



- 1 (a) A stone falls from the top of a building and hits the ground at a speed of 32 m/s. The air resistance-force on the stone is very small and may be neglected.

(i) Calculate the time of fall.

time = .....

(ii) On Fig. 1.1, draw the speed-time graph for the falling stone.

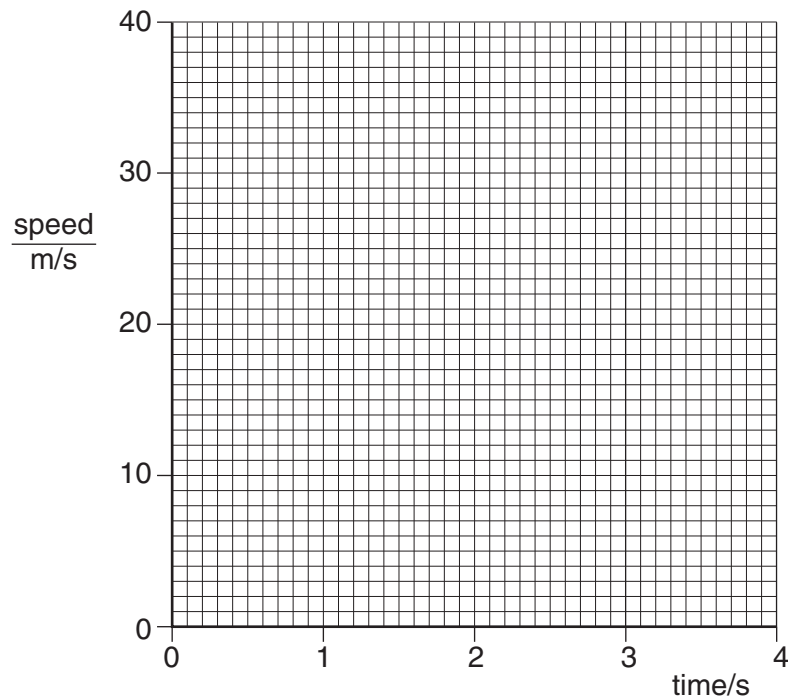


Fig. 1.1

- (iii) The weight of the stone is 24 N. Calculate the mass of the stone.

mass = .....

[5]

(b) A student used a suitable measuring cylinder and a spring balance to find the density of a sample of the stone.

- (i) Describe how the measuring cylinder is used, and state the readings that are taken.

.....

.....

.....

.....

- (ii) Describe how the spring balance is used, and state the reading that is taken.

.....

.....

- (iii) Write down an equation from which the density of the stone is calculated.

.....

- (iv) The student then wishes to find the density of cork. Suggest how the apparatus and the method would need to be changed.

.....

.....

.....

[6]

- 2 In an experiment, forces are applied to a spring as shown in Fig. 2.1a. The results of this experiment are shown in Fig. 2.1b.

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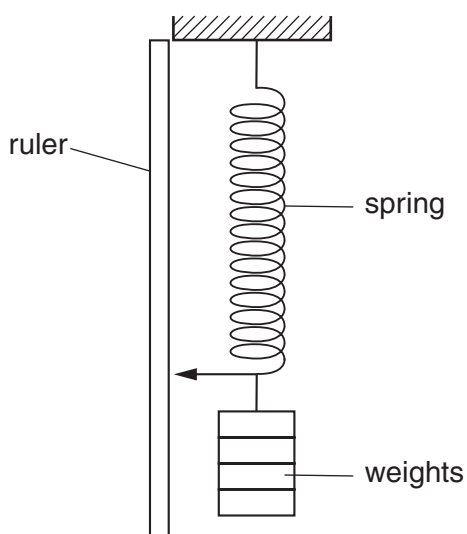


