MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
CAMBRIDGE ASSESSMENT INTERNATIONAL EDUCATION
General Certificate of Education Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	S
INDEX NUMBER	

SCIENCE (PHYSICS, CHEMISTRY) 5086/02

Paper 2 Physics

For examination from 2024

SPECIMEN PAPER

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on the work you hand in.
You may use an HB pencil for any diagrams, graphs or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.
DO **NOT** WRITE ON ANY BARCODES.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer **one** question.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

Singapore Examinations and Assessment Board

Cambridge Assessment International Education

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Section A

Answer **all** the questions in the spaces provided.

1 A U-shaped tube, of constant cross-sectional area, contains water of density 1000 kg / m^3. Oil that does not mix with water is then poured into the right-hand side of the tube. Fig. 1.1 shows the levels of water and oil when equilibrium is reached.

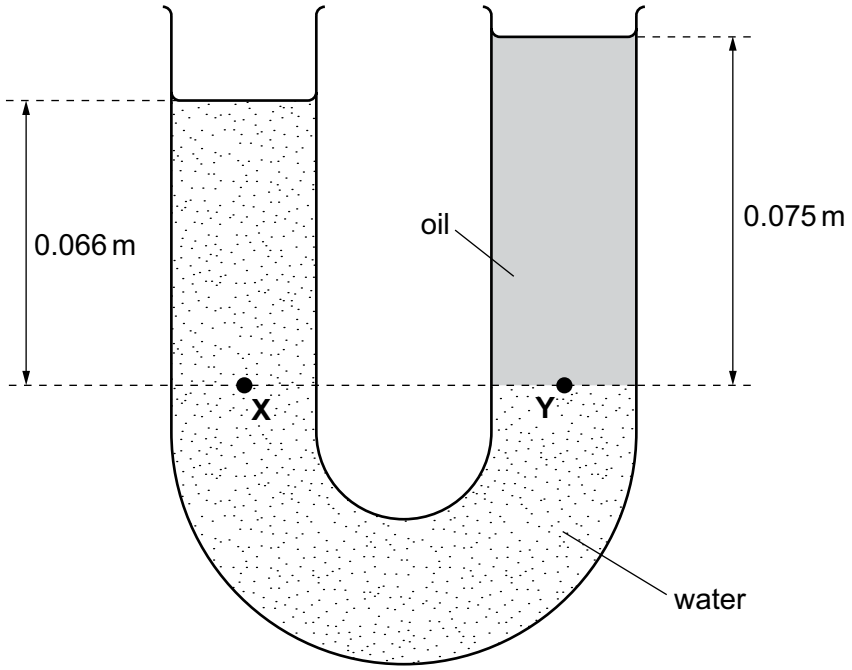

Fig. 1.1

Points **X** and **Y** are at the same horizontal level. **X** is 0.066 m below the top surface of the water. **Y** is 0.075 m below the top surface of the oil.

(a) The cross-sectional area of the tube is 5.0×10^{-4} m^2.

(i) Calculate the mass of water above the level of **X**.

mass = ... kg [2]

(ii) Calculate the weight of water above the level of **X**. (gravitational field strength g = 10 N / kg)

weight = ... N [1]

(iii) Calculate the pressure at **X** due to water.

pressure = ... N/m^2 [1]

(b) The pressure at **X** is equal to the pressure at **Y**.

Determine the density of the oil.

density = ... kg/m^3 [2]

[Total: 6]

2 Violet light has a wavelength of 4.0×10^{-7} m.

(a) Calculate the frequency of this light, assuming that the speed of light is 3.0×10^{5} km / s.

frequency = ... Hz [2]

(b) State **two** different components of the electromagnetic spectrum that have wavelengths shorter than the wavelength of violet light and state a use for each.

wave 1 .....

use .....

wave 2 .....

use .....

[4]

[Total: 6]

3 A car of mass 800 kg travels in a straight line. It has a speed of 10 m / s at t = 0 s.

It accelerates uniformly at 1.5 m / s^2 until t = 12 s.

It then travels at a constant speed for a distance of 210 m.

It then decelerates uniformly for 4.0 s until it is at rest.

