UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **5054/02**

Paper 2 Theory **October/November 2007**

1 hour 45 minutes

Candidates answer on the Question Paper.

Additional Materials: Answer Booklet/Paper.

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.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer any **two** questions.
Write your answers on the separate answer paper provided.

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	
Section A	
Q9	
Q10	
Q11	
Total	

This document consists of **12** printed pages.

Section A

Answer **all** the questions in this section.

1 A parachutist jumps from an aircraft. Some time later, the parachute opens.

Fig. 1.1 is a graph of the vertical speed of the parachutist plotted against time *t*.

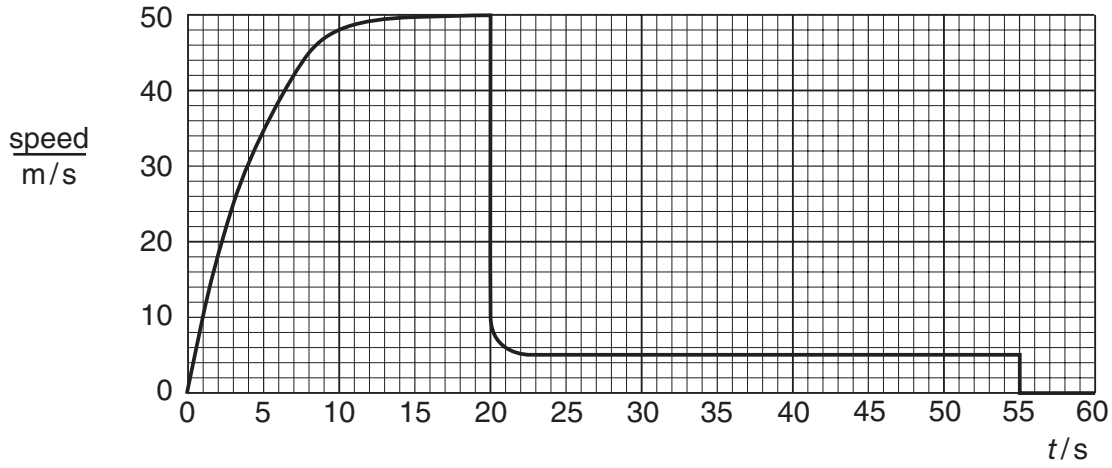


Fig. 1.1

(a) State what happens at $t = 20\,s$ and $t = 55\,s$.

at 20 s .....

at 55 s ..... [1]

(b) Describe the motion of the parachutist between $t = 0$ and $t = 20\,s$.

.....

.....

..... [2]

(c) Explain, in terms of the forces acting, why the speed of the parachutist is constant between $t = 25\,s$ and t = 55 s.

.....

.....

..... [2]

(d) Calculate the distance travelled by the parachutist between $t = 25\,s$ and $t = 55\,s$.

distance = ... [2]

2 A student measures the mass and the volume of four samples of rock A, B, C and D. The results are shown in Fig. 2.1.

	A	B	C	D
mass/g	101	202	448	4508
volume/cm^3	22	44	80	978

Fig. 2.1

(a) (i) Describe in detail how a measuring cylinder is used to find the volume of rock A.

.....

.....

.....

.....

..... [2]

(ii) Explain why the volume of rock D cannot be found with an ordinary laboratory measuring cylinder.

.....

..... [1]

(b) Calculate the density of rock A.

density = ... [2]

(c) Three of the rocks are made from the same material.

State and explain which of the rocks is made from a different material.

.....

.....

.....

..... [2]

