UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS   **0625/03**

Paper 3 Extended   **May/June 2007**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You may lose marks if you do not show your working or if you do not use
appropriate units.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or
part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

This document consists of **15** printed pages and **1** blank page.

UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

2

1 Fig. 1.1 shows a model car moving clockwise around a horizontal circular track.
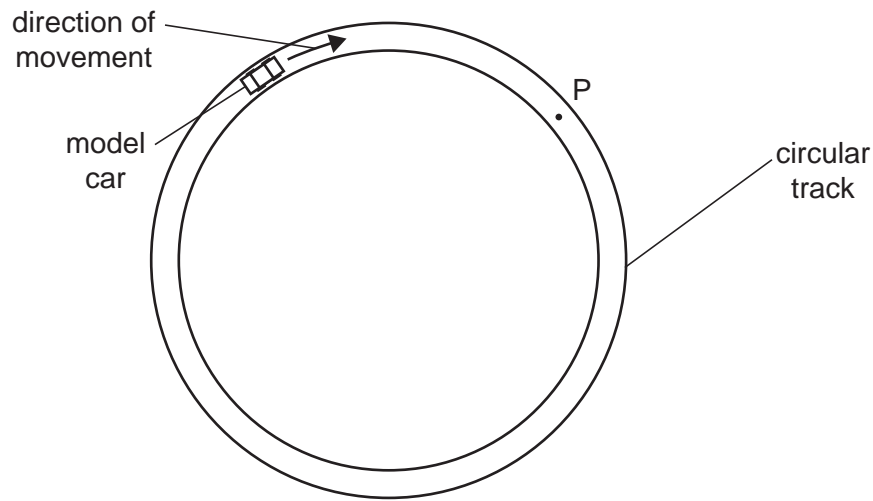

Fig. 1.1

(a) A force acts on the car to keep it moving in a circle.

    (i) Draw an arrow on Fig. 1.1 to show the direction of this force. [1]

    (ii) The speed of the car increases. State what happens to the magnitude of this force.

        .... [1]

(b) (i) The car travels too quickly and leaves the track at P. On Fig. 1.1, draw an arrow to show the direction of travel after it has left the track. [1]

    (ii) In terms of the forces acting on the car, suggest why it left the track at P.

        ....

        ....

        .... [2]

(c) The car, starting from rest, completes one lap of the track in 10 s. Its motion is shown graphically in Fig. 1.2.
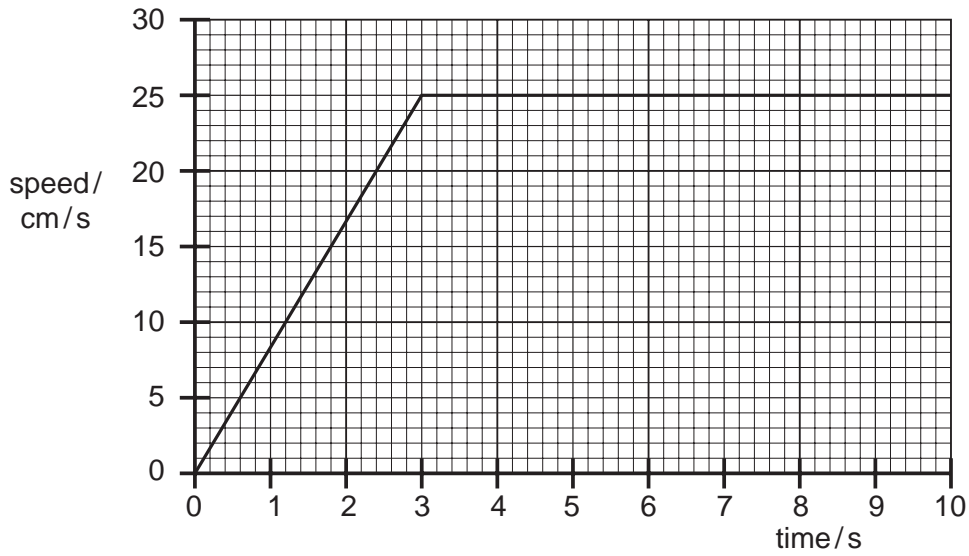
Fig. 1.2

(i) Describe the motion between 3.0 s and 10.0 s after the car has started.