Fig. 2.1a

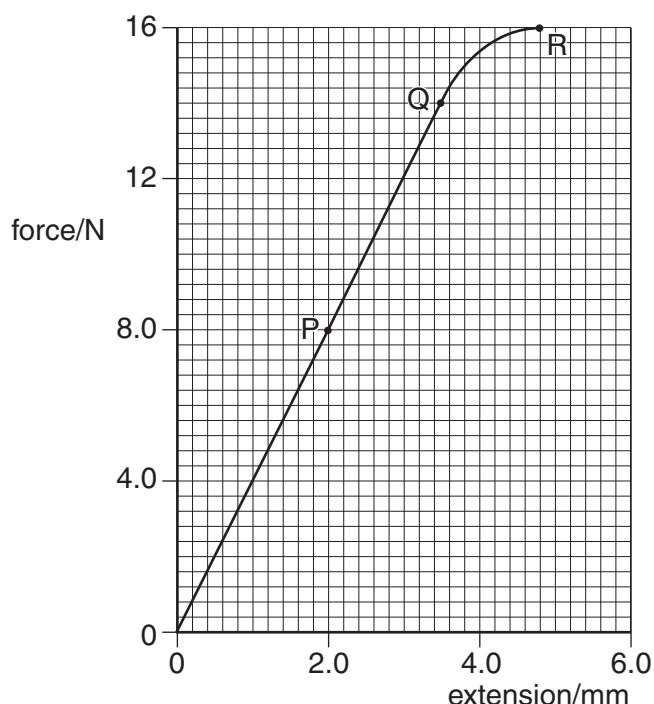


Fig. 2.1b

- (a) What is the name given to the point marked Q on Fig. 2.1b?

.....[1]

- (b) For the part OP of the graph, the spring obeys Hooke's Law.  
State what this means.

.....  
.....[1]

- (c) The spring is stretched until the force and extension are shown by the point R on the graph. Compare how the spring stretches, as shown by the part of the graph OQ, with that shown by QR.

.....  
.....[1]

- (d) The part OP of the graph shows the spring stretching according to the expression

$$F = kx.$$

Use values from the graph to calculate the value of  $k$ .

$k =$ .....[2]

- 3 Fig. 3.1 shows water falling over a dam.

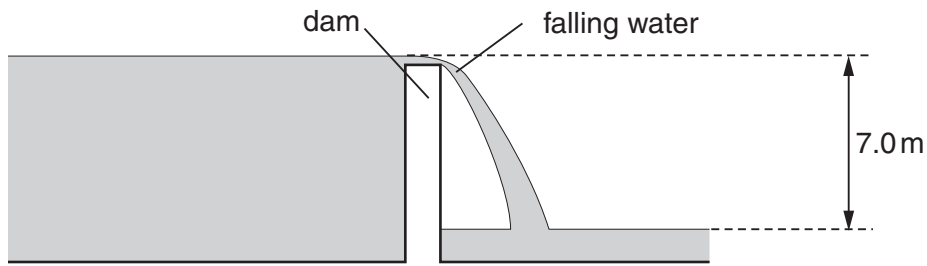


Fig. 3.1

- (a) The vertical height that the water falls is 7.0 m.  
Calculate the potential energy lost by 1.0 kg of water during the fall.

potential energy = .....[2]

- (b) Assuming all this potential energy loss is changed to kinetic energy of the water, calculate the speed of the water, in the vertical direction, at the end of the fall.

speed = .....[3]

- (c) The vertical speed of the water is less than that calculated in (b). Suggest one reason for this.

.....  
.....[1]

- 4 Some water is heated electrically in a glass beaker in an experiment to find the specific heat capacity of water. The temperature of the water is taken at regular intervals.

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The temperature-time graph for this heating is shown in Fig. 4.1.