3 One type of renewable energy source is shown in Fig. 3.1.

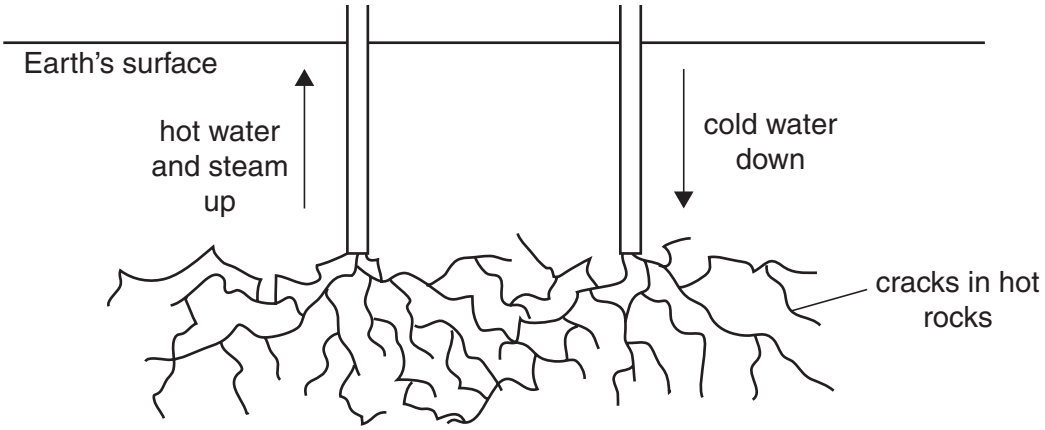


Fig. 3.1

(a) (i) State the name of the renewable energy source shown in Fig. 3.1.

..... [1]

(ii) State what is meant by a *renewable* energy source.

.....

.....

..... [1]

(b) 1000 kg of cold water at a temperature of 20 °C is pumped down to the hot rocks. 100 kg of water returns as steam and 900 kg as hot water, both at a temperature of 100 °C.

The specific heat capacity of water is 4200 J/(kg °C) and the specific latent heat of vaporisation of water is 2.3×10^6 J/kg.

Calculate

(i) the energy needed to heat 1000 kg of water from 20 °C to 100 °C,

energy = ... [2]

(ii) the energy needed to produce 100 kg of steam from water that is already at 100 °C.

energy = ... [2]

4 Fig. 4.1 shows equipment placed on top of a house that uses solar energy to produce hot water.

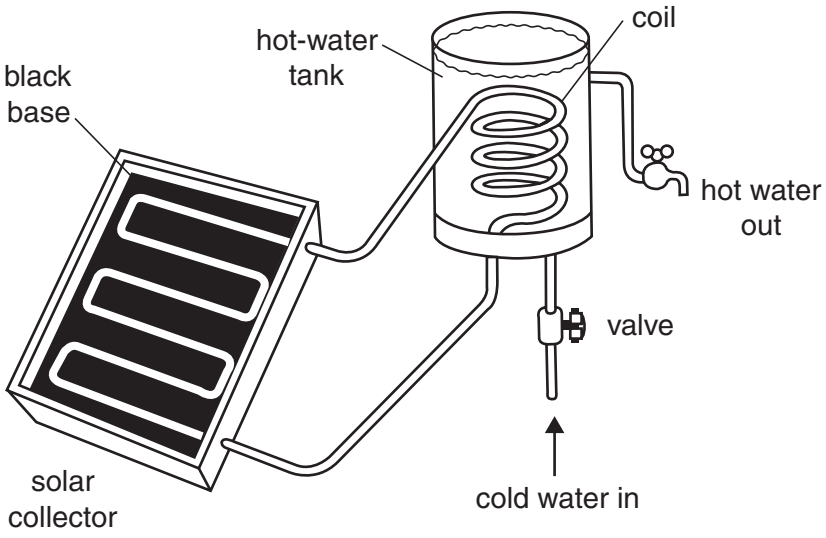


Fig. 4.1

(a) Explain why the solar collector has a black base.

.....

.....

..... [2]

(b) State and explain why the hot water in the solar collector travels to the hot-water tank.

.....

.....

..... [2]

(c) Fig. 4.1 does not show any insulation.

(i) Explain why it is important to insulate the hot-water tank.

.....

..... [1]

(ii) Explain how the hot-water tank is insulated.

.....

