



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE  
NAME

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NUMBER

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**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	
<b>Section A</b>	
<b>Q9</b>	
<b>Q10</b>	
<b>Q11</b>	
<b>Total</b>	

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

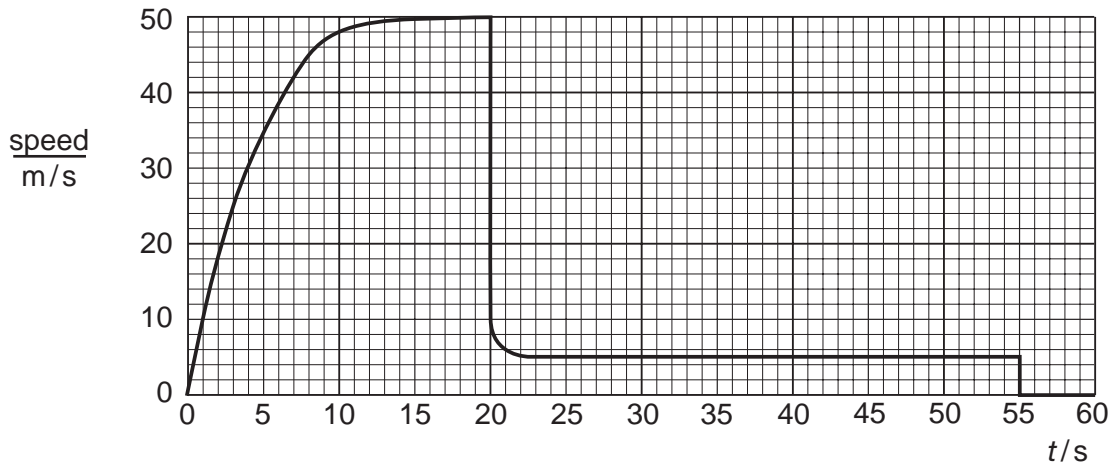


**Section A**

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 <sup>3</sup>	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.

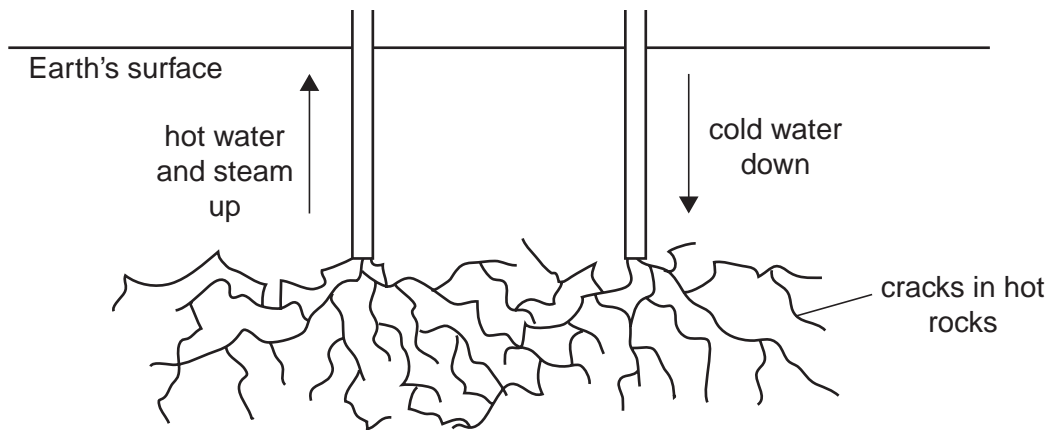


Fig. 3.1

(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  $2.3 \times 10^6$  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.