.... [1]

(ii) Use Fig. 1.2 to calculate the circumference of the track.

circumference = ... [2]

(iii) Calculate the increase in speed per second during the time 0 to 3.0 s.

increase in speed per second = ... [2]

[Total: 10]

2 Fig. 2.1 shows a steam safety valve. When the pressure gets too high, the steam lifts the weight W and allows steam to escape.
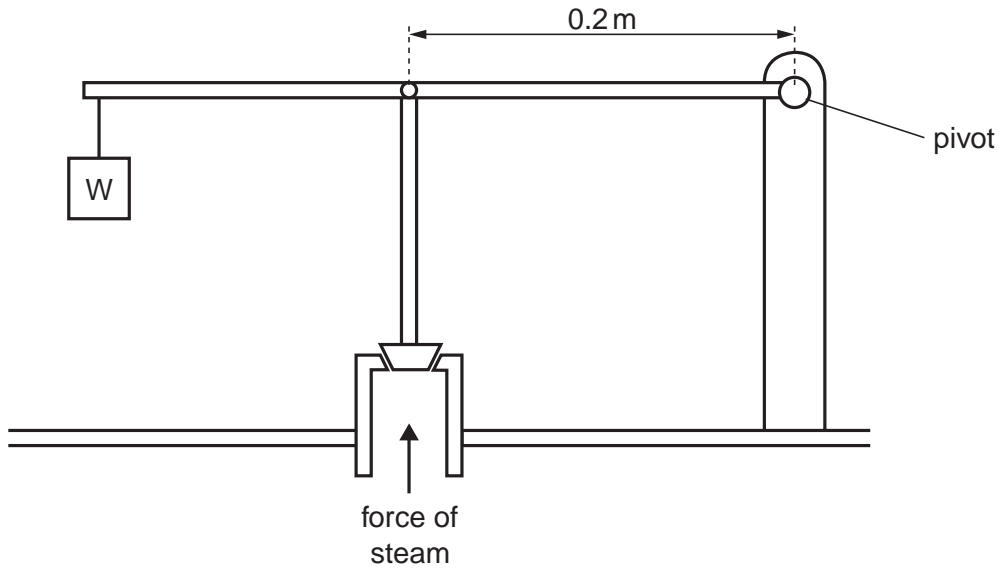
0.2 m

pivot

W

force of
steam

Fig. 2.1

(a) Explain, in terms of moments of forces, how the valve works.

....

....

....

.... [2]

(b) The moment of weight W about the pivot is 12 N m. The perpendicular distance of the line of action of the force of the steam on the valve from the pivot is 0.2 m.

The area of the piston is 0.0003 m^2.

Calculate

(i) the minimum steam force needed for the steam to escape,

force = ... [2]

(ii) the minimum steam pressure for the steam to escape.

pressure = ... [2]

[Total: 6]

5

3 A student wishes to work out how much power she uses to lift her body when climbing a flight of stairs.

Her body mass is 60 kg and the vertical height of the stairs is 3.0 m. She takes 12 s to walk up the stairs.

(a) Calculate

(i) the work done in raising her body mass as she climbs the stairs,

work = ... [2]

(ii) the output power she develops when raising her body mass.

power = ... [2]

(b) At the top of the stairs she has gravitational potential energy.

Describe the energy transformations taking place as she walks back down the stairs and stops at the bottom.

....

....

....