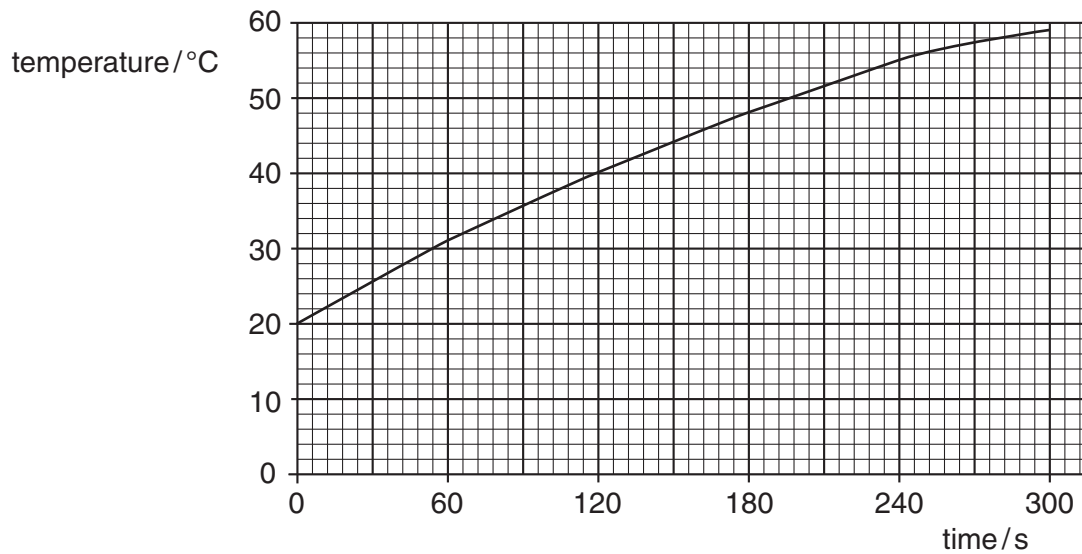


Fig. 4.1

- (a) (i) Use the graph to find

1. the temperature rise in the first 120 s,

.....

2. the temperature rise in the second 120 s interval.

.....

- (ii) Explain why these values are different.

.....

.....

[2]

- (b) The experiment is repeated in an insulated beaker. This time, the temperature of the water increases from 20°C to 60°C in 210 s. The beaker contains 75 g of water. The power of the heater is 60 W. Calculate the specific heat capacity of water.

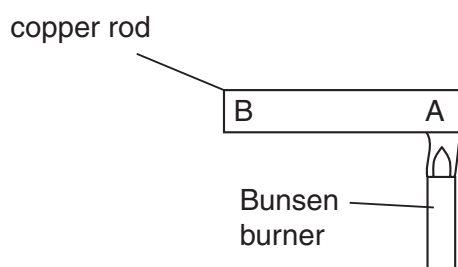
specific heat capacity = ..... [4]

- (c) In order to measure the temperature during the heating, a thermocouple is used. Draw a labelled diagram of a thermocouple connected to measure temperature.

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[2]

- 5 (a) Fig. 5.1 shows a copper rod AB being heated at one end.



**Fig. 5.1**

- (i) Name the process by which heat moves from A to B.

.....

- (ii) By reference to the behaviour of the particles of copper along AB, state how this process happens.

.....

.....

[3]

- (b) Give an account of an experiment that is designed to show which of four surfaces will absorb most heat radiation.

The four surfaces are all the same metal, but one is a polished black surface, one is a polished silver surface, one is a dull black surface and the fourth one is painted white. Give your answer under the headings below.

labelled diagram of the apparatus

readings to be taken

one precaution to try to achieve a fair comparison between the various surfaces

.....

.....[3]



- 6 Fig. 6.1 shows a ray of light, from the top of an object PQ, passing through two glass prisms.

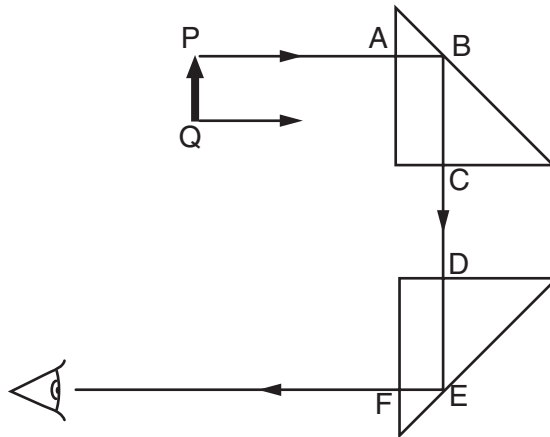


Fig. 6.1

- (a) Complete the path through the two prisms of the ray shown leaving Q. [1]
- (b) A person looking into the lower prism, at the position indicated by the eye symbol, sees an image of PQ.  
State the properties of this image.

.....[2]

- (c) Explain why there is no change in direction of the ray from P at points A, C, D and F.