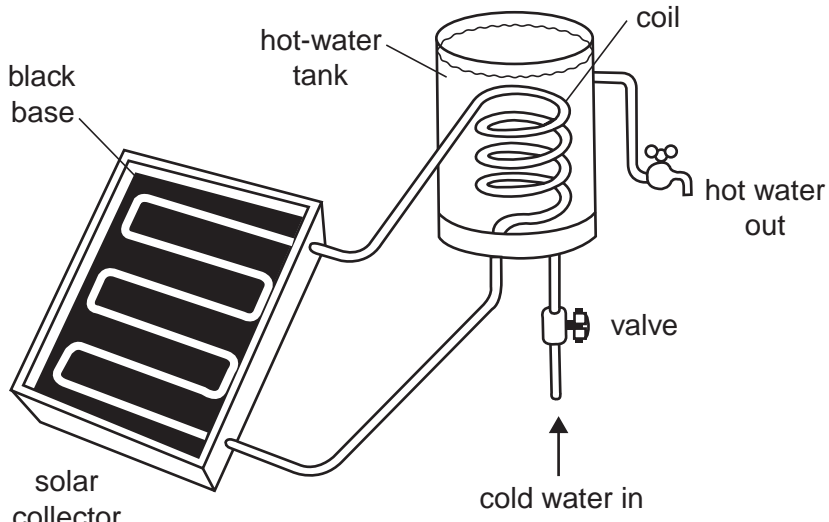


Fig. 4.1

- (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.

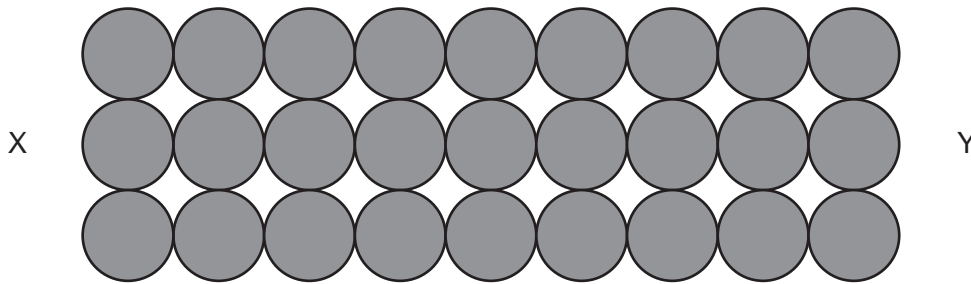


Fig. 5.1

(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.

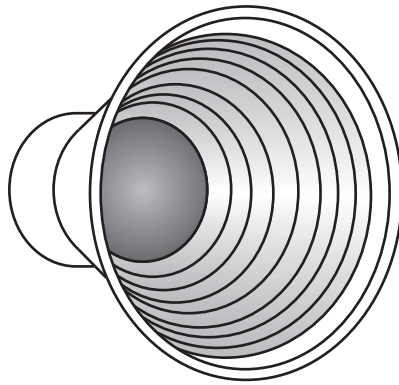


Fig. 6.1

(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.

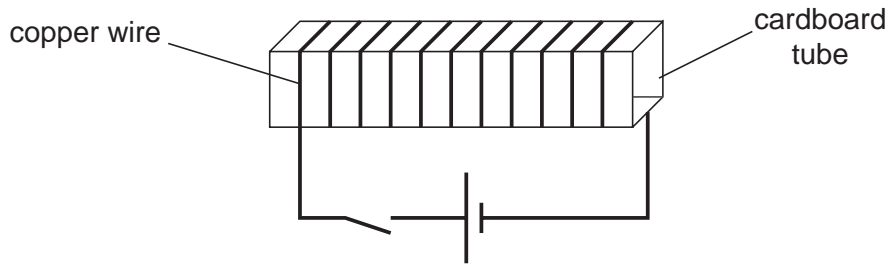


Fig. 7.1

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.