.... [2]

[Total: 6]

 [Turn over

6

4 Fig. 4.1 shows a student's attempt to estimate the specific latent heat of fusion of ice by adding ice at 0 °C to water at 20 °C. The water is stirred continuously as ice is slowly added until the temperature of the water is 0 °C and all the added ice has melted.
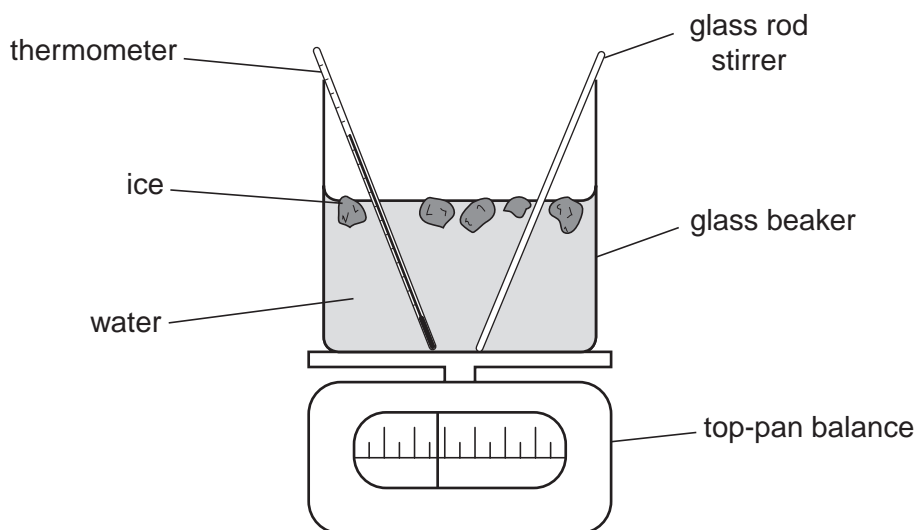

Fig. 4.1

(a) Three mass readings are taken. A description of the first reading is given.

Write down descriptions of the other two.

reading 1 the mass of the beaker + stirrer + thermometer

reading 2 ....

reading 3 .... [2]

(b) Write down word equations which the student could use to find

(i) the heat lost by the water as it cools from 20 °C to 0 °C,

.... [1]

(ii) the heat gained by the melting ice.

.... [1]

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(c) The student calculates that the water loses 12 800 J and that the mass of ice melted is 30 g.

Calculate a value for the specific latent heat of fusion of ice.

specific latent heat of fusion = ... [2]

(d) Suggest two reasons why this value is only an approximate value.

Reason 1 ....

....

Reason 2 ....

.... [2]

[Total: 8]

5 Fig. 5.1 shows some apparatus designed to compare the ability of two surfaces to absorb infra-red radiation.

surface painted dull black
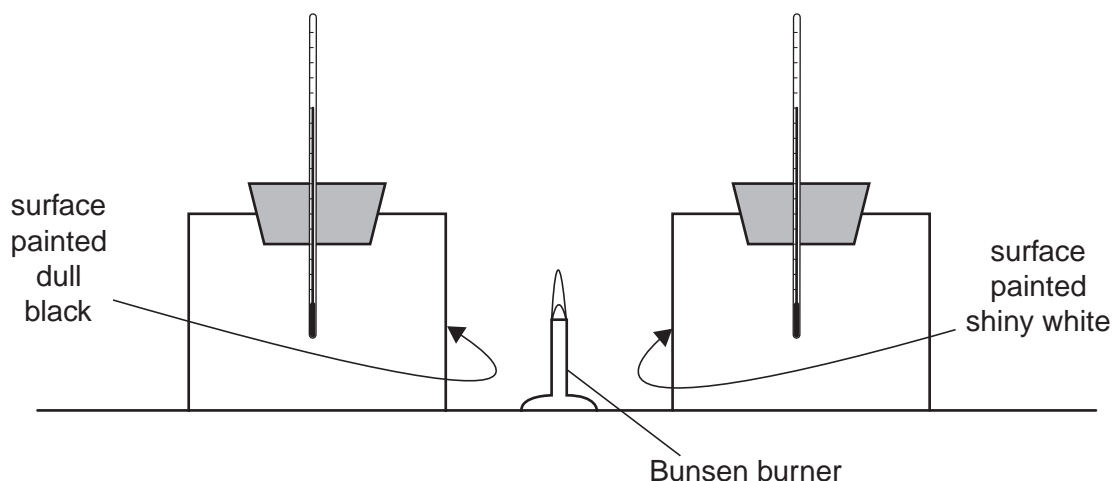
surface painted shiny white

Bunsen burner

Fig. 5.1

The containers, which are identical, are painted on the outside. One is dull black, the other is shiny white. Both are filled with water, initially at the same temperature.