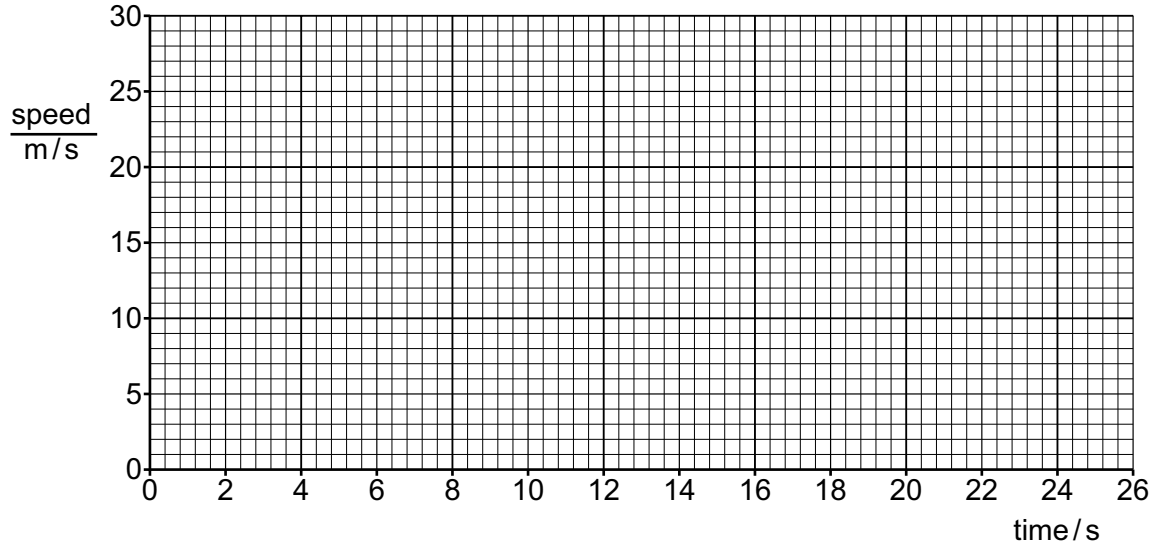

Fig. 3.1

(a) On the grid in Fig. 3.1, plot a graph to show how the speed of the car changes with time. [3]

(b) Calculate:

(i) the distance travelled in the first 12 s

distance = ... m [2]

(ii) the constant braking force on the car during the final 4.0 s of the journey.

force = ... N [3]

[Total: 8]

4 A solid substance is heated until its temperature rises from 5 °C to 150 °C.

Fig. 4.1 shows how the temperature of the substance changes with time.

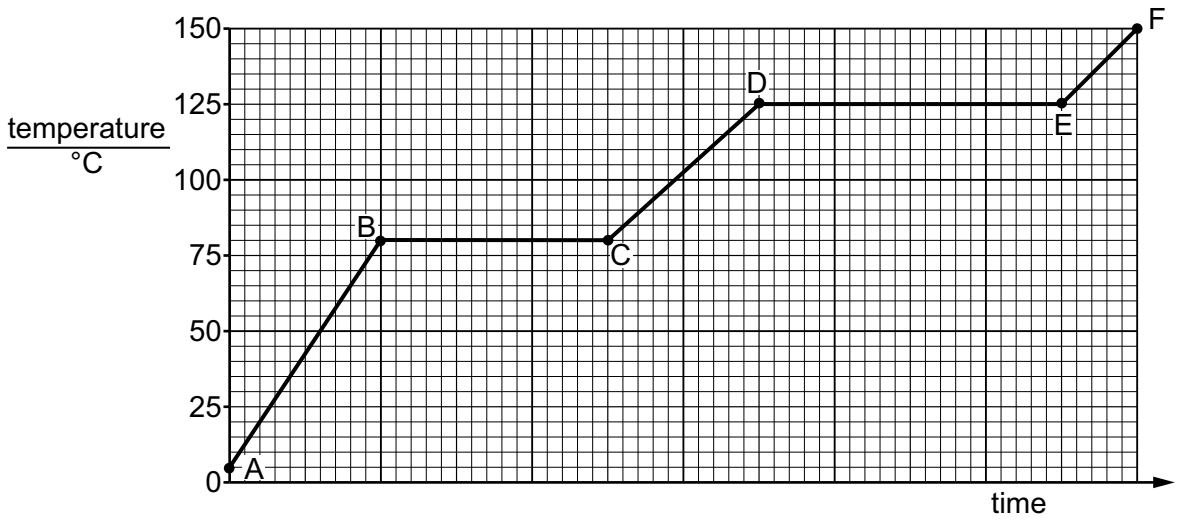

Fig. 4.1

(a) (i) State the regions of the graph where the average kinetic energy of the molecules of the substance does not change.