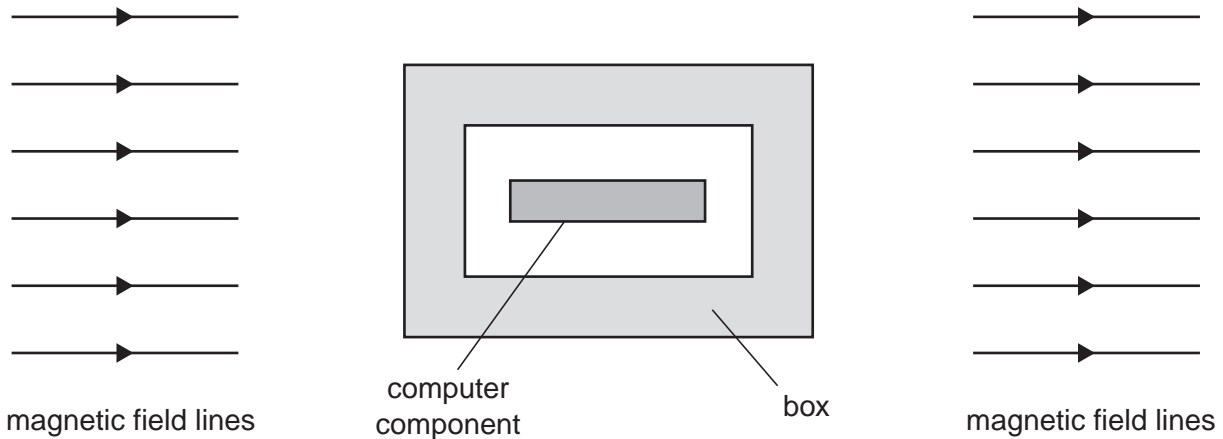


Fig. 7.2

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]

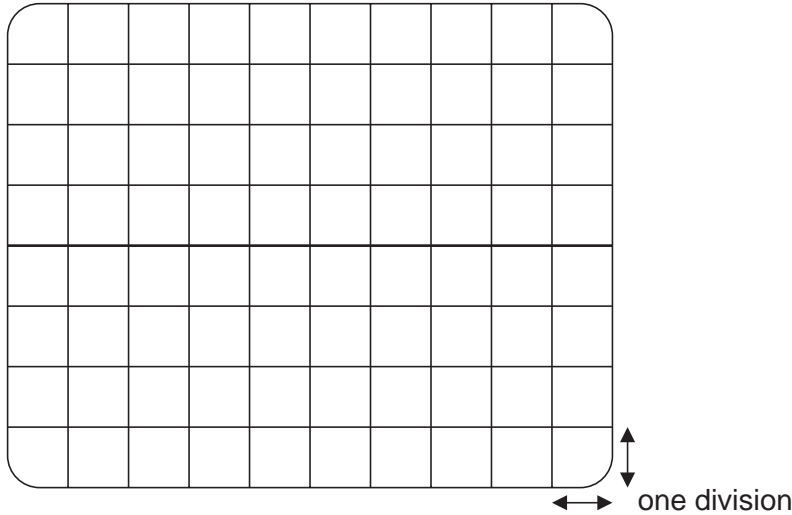


**8 EITHER**

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

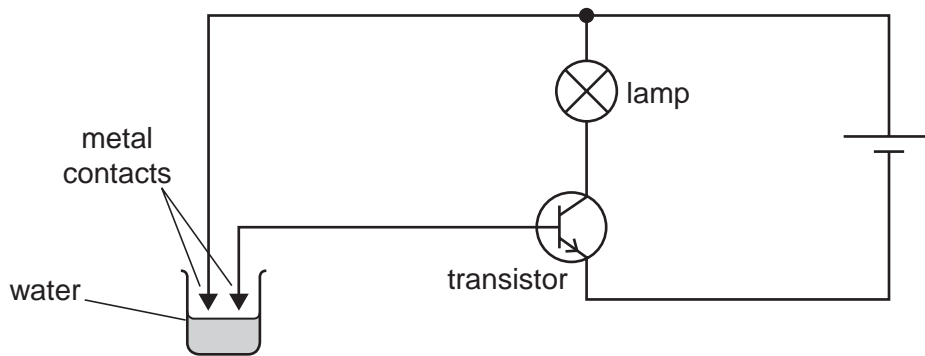
The Y-gain of the CRO is set at 2.0V/division and the time-base is set at 0.01 s/division.

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.

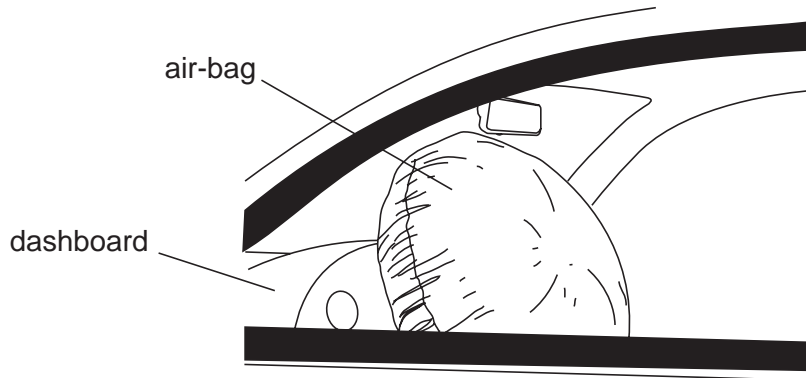


Fig. 9.1

- (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<sup>3</sup> of gas at a pressure of  $1.4 \times 10^7$  Pa. The cylinder and the inflated air-bag have a volume of 30 000 cm<sup>3</sup>.
- (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.