..... [1]

5 Fig. 5.1 shows the arrangement of atoms in a solid block.

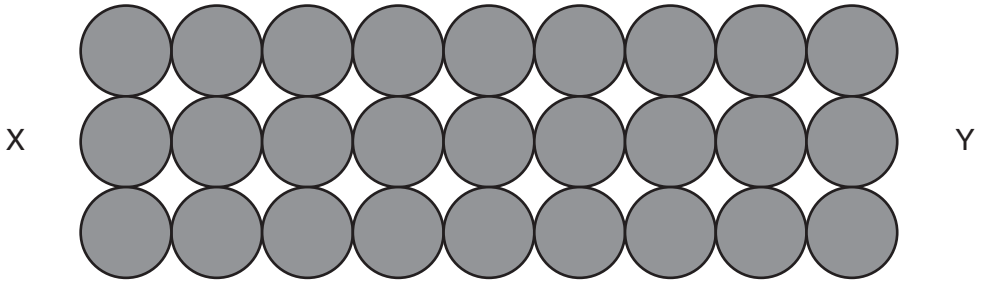


Fig. 5.1

(a) End X of the block is heated. Energy is conducted to end Y, which becomes warm.

(i) Explain how heat is conducted from X to Y by the atoms.

.....

.....

..... [2]

(ii) Explain why the solid block expands when it is heated.

.....

.....

..... [1]

(b) The block is heated and becomes a liquid.

Describe the changes that occur to the arrangement and the motion of the atoms.

.....

.....

.....

..... [2]

6 Fig. 6.1 shows the cone of a loudspeaker.

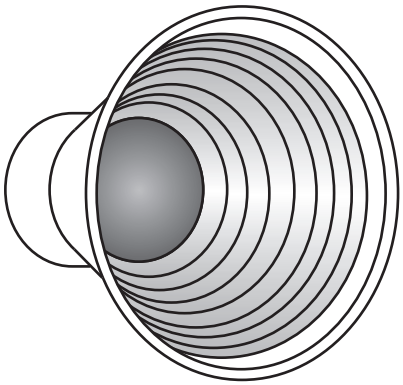


Fig. 6.1

(a) Sound is being produced. Describe in detail the behaviour of the cone and the air near to it.

.....

.....

.....

.....

..... [2]

(b) The lowest frequency that a human can hear is 20 Hz.

(i) State the highest frequency that a human with normal hearing can hear.

..... [1]

(ii) Calculate the longest wavelength of sound that a human can hear. The speed of sound in air is 340 m/s.

wavelength = ... [2]

7 Fig. 7.1 shows apparatus that can be used to make an electromagnet or a permanent magnet.

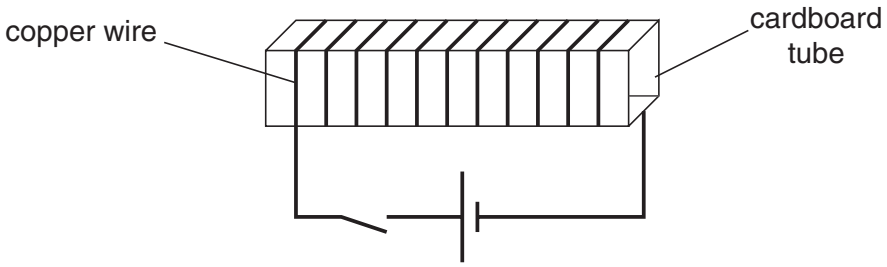


Fig. 7.1

Four rods are available. They are made of aluminium, soft iron, steel and wood.

(a) **(i)** State which rod is used to make a permanent magnet.

..... [1]

(ii) Describe how the apparatus is used to make a permanent magnet.

.....

..... [1]

(b) A computer component is screened from external magnetic fields by placing it in a box, as shown in Fig. 7.2.