.....[1]

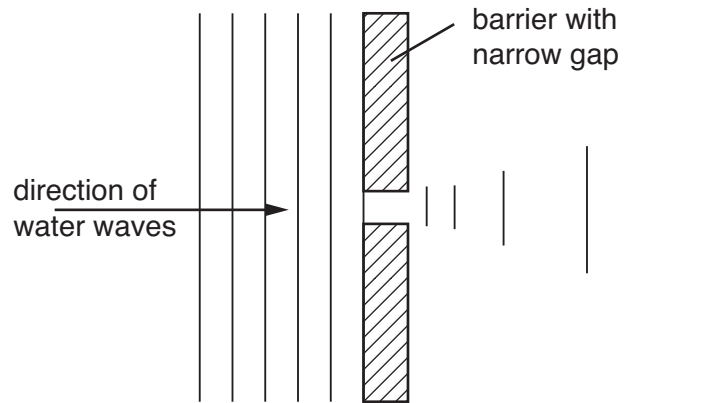
- (d) The speed of light as it travels from P to A is  $3 \times 10^8$  m/s and the refractive index of the prism glass is 1.5.  
Calculate the speed of light in the prism.

speed = .....[2]

- (e) Explain why the ray AB reflects through  $90^\circ$  at B and does not pass out of the prism at B.

.....[2]

- 7 Fig. 7.1 is a drawing of a student's attempt to show the diffraction pattern of water waves that have passed through a narrow gap in a barrier.



**Fig. 7.1**

- (a) State two things that are wrong with the wave pattern shown to the right of the barrier.

1. ....

2. .... [2]

- (b) In the space below, sketch the wave pattern when the gap in the barrier is made five times wider.

[2]

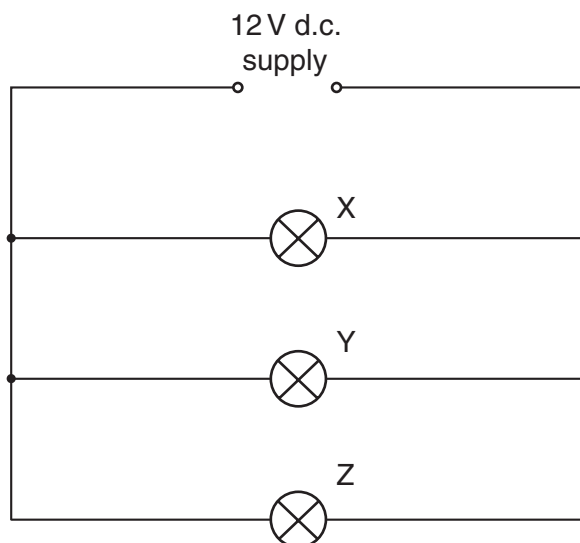
- (c) The waves approaching the barrier have a wavelength of 1.2cm and a frequency of 8.0Hz.

Calculate the speed of the water waves.

speed = ..... [2]

- 8 Fig. 8.1 shows a low-voltage lighting circuit.

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**Fig. 8.1**

- (a) On Fig. 8.1, indicate with a dot and the letter S, a point in the circuit where a switch could be placed that would turn off lamps Y and Z at the same time but would leave lamp X still lit. [1]

- (b) (i) In the space below, draw the circuit symbol for a component that would vary the brightness of lamp X.

- (ii) On Fig. 8.1, mark with a dot and the letter R where this component should be placed. [2]

- (c) Calculate the current in lamp Y.

current = ..... [2]

- (d) The current in lamp Z is 3.0 A. Calculate the resistance of this lamp.

resistance = ..... [2]

- (e) The lamp Y is removed.

- (i) Why do lamps X and Z still work normally?

.....  
.....

- (ii) The current in lamp X is 1.0 A. Calculate the current supplied by the battery with lamp Y removed.

current = ..... [2]

- 9 (a) Fig. 9.1 shows how a beam of electrons would be deflected by an electric field produced between two metal plates. The connections of the source of high potential difference are not shown.