..... [1]

(ii) State what is happening to the substance in these regions.

..... [1]

(b) Compare the movement and spacing of the molecules of the substance at temperatures 50 °C and 120 °C.

movement .....

.....

spacing .....

.....

[2]

[Total: 4]

5 A thin converging lens is used to project an image of an object onto a screen.

When the distance between the object and the lens (object distance) is changed, the distance between the image and the lens (image distance) also changes.

Fig. 5.1 shows how the image distance varies with the object distance for the lens.

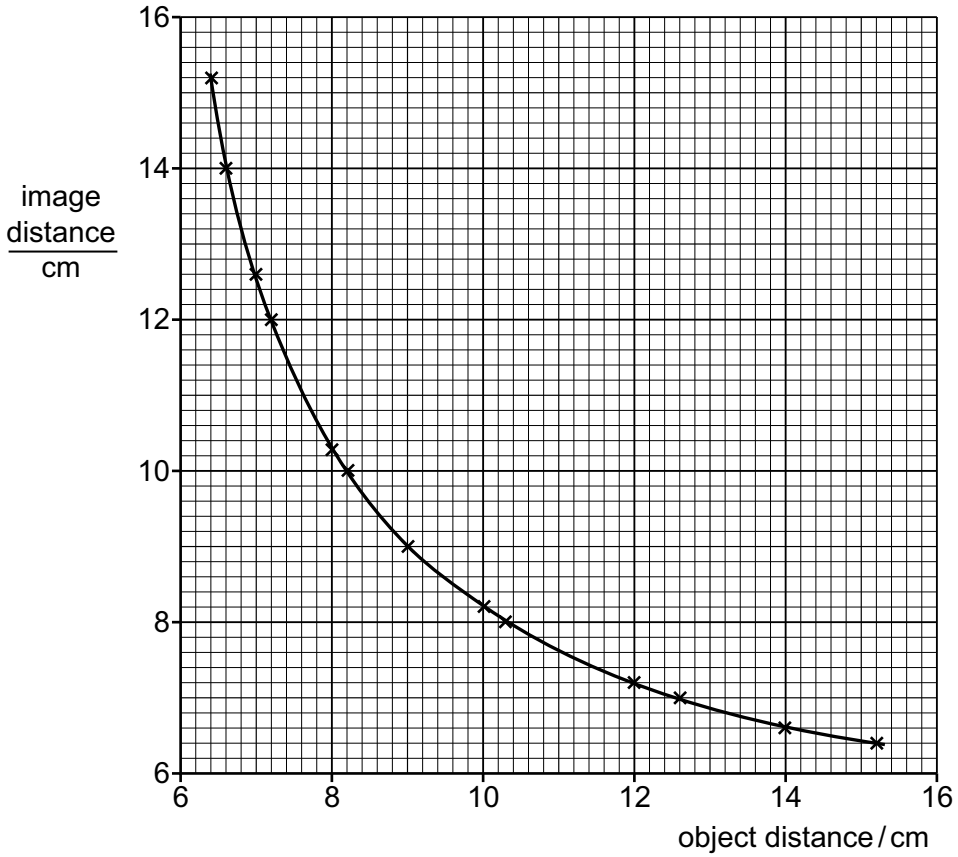

Fig. 5.1

(a) Determine the object distance for which the image distance is equal to the object distance.

object distance = ... cm [1]

(b) If the object distance is greater than the image distance, the image formed is diminished. If the object distance is less than the image distance, the imaged formed is magnified.

State **two** characteristics of the image formed when the object distance is 11.0 cm.

.....