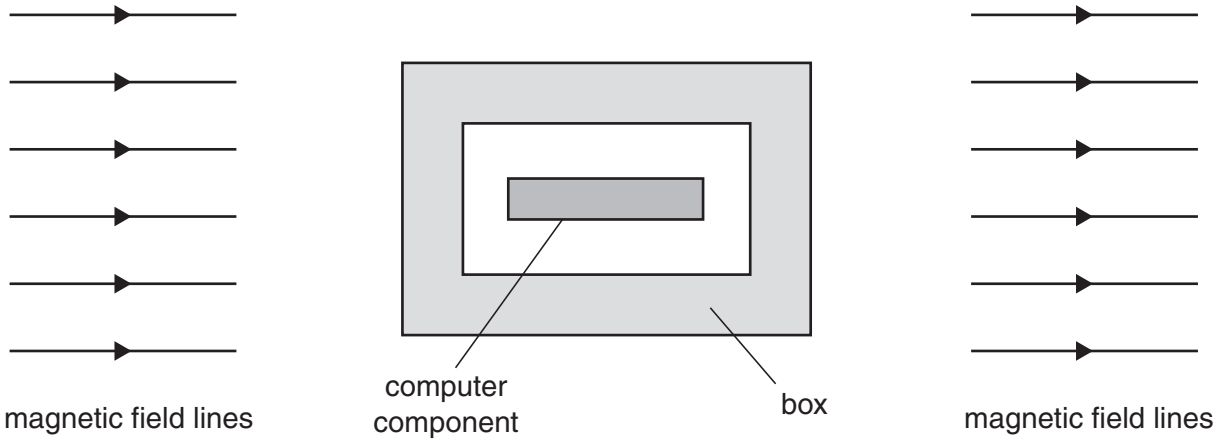


Fig. 7.2

There is a strong magnetic field outside the box. The magnetic field lines have not been drawn near the box.

(i) State the best choice for the material of the box.

..... [1]

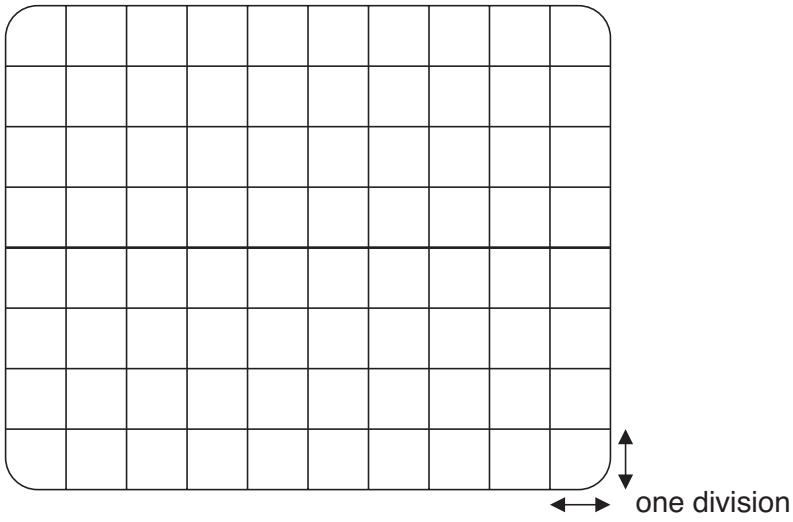
(ii) On Fig. 7.2, join the magnetic field lines on the left of the box to those on the right, showing the pattern of the magnetic field. [2]

8 EITHER

The Y-plates of a cathode-ray oscilloscope (CRO) are connected to an alternating voltage of amplitude 4.0 V and frequency 25 Hz.

The Y-gain of the CRO is set at 2.0 V / division and the time-base is set at 0.01 s / division.

On the grid below, draw the trace on the screen of the CRO. Show your calculations beside the grid. [4]



OR

Fig. 8.1 shows a transistor used in the circuit of a simple moisture detector.

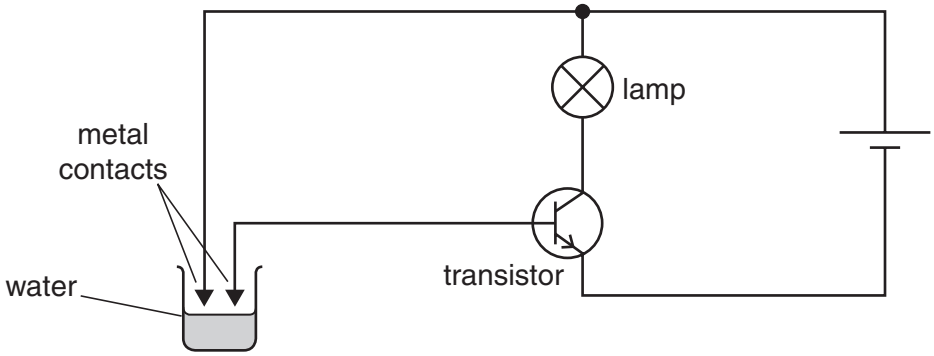


Fig. 8.1

(a) Describe what happens when the water level in the beaker reaches the metal contacts.