(a) (i) Describe how you would use the apparatus to compare the abilities of the two surfaces to absorb infra-red radiation.

....

....

....

.... [2]

(ii) State the result that you would expect.

.... [1]

(b) The thermometers used have high sensitivity and linear scales.

(i) State what is meant by *high sensitivity*.

....

.... [1]

(ii) Explain why a high sensitivity is important for this experiment.

....

.... [1]

(iii) State what is meant by a *linear scale*.

....

.... [1]

[Total: 6]

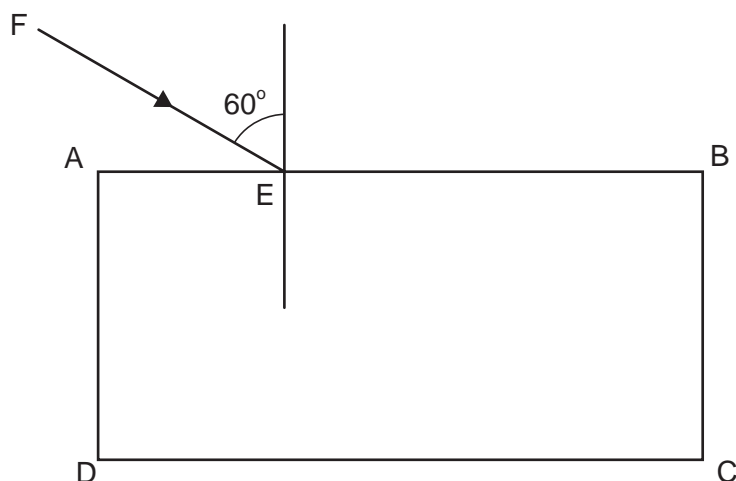**6** Fig. 6.1 shows a rectangular glass block ABCD.

Fig. 6.1

(a) The ray FE is partly reflected and partly refracted at E.

(i) On Fig. 6.1, draw in the approximate path of the refracted ray, within and beyond the block. Label the ray *refracted ray*. [1]

(ii) On Fig. 6.1, draw in the path of the reflected ray. Label the ray *reflected ray*. [1]

(b) A second ray, almost parallel to AE, strikes the block at E and is partly refracted at an angle of refraction of 43°.

(i) State an approximate value for the angle of incidence at E.

.... [1]

(ii) State an approximate value for the critical angle for the light in the glass block.

.... [1]

(iii) Calculate an approximate value for the refractive index of the glass of the block.

refractive index = ... [2]

(c) The speed of the light along ray FE is 3.0×10^8 m/s. Calculate the speed of the refracted light in the glass block.

speed = ... [2]

[Total: 8]

10

7 Two students are asked to determine the speed of sound in air on the school playing fields.

   (a) List the apparatus they need.

   ....

   ....

   .... [1]

   (b) List the readings that the students need to take.

   ....

   ....

   .... [1]

   (c) State how the speed of sound is calculated from the readings.

   .... [1]

   (d) State one precaution that could be taken to improve the accuracy of the value obtained.

   ....

   .... [1]

   (e) The table gives some speeds.

speed/ m/s	speed of sound in air	speed of sound in water
10		
100		
1000		
10 000		

   Place a tick in the table to show the speed which is closest to

   (i) the speed of sound in air,

   (ii) the speed of sound in water.