..... [2]

[Total: 3]

6 A 12 V battery and three resistors of values 15 Ω, 4.0 Ω and 12 Ω are connected as shown in Fig. 6.1.

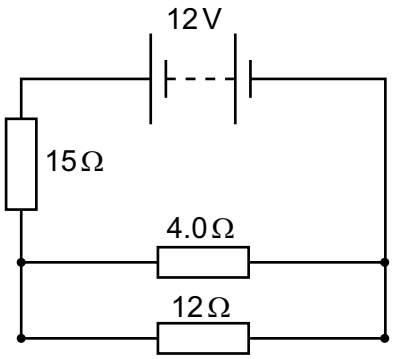

Fig. 6.1

(a) Calculate the effective resistance of the circuit.

effective resistance = ... Ω [3]

(b) Calculate the current in the 15 Ω resistor.

current = ... A [1]

(c) Calculate the potential difference across the 15 Ω resistor.

potential difference = ... V [1]

(d) Calculate the current in the 4.0 Ω resistor.

current = ... A [2]

[Total: 7]

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7 Fig. 7.1 shows a fishing boat using sound waves to locate a shoal of fish.

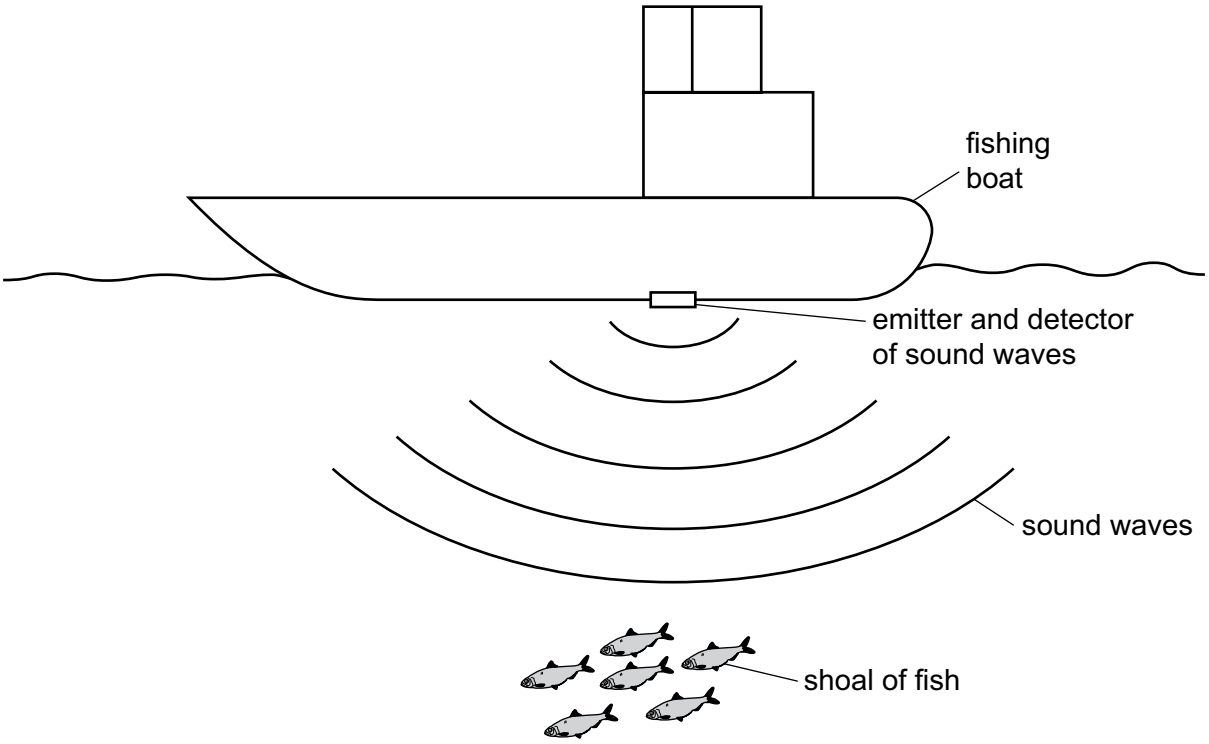

Fig. 7.1

Sound waves are emitted from the bottom of the fishing boat. When the sound waves reach the shoal of fish, they are reflected back to the boat. The time between the sound waves leaving the boat and their reflection being detected is measured.

(a) State the name given to a reflected sound wave.

