CAMBRIDGE INTERNATIONAL EXAMINATIONS

Joint Examination for the School Certificate and General Certificate of Education Ordinary Level

PHYSICS 5054/3

PAPER 3 Practical Test

OCTOBER/NOVEMBER SESSION 2002

2 hours

Additional materials:
As specified in Instructions to Supervisors
Graph paper

TIME 2 hours

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer booklet.

Answer **all** questions.

Write your answers in the spaces provided in the answer booklet.

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. All of your answers should be written in the answer booklet; scrap paper must **not** be used.

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

At the end of the examination, hand in only the answer booklet.

INFORMATION FOR CANDIDATES

Graph paper is provided in the enclosed answer booklet. Additional sheets of graph paper should be used only if it is necessary to do so.

Any additional sheets should be attached firmly to the answer booklet.

This question paper 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 density of the material from which a metre rule is made.*

You have been provided with a metre rule, a pivot, a 100 g slotted mass and a mm scale.

(a) Balance the metre rule on the pivot to locate the position of the centre of mass. Record the position of the centre of mass on page 2 of your answer booklet.

(b) Set up the apparatus as shown in Fig. 1.1. Move the pivot until the system is balanced. Take measurements to determine the distances *x* and *y*.

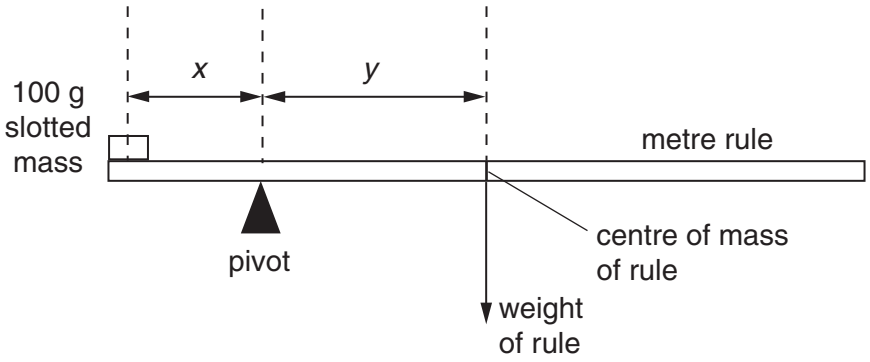

Fig. 1.1

(c) Calculate the mass *M* of the metre rule, given that

$$M = \frac{x}{y} \times 100 \text{ grams.}$$

(d) Measure and record

(i) the length l of the metre rule,

(ii) the width w of the metre rule,

(iii) the thickness t of the metre rule.

(e) Calculate

(i) the volume V of the metre rule, given that $V = lwt$,

(ii) the density ρ of the material of the rule, given that $\rho = M/V$.

2 *In this experiment, you will measure the specific latent heat of fusion of ice.*

You have been provided with a supply of water in a beaker, a polystyrene or plastic measuring cylinder, a thermometer held in a clamp, and a stirrer.

(a) Measure a volume V_1 of approximately 80 cm^3 of water and pour it into the cup.

On page 3 of your answer booklet, record the temperature θ_1 and the volume V_1 of the water.

(b) Carefully place an ice cube in the cup of water and record the final temperature θ_2 of the water when all the ice has melted.

(c) Measure the final volume V_2 of the water in the cup.

(d) Given that 1.0 cm^3 of water has a mass of 1.0 g, find

(i) the initial mass m_W of water that was in the cup,

(ii) the mass m_I of ice that has melted.

(e) Calculate the specific latent heat L of fusion of ice, given that

$$m_I L + m_I c\theta_2 = m_W c(\theta_1 - \theta_2)$$

where c = specific heat capacity of water = 4.2 J / (g °C)

(f) State any precautions which you took to ensure that your value of L was as precise as possible.

3 *In this experiment, you will investigate the action of a light-dependent resistor.*

You have been provided with a power supply, a switch, a 1 kΩ resistor, a light-dependent resistor (LDR), a disc which will cover the LDR, a voltmeter and connecting leads.

(a) In the space on page 4 of your answer booklet, draw a diagram of the circuit that has been set up for you.

(b) Ensure that the LDR is **not covered**. Connect the voltmeter in order to record

(i) the voltage V_{AB} between points A and B,

(ii) the voltage V_{BC} between points B and C,

(iii) the voltage V_{AC} between points A and C.

(c) Calculate the current I in the circuit given that

$$I = \frac{V_{AB}}{R}$$

where $R = 1000\,\Omega$.

(d) Repeat **(b)** with the disc covering the LDR.

(e) The resistance of the LDR increases when it is covered. Explain how your observations support this statement.

Section B

4 *In this experiment, you will investigate the refraction of light through a transparent block.*

You have been provided with a transparent block, a protractor, four optics pins and a board in which the pins may be placed.

(a) (i) Place the block flat on the middle of page 5 of your answer booklet, with the block below the line **AB** and a longer edge along **AB**. Draw around the block and remove it from the page.

(ii) Draw a normal in the middle of the line representing a longer edge of the block.

(b) (i) Use the protractor to construct an incident ray at an angle of incidence *i* of 40°. Record *i* in the table on page 6 of your answer booklet.

(ii) Place page 5 of your answer booklet on the board. Stick two object pins vertically along the incident ray.

(iii) Replace the block and observe the pins through the opposite edge of the block. Place two further pins in line with the images of the object pins so that, when viewed through the block, the four pins appear to be one behind the other.

(iv) Remove the block and draw the emergent ray from the edge of the block.

(v) Join the point where the incident ray enters the block to the point where the emergent ray leaves the block. This line represents the refracted ray inside the block.

(vi) Measure the angle of refraction *r* inside the block. Record *r* in the table on page 6 of your answer booklet.

(c) Calculate sin *i* and sin *r* and record the values in the table.

(d) Repeat the procedure set out in **(b)** and **(c)** for four other values of *i.* All the angles should be measured from the same normal.

(e) Plot a graph of sin *i* against sin *r* on the grid on page 7 of your answer booklet.

(f) Determine the gradient *G* of your graph.

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