.....

.....

.....

..... [3]

(b) State one use for this simple moisture detector.

..... [1]

Section B

Answer **two** questions from this section.

Use the separate sheets available from the Supervisor.

9 Many cars are fitted with an air-bag, as shown in Fig. 9.1. In a collision, the air-bag inflates and reduces the effect of the impact between the passenger and the dashboard.

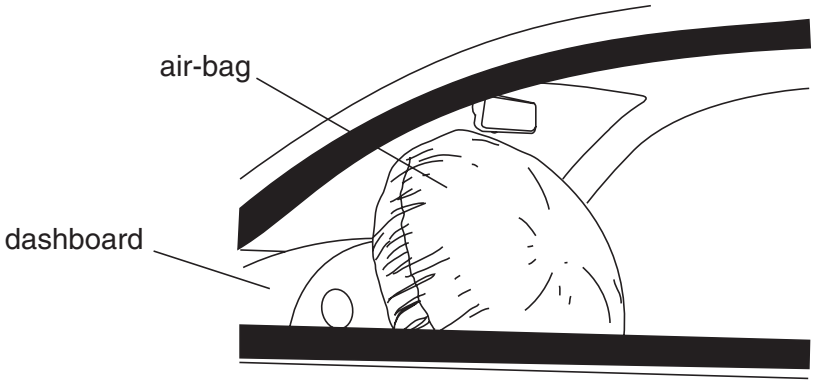


Fig. 9.1

(a) In a test of the air-bag, a heavy ball is used instead of the passenger.

The car is travelling at 14 m/s when it hits a wall. The air-bag inflates and the ball takes 3.0 s to come to rest. The ball has mass 5.0 kg.

(i) Calculate the average deceleration of the ball. [3]

(ii) Calculate the average force exerted on the ball. [2]

(iii) Using ideas about acceleration, explain how the air-bag reduces the force on the ball during the test. [2]

(b) If there was no air-bag, a large pressure would be exerted on the ball at the point where it hits the dashboard.

(i) Define *pressure*. [1]

(ii) The inflated air-bag reduces the pressure exerted on the ball. State **two** reasons why the pressure is reduced. [2]

(c) Compressed gas from a small cylinder inflates the air-bag. The cylinder contains a volume of 600 cm^3 of gas at a pressure of 1.4×10^7 Pa. The cylinder and the inflated air-bag have a volume of 30 000 cm^3.

(i) Calculate the pressure of the gas in the inflated air-bag, assuming that the temperature is constant. [3]

(ii) The pressure inside the cylinder decreases as the air-bag is inflated. Explain, using ideas about molecules, why the pressure decreases. [2]

10 **(a)** Describe an experiment to show the difference between an electrical insulator and an electrical conductor. Name one example of each. [4]

(b) Fig. 10.1 is a sketch graph of the current in a component P against the potential difference (p.d.) across it.

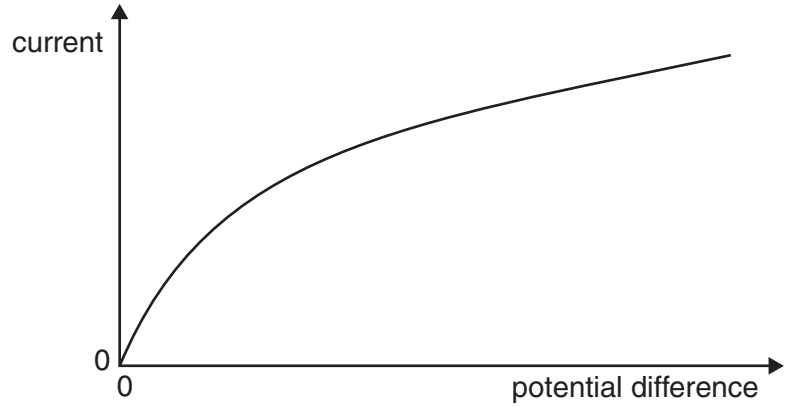


Fig. 10.1

(i) Define *resistance*. [1]

(ii) State how the resistance of P varies with the p.d. across it. [1]

(iii) Suggest what component P is. [1]

(iv) Explain why the resistance of P varies with the p.d. across it. [2]

(c) Component P is used in the electrical circuit shown in Fig. 10.2.