..... [1]

(b) The speed of sound in water is 1500 m / s. The time between the sound wave leaving the fishing boat and the reflected wave being detected is 0.060 s.

Calculate the distance between the boat and the shoal of fish.

distance = ... m [3]

(c) Suggest, in terms of molecules in air and water, why a sound wave travels more quickly through water than it does through air.

.....

.....

..... [2]

[Total: 6]

8 A solenoid is a coil of several turns of insulated wire.

An iron bar is placed inside the solenoid and the solenoid is connected to the d.c. power supply as shown in Fig. 8.1.

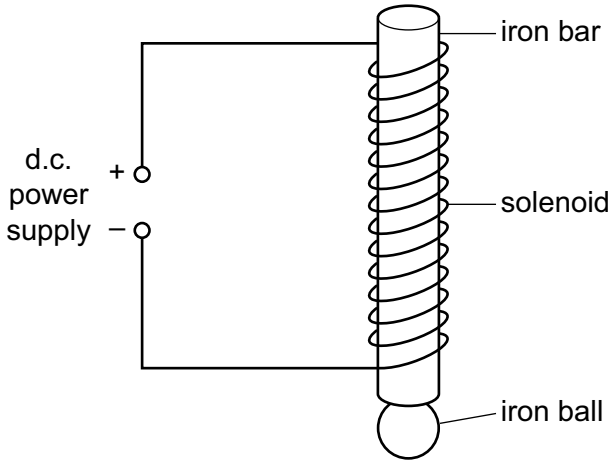

Fig. 8.1

When the d.c. supply is switched on, there is a current in the solenoid and the iron ball is attracted to the iron bar.

When the d.c. supply is switched off, the ball falls.

(a) Explain why a current in the solenoid causes the iron ball to be attracted to the iron bar.

.....

.....

.....

..... [3]

(b) State what would happen differently if the ball were made of steel.

.....

..... [1]

(c) The current in the solenoid is increased. State how this would alter the experiment.

..... [1]

[Total: 5]

9 **(a)** The activity of a radioactive source was measured at the same time each day for 5 days. The results after allowing for background radiation are shown in Table 9.1.

Table 9.1

time / days	0	1	2	3	4	5
activity / Bq	120	75	48	30	19	12

(i) On the grid of Fig. 9.1, draw a graph to show how the activity of the radioactive source varies with time.