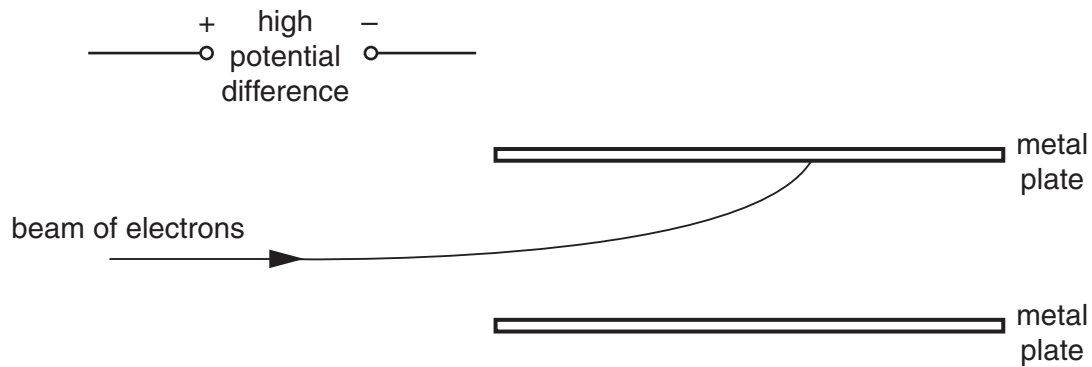


Fig. 9.1

- (i) On Fig. 9.1, draw in the missing connections.
- (ii) Explain why the beam of electrons is deflected in the direction shown. In your answer, consider all the charges involved and their effect on each other.

.....

.....

.....

.....

[5]

- (b) The deflection of a beam of electrons by an electric field is used in cathode-ray oscilloscopes.

- (i) What makes the electron beam move backwards and forwards across the screen?

.....

.....

- (ii) What makes the electron beam move up and down the screen?

.....

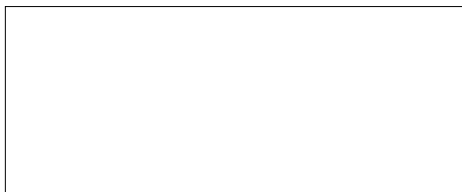
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[2]

- (c) An a.c. waveform is displayed so that two full waves appear on the screen of a cathode-ray oscilloscope.

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Fig. 9.2 shows the face of the oscilloscope. On Fig. 9.2, draw in the waveform.



**Fig. 9.2**

[1]

- 10 Fig. 10.1 shows a circuit that is used to switch on a lamp automatically when it starts to go dark.

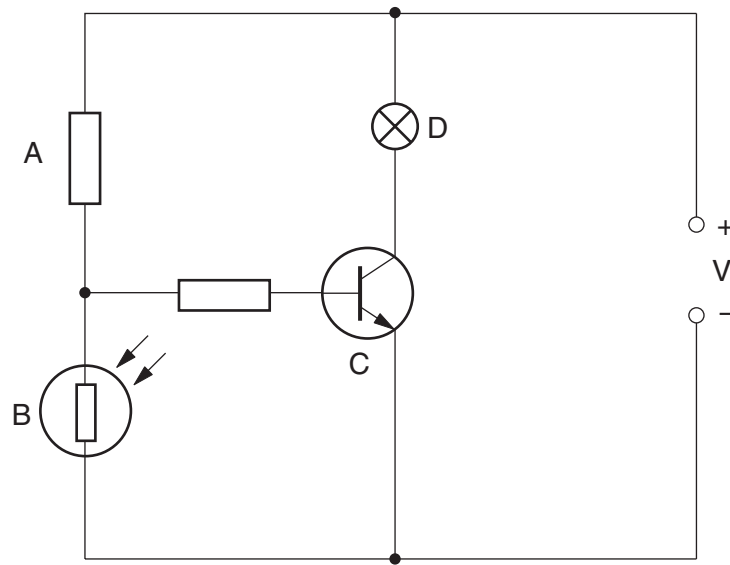


Fig. 10.1

- (a) Write down the names of the components labelled A, B, C and D.

A .....

B .....

C .....

D .....

[2]

- (b) Which of the four components A, B, C or D acts as a switch?

.....[1]

- (c) Explain why the lamp comes on as it goes dark.

.....

.....

.....

.....[3]

**11 (a)**  $\alpha$ -particles,  $\beta$ -particles and  $\gamma$ -rays are known as ionising radiations.

**(i)** Describe what happens when gases are ionised by ionising radiations.

.....

.....

.....

**(ii)** Suggest why  $\alpha$ -particles are considered better ionisers of gas than  $\beta$ -particles.

.....

.....

[3]

**(b) (i)** Suggest two practical applications of radioactive isotopes.

1. ....
2. ....

**(ii)** For one of the applications that you have suggested, describe how it works, or draw a labelled diagram to illustrate it in use.

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[4]

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