International General Certificate of Secondary Education

CAMBRIDGE INTERNATIONAL EXAMINATIONS

PHYSICS   **0625/3**

PAPER 3

MAY/JUNE SESSION 2002

1 hour 15 minutes

Candidates answer on the question paper.
No additional materials required.

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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	
TOTAL	

This question paper consists of 12 printed pages.

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

[Turn over

1 A group of students attempts to find out how much power each student can generate. The students work in pairs in order to find the time taken for each student to run up a flight of stairs.

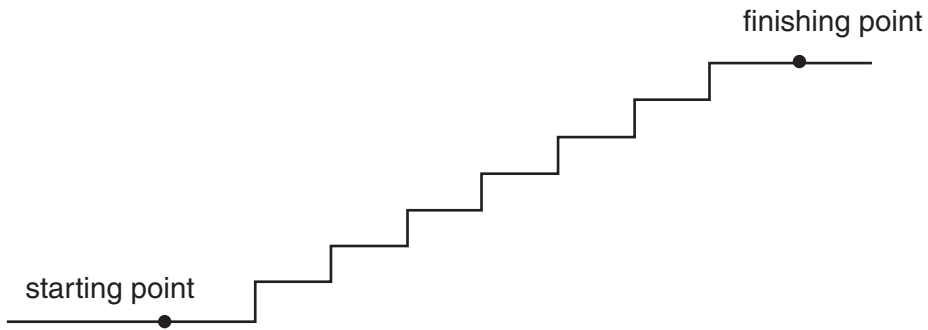The stairs used are shown in Fig. 1.1.

finishing point

starting point

Fig. 1.1

(a) Make a list of all the readings that would be needed. Where possible, indicate how the accuracy of the readings could be improved.

....

....

....

....

....

.... [4]

(b) Using words, not symbols, write down all equations that would be needed to work out the power of a student.

....

....

.... [2]

(c) (i) When the student has reached the finishing point and is standing at the top of the stairs, what form of energy has increased to its maximum?

....

(ii) Suggest why the total power of the student is greater than the power calculated by this method.

....

....
[3]

2 A small rubber ball falls vertically, hits the ground and rebounds vertically upwards.
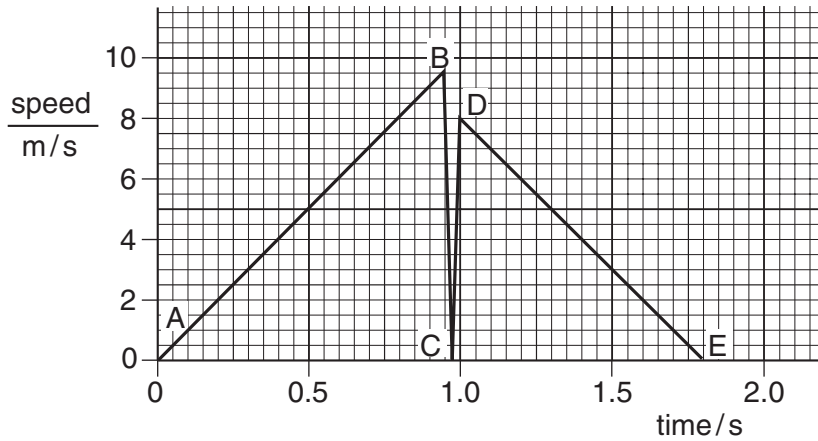Fig. 2.1 is the speed-time graph for the ball.

Fig. 2.1

(a) Using information from the graph, describe the following parts of the motion of the ball.

  (i) part AB

  ....

  ....

  ....

  (ii) part DE

  ....

  ....

  ....
  [3]

(b) Explain what is happening to the ball along the part of the graph from B through C to D.

  ....

  ....

  .... [2]

(c) Whilst the ball is in contact with the ground, what is the

  (i) overall change in speed,

  change in speed = ...

  (ii) overall change in velocity?

  change in velocity = ...
  [2]

[Turn over

(d) Use your answer to **(c)** to explain the difference between speed and velocity.

....

....