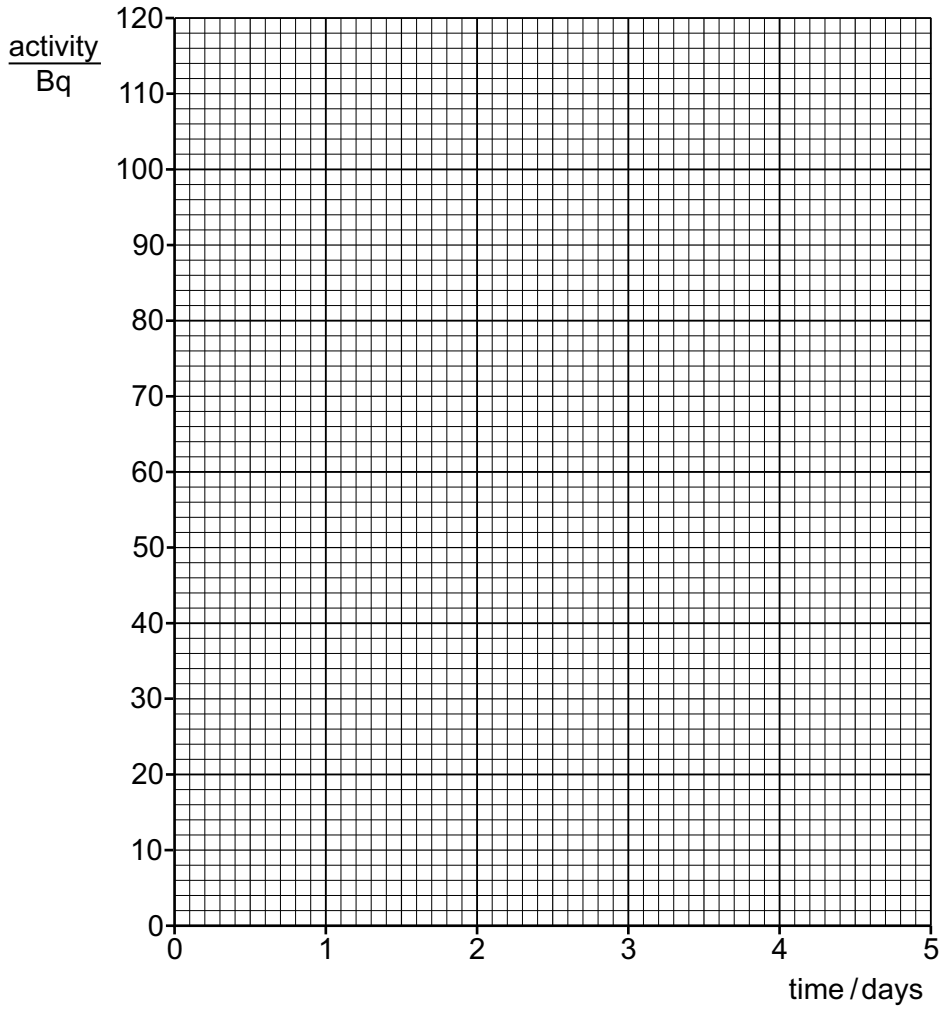

Fig. 9.1

[2]

(ii) Determine the half-life of the source. Show on your graph how you arrive at your answer.

half-life = ... [2]

(b) In a factory making sheets of plastic, a radioactive source is used to check that the thickness of the plastic does not vary. The arrangement is shown in Fig. 9.2.

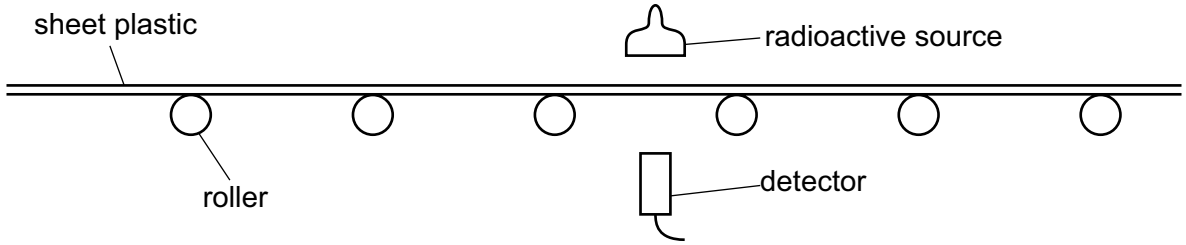

Fig. 9.2

Radiation from the radioactive source passes through the sheet of plastic and is detected by the detector. If the reading on the detector does not change, the thickness of the plastic sheet has not changed.

Three radioactive sources are available:

Source **A**, which emits alpha radiation;
Source **B**, which emits beta radiation;
Source **C**, which emits gamma radiation.

State and explain which source would be suitable to check the thickness of the plastic. Explain why the other sources are unsuitable.

.....

.....

.....

.....

.....

..... [3]

(c) A different radioactive source has a half-life of 2 hours.

Initially the measured activity is 544 Bq when the background radiation is 32 Bq.

Calculate the measured activity 6 hours later. Assume that the background activity does not change.

activity = ... Bq [3]

[Total: 10]

Section B

Answer **one** question from this section.

10 Fig. 10.1 shows a uniform ladder leaning against a wall.

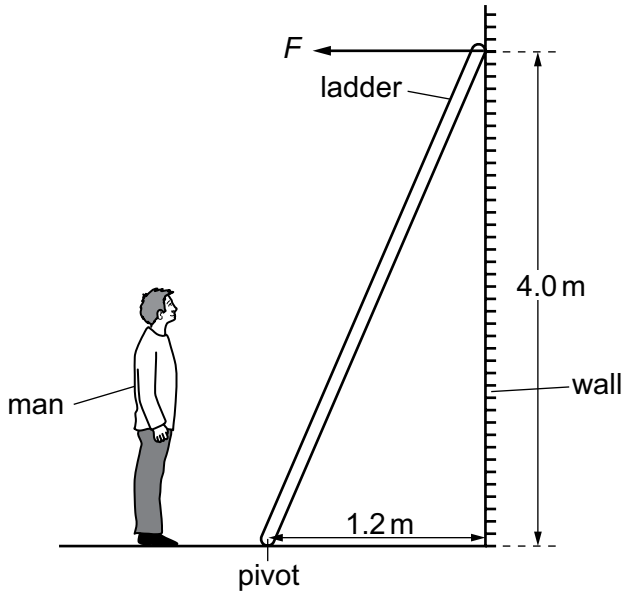

Fig. 10.1 (not to scale)

