booklet, plot a graph of P/W on the y -axis against l/cm on the x -axis.
- (g) Draw a smooth curve through your points. Find the length l_M of wire at which the maximum power P_M is dissipated.
- (h) Using the value of the resistance of a one metre length of the wire which is given on the card, find the resistance corresponding to the length l_M of wire.