.... [2]

(e) Use the graph to calculate the distance travelled by the ball between D and E.

distance travelled = ...[2]

(f) Use the graph to calculate the deceleration of the ball between D and E.

deceleration = ...[2]

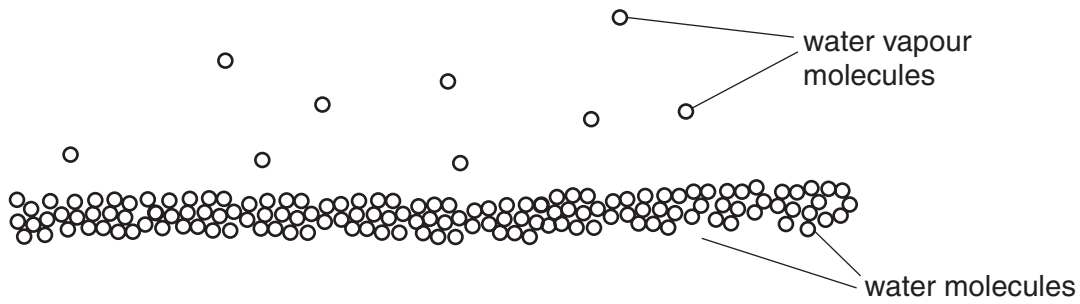**3** Fig. 3.1 is an attempt to show the molecules in water and the water vapour molecules over the water surface.

Fig. 3.1

(a) Explain, in terms of the energies of the molecules, why only a few water molecules have escaped from the water surface.

....

....

.... [2]

(b) State two ways of increasing the number of water molecules escaping from the surface.

1 ....

2 .... [2]

(c) Energy is required to evaporate water.

Explain, in molecular terms, why this energy is needed.

....

....

.... [2]

[Turn over

4 **(a)** Fig. 4.1 shows a cylinder containing air at a pressure of 1.0×10^5 Pa. The length of the air column in the cylinder is 80 mm.
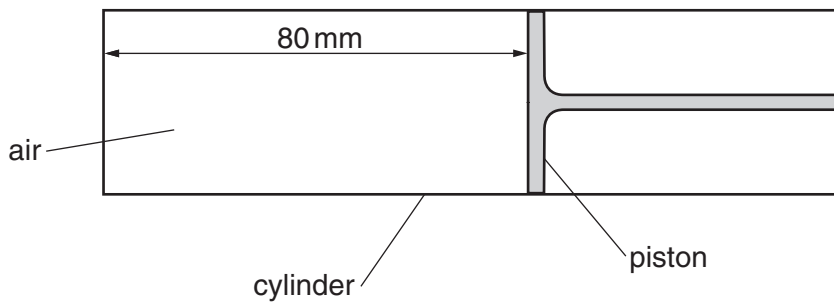

Fig. 4.1

The piston is pushed in until the pressure in the cylinder rises to 3.8×10^5 Pa.

Calculate the new length of the air column in the cylinder, assuming that the temperature of the air has not changed.

new length = ... [3]

(b) Fig. 4.2 shows the same cylinder containing air.

Fig. 4.2

The volume of the air in the cylinder changes as the temperature of the air changes.

(i) The apparatus is to be used as a thermometer. Describe how two fixed points, 0 °C and 100 °C, and a temperature scale could be marked on the apparatus.

....

....

....

....

(ii) Describe how this apparatus could be used to indicate the temperature of a large beaker of water.

....

....

....

....

[5]

5 Fig. 5.1 shows an arrangement where a plane mirror is used in a shop to watch a display counter. The arrangement is drawn to a scale of 1 cm : 1 m.
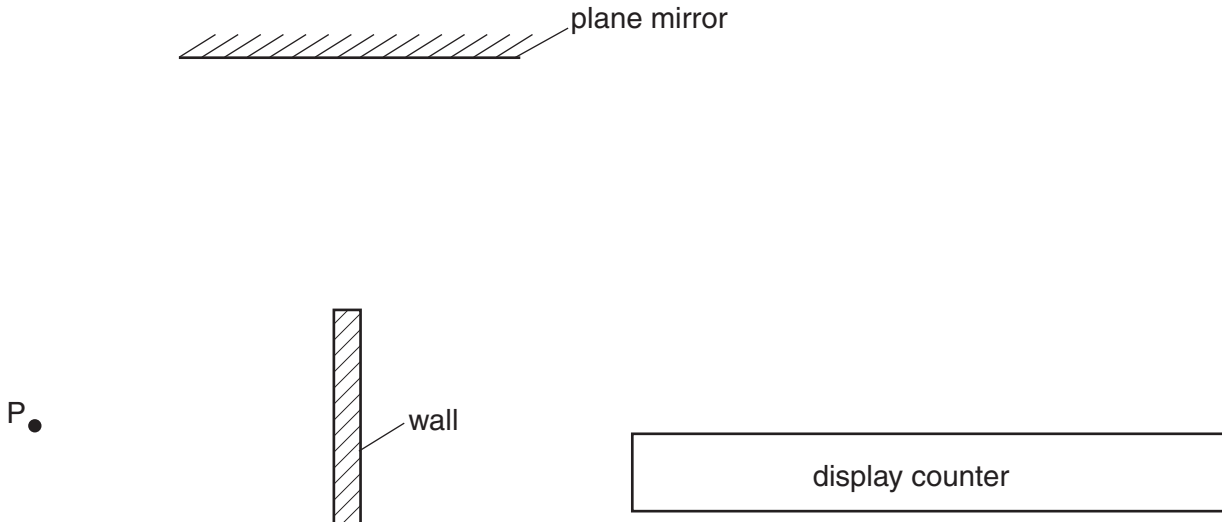