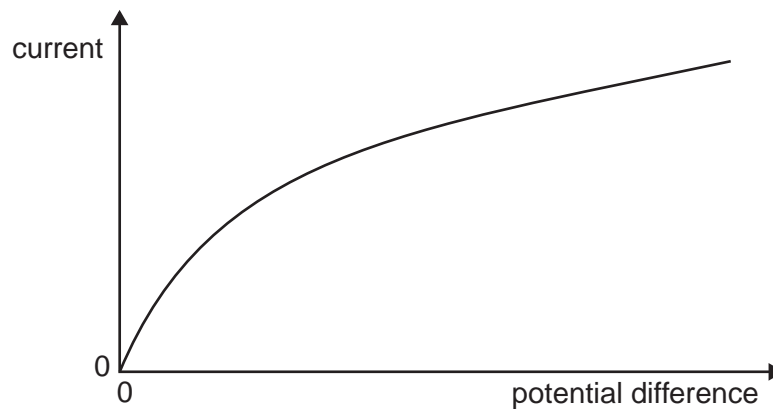


Fig. 10.1

- (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.

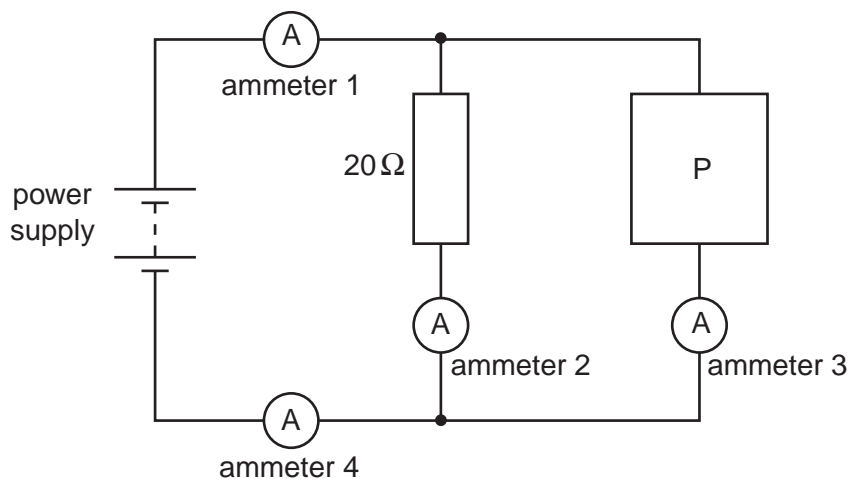


Fig. 10.2

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  $20\ \Omega$  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.

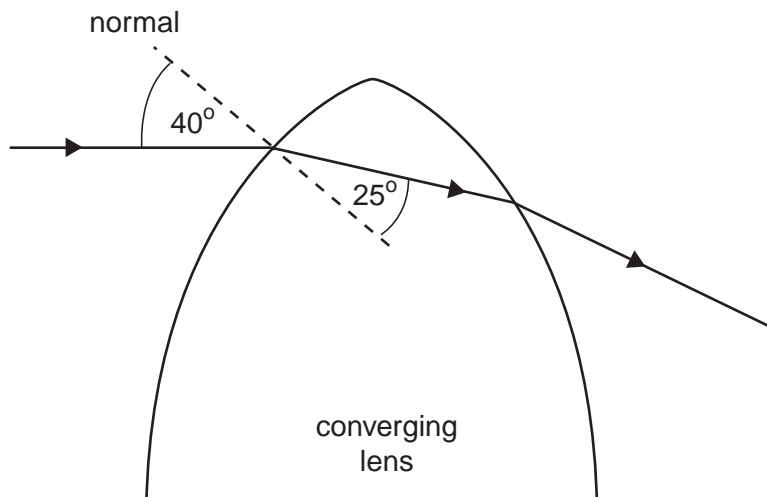


Fig. 11.1

- (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]

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