                                                                                          [2]

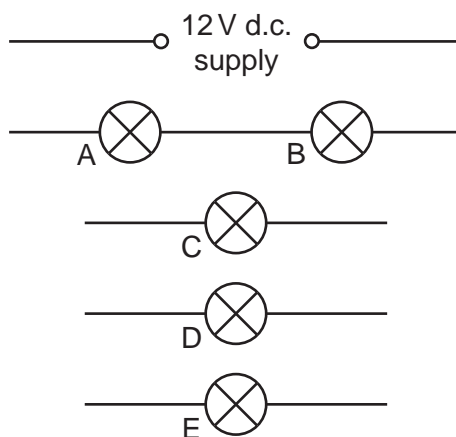   [Total: 6]

8 Fig. 8.1 shows part of a low-voltage lighting circuit containing five identical lamps.

Fig. 8.1

(a) Complete the circuit, by the addition of components as necessary, so that

(i) the total current from the supply can be measured,

(ii) the brightness of lamp E only can be varied,

(iii) lamps C and D may be switched on and off together whilst lamps A, B and E remain on. [4]

(b) All five lamps are marked 12V, 36W. Assume that the resistance of each lamp is the same fixed value regardless of how it is connected in the circuit.

Calculate

(i) the current in one lamp when operating at normal brightness,

current = ... [1]

(ii) the resistance of one lamp when operating at normal brightness,

resistance = ... [1]

(iii) the combined resistance of two lamps connected in parallel with the 12V supply,

resistance = ... [1]

(iv) the energy used by one lamp in 30s when operating at normal brightness.

energy = ... [1]

(c) The whole circuit is switched on. Explain why the brightness of lamps A and B is much less than that of one lamp operating at normal brightness.

....

....

.... [2]

[Total: 10]

9 Fig. 9.1 is a sketch of some apparatus, found in a Science museum, which was once used to show how electrical energy can be converted into kinetic energy.

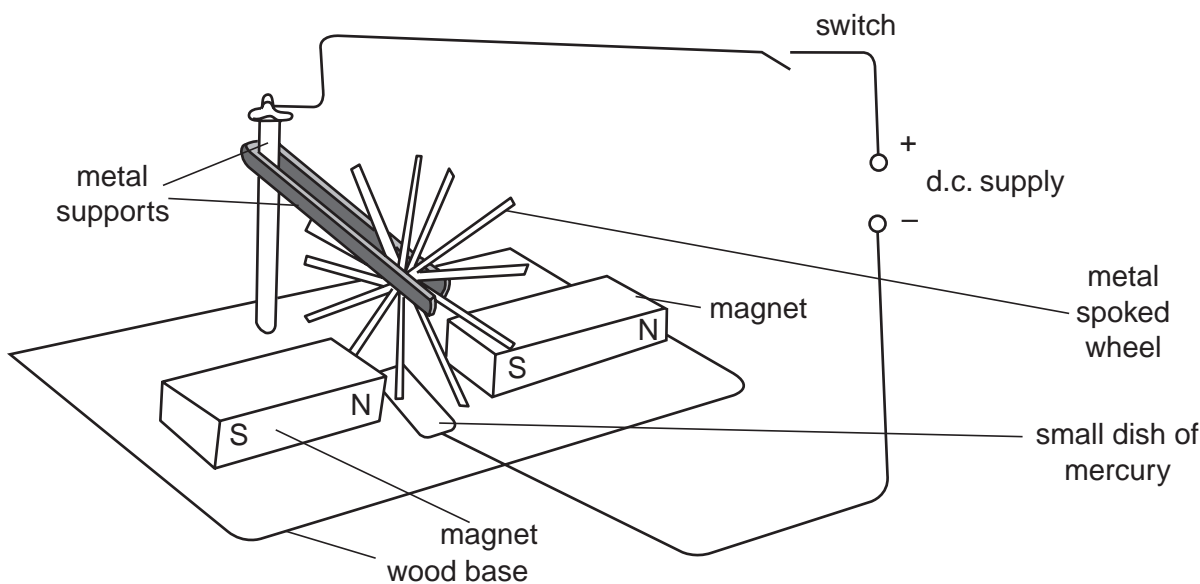When the switch is closed the wheel starts to turn.