plane mirror

P

wall

display counter

Fig. 5.1

(a) (i) State the law of reflection.

....

(ii) On Fig. 5.1, draw rays to show how much of the display cannot be seen from P. Indicate this by shading in the part that cannot be seen.

[3]

(b) By construction on Fig. 5.1 and by using the scale, calculate how far the mirror must be moved so that all of the display counter can be seen from P.

distance moved = ... [2]

(c) State the characteristics of an image seen in a plane mirror.

....

....

.... [2]

[Turn over

6 Observations of a distant thunderstorm are made.

(a) During a lightning flash, the average wavelength of the light emitted is 5×10^{-7} m. This light travels at 3×10^{8} m/s.

Calculate the average frequency of this light.

frequency = ... [2]

(b) The interval between the lightning flash being seen and the thunder being heard is 3.6 s. The speed of sound in air is 340 m/s.

(i) Calculate the distance between the thunderstorm and the observer.

distance = ...

(ii) Explain why the speed of light is not taken into account in this calculation.

....

....
[3]

(c) A single ray of white light from the lightning is incident on a prism as shown in Fig. 6.1.
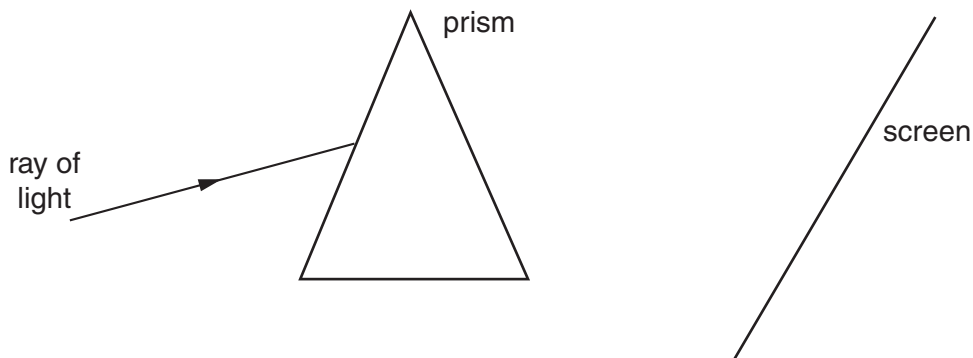

Fig. 6.1

Complete the path of the ray to show how a spectrum is formed on the screen. Label the colours. [2]

7 **(a)** Two non-conducting spheres, made of different materials, are initially uncharged. They are rubbed together. This causes one of the spheres to become positively charged and one negatively charged.

Describe, in terms of electron movement, why the spheres become charged.

....

....

.... [2]

(b) Once charged, the two spheres are separated, as shown in Fig. 7.1.

Fig. 7.1

On Fig. 7.1, draw the electric field between the two spheres. Indicate by arrows the direction of the electric field lines. [2]

(c) A conducting wire attached to a negatively charged metal object is connected to earth. This allows 2.0×10^{10} electrons, each carrying a charge of 1.6×10^{-19} C, to flow to earth in 1.0×10^{-3} s.

Calculate

(i) the total charge that flows,

charge ....

(ii) the average current in the wire.

current ....
[3]

[Turn over

8 Fig. 8.1 shows a transformer and a rectifier used in a battery charging circuit for a 12 V battery.
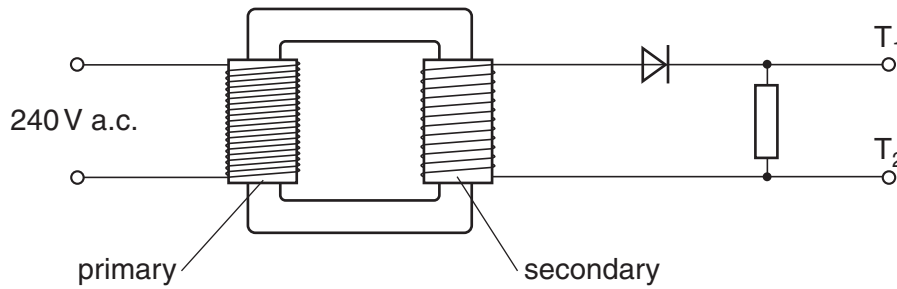

Fig. 8.1

(a) The transformer produces an output of 15 V across the secondary coil.