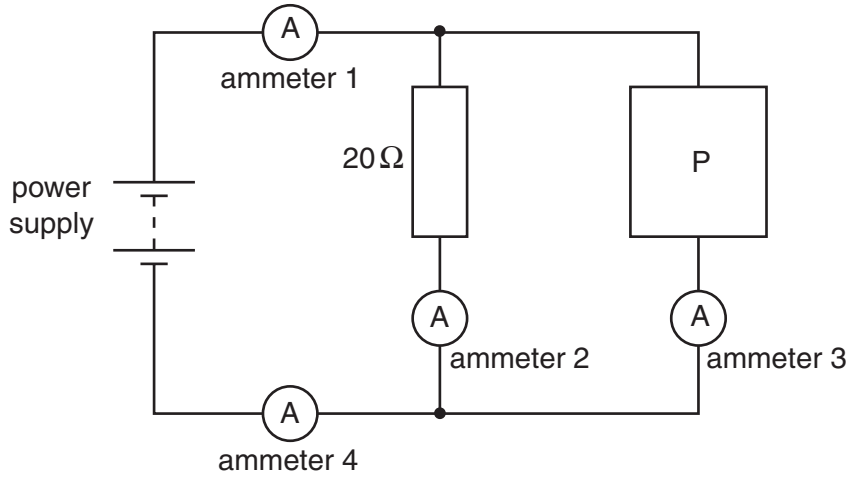


Fig. 10.2

The current in ammeter 2 is 0.40 A and the current in ammeter 3 is 0.60 A.

(i) Determine the readings of ammeters 1 and 4. [1]

(ii) Calculate the p.d. across the 20 Ω resistor. [2]

(iii) State the p.d. across the power supply. [1]

(iv) Calculate the resistance of P in this circuit. [2]

11 (a) Fig. 11.1 shows a ray of light passing through the edge of a converging lens.

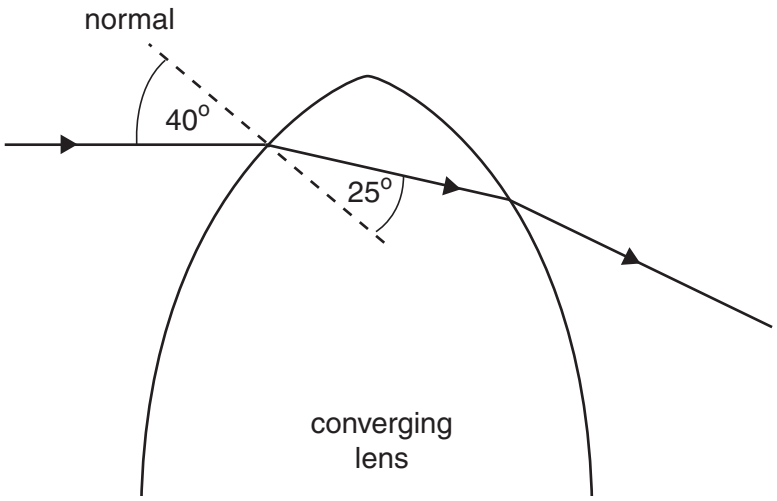


Fig. 11.1

(i) Describe what happens to the direction of the ray of light as it enters and leaves the lens. [2]

(ii) State what happens to the speed, frequency and wavelength of the light as it enters the lens. [3]

(iii) Calculate the refractive index of the glass used in the lens. [3]

(b) The focal length of the lens is 20 cm. An object is placed 50 cm from the lens and an image is formed on a screen.

(i) Explain what is meant by the *focal length* of a lens. You may draw a diagram if you wish. [2]

(ii) Draw a ray diagram to scale to show the formation of the image. [3]

(iii) The image is real. State **two** other properties of the image. [2]