The bottom of the ladder is 1.2 m from the wall. The top of the ladder is 4.0 m above the ground.

The weight of the ladder is 110 N.

(a) Draw on Fig. 10.1 the line of action of the weight of the ladder and determine the perpendicular distance between the line of action of the weight and the pivot.

distance = ... [2]

(b) Calculate the value of the force, *F*, between the wall and the top of the ladder.

F = ... [3]

(c) A man steps on to the ladder and slowly climbs to the top.

State and explain how force, *F*, changes, if at all, as the man climbs up the ladder.

.....

.....

.....

.....

.....

..... [3]

(d) Name the force that stops the bottom of the ladder from slipping along the ground and draw the direction of this force on Fig. 10.1.

Suggest how to make this ladder safer.

.....

.....

.....

..... [2]

[Total: 10]

11 Fig. 11.1 shows the inside of an oven.

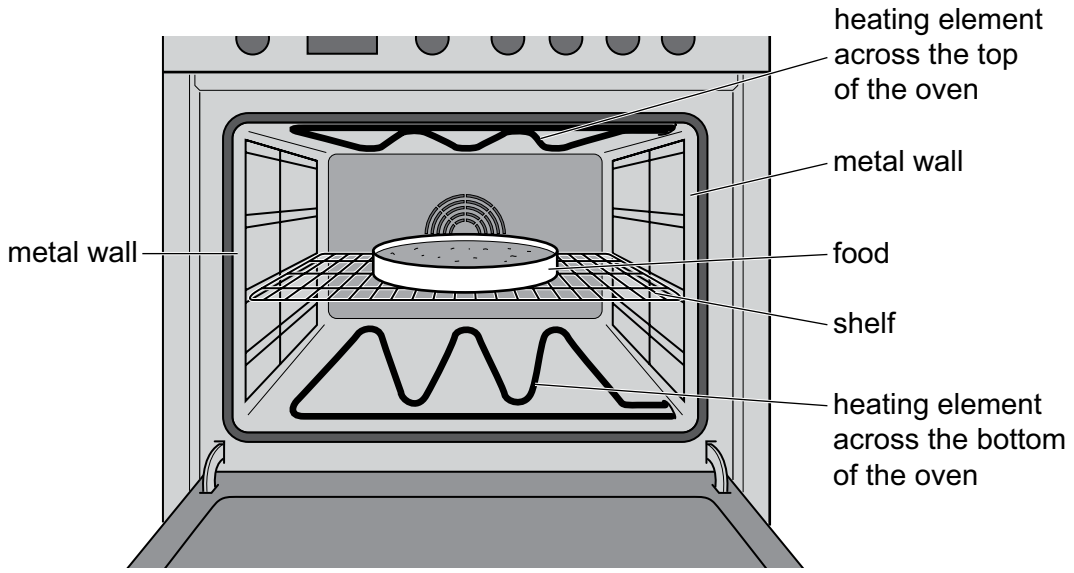

Fig. 11.1

(a) Explain how thermal energy is transferred from the heating elements to the food being cooked.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Describe what happens to the energy transferred to the food.

.....

.....

..... [2]

(c) Fig. 11.2 shows a metal plate attached to the inside of the oven.

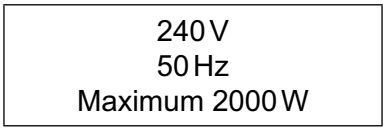

Fig. 11.2

The two identical heating elements are connected in parallel to the mains supply.

(i) Calculate the maximum current in each heating element.

current = ... [2]

(ii) Calculate the maximum amount of energy, in joules, transferred by the oven when it is used for 45 minutes.

energy = ... [2]

[Total: 10]

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