Fig. 9.1

(a) Explain why the wheel turns when the switch is closed.

....

....

....

.... [2]

(b) On Fig. 9.1, draw an arrow to show the direction of rotation of the wheel. [1]

13

(c) The d.c. motor is another way to convert electrical energy into kinetic energy.

In the space below, draw a labelled diagram of a d.c. motor.

[3]

(d) Describe how the split-ring commutator on an electric motor works.

....

....

....

.... [2]

[Total: 8]

10 Fig. 10.1 shows a circuit based on a transistor and a thermistor.
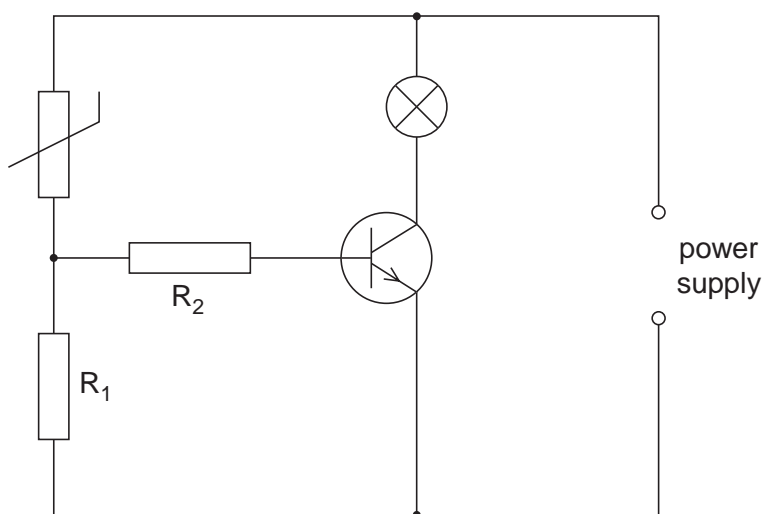
Fig. 10.1

(a) Describe the action of the thermistor in this circuit.

....

....

....

.... [3]

(b) State and explain how the circuit may be modified so that the lamp switches on at a different temperature.

....

....

.... [2]

(c) State one practical use of this circuit.

.... [1]

11 Fig. 11.1 shows the paths of three α-particles moving towards a thin gold foil.

gold foil

A ──────────▶

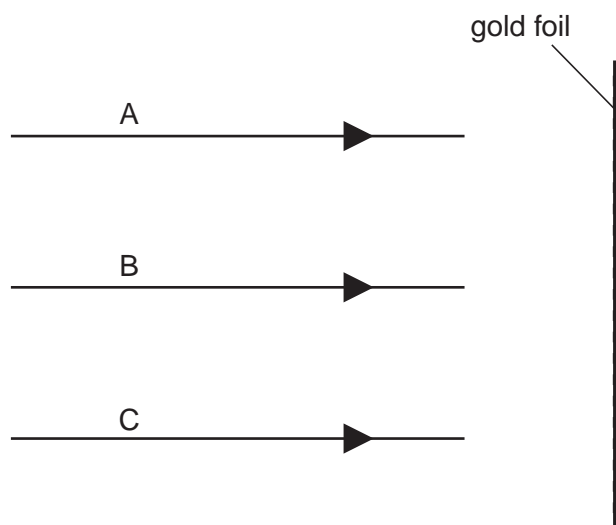B ──────────▶

C ──────────▶

Fig. 11.1

Particle A is moving directly towards a gold nucleus.
Particle B is moving along a line which passes close to a gold nucleus.
Particle C is moving along a line which does not pass close to a gold nucleus.

(a) On Fig. 11.1, complete the paths of the α-particles A, B and C.   [3]

(b) State how the results of such an experiment, using large numbers of α-particles,
provides evidence for the existence of nuclei in gold atoms.

....

....

....

.... [3]

[Total: 12]

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