Calculate a suitable turns ratio for the transformer.

turns ratio = ... [2]

(b) Fig. 8.2 shows the 15 V output across the secondary coil.

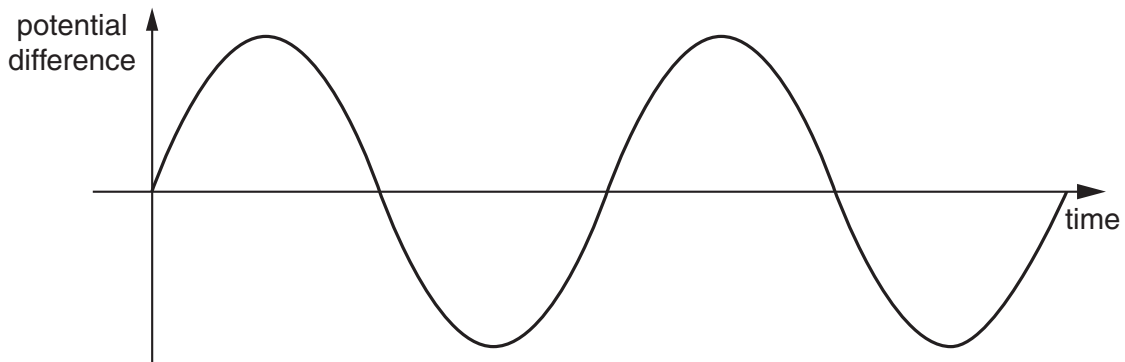**Fig. 8.2**

On the same axes, sketch the graph of the potential difference across the terminals T_1 and T_2 before the battery is connected. [2]

(c) Explain how the circuit converts an a.c. supply into a d.c. output.

....

....

.... [2]

(d) On Fig. 8.1, draw in a battery connected so that it may be charged. [1]

(e) When fully charged, the 12V battery can supply a current of 2.0 A for 30 hours (1.08 × 10^5 s).

Calculate

(i) the battery power when supplying a current of 2.0 A,

power = ...

(ii) the total energy that the battery will supply during the 30 hours.

energy = ...
[4]

9 Fig. 9.1 shows three resistors connected across a low voltage d.c. supply, and a c.r.o.
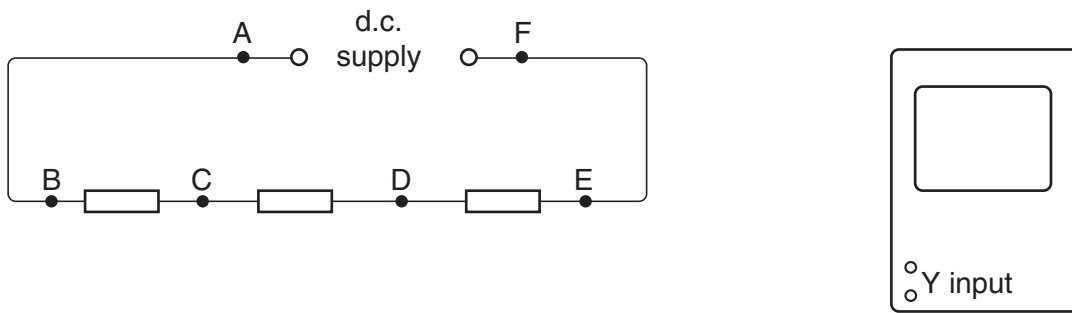
Fig. 9.1

(a) Explain how you would use a 1 V d.c. supply to calibrate the c.r.o.

....

....

.... [2]

(b) On Fig. 9.1, draw in the connections between the c.r.o. and the circuit so that the potential difference between points C and D may be measured. [2]

(c) The potential differences between A and F, B and C, C and D, and D and E are measured.

State the relationship between them.

....

....[2]

[Turn over

10 Some liquid from an atomic power station is known to be radioactive. A sample of this liquid is tested in a laboratory.

(a) In the space below, draw a labelled diagram of the test apparatus used to verify that α-particles are emitted from the liquid. [2]

(b) Explain how the apparatus may be used to estimate the quantity of α-radiation being emitted from the sample.

....

....

....

....

.... [2]

(c) State any two safety precautions that the technician might take whilst making the test.

precaution 1 ....

....

precaution 2 ....

.... [2]