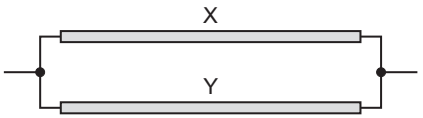
36 Two identical wires X and Y, each of length L and radius r, are connected in parallel as shown.



The total resistance of this combination is R_1.

Wire X is replaced with a wire of the same material with length L and radius $2r$.

The total resistance of the new combination is R_2.

What is the ratio $\frac{R_1}{R_2}$?

A $\frac{2}{5}$ **B** $\frac{2}{3}$ **C** $\frac{3}{2}$ **D** $\frac{5}{2}$

31 There is a potential difference V across a resistor of resistance R. The current in the resistor is I.

Which equation gives the power P dissipated by the resistor?

A $P = V^2I$ **B** $P = \frac{V^2}{I}$ **C** $P = V^2R$ **D** $P = \frac{V^2}{R}$

32 What is a possible charge on a particle?

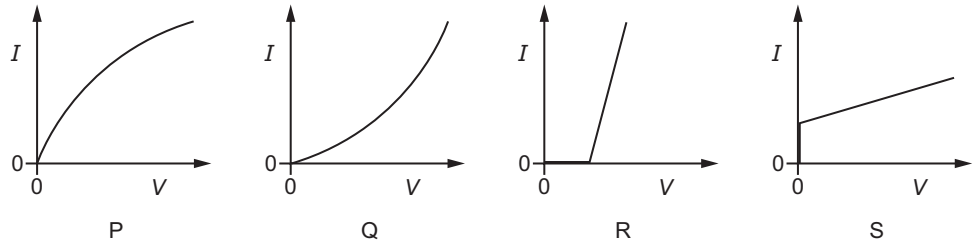
A 6.40×10^{-20} C

B 4.00×10^{-19} C

C 1.12×10^{-18} C

D 9.11×10^{-18} C

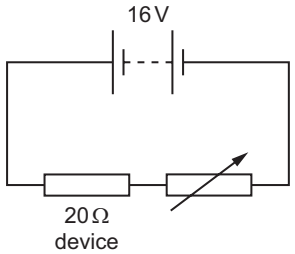
33 The graphs show possible current–voltage (I–V) characteristics for a filament lamp and for a semiconductor diode.



Which row identifies the I–V graphs for the lamp and for the diode?

	filament lamp	semiconductor diode
A	P	R
B	P	S
C	Q	R
D	Q	S

37 An electrical device of fixed resistance 20 Ω is connected in series with a variable resistor and a battery of e.m.f. 16 V and negligible internal resistance.



The power dissipated in the electrical device is 4.0 W.

What is the resistance of the variable resistor?

A 16 Ω **B** 36 Ω **C** 44 Ω **D** 64 Ω

6 A nichrome wire X of length 45 cm and cross-sectional area $4.7 \times 10^{-7}\,m^2$ is connected into the circuit shown in Fig. 6.1.

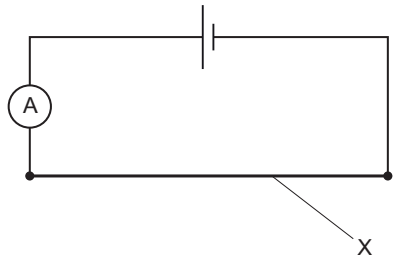


Fig. 6.1

The resistance of X is 1.1 Ω. The cell has electromotive force (e.m.f.) 1.3 V and negligible internal resistance.

(a) (i) Calculate the current in X.

current = ...A [1]

(ii) The number density of charge carriers (electrons) in nichrome is $8.5 \times 10^{28}\,m^{-3}$.

Calculate the average drift speed of the charge carriers in X.

average drift speed = ... $m\,s^{-1}$ [2]

(iii) Calculate the resistivity of the nichrome.

resistivity = ... Ω m [3]

(b) Wire Y is identical to wire X. Wire Y is added to the circuit in parallel with wire X, as shown in Fig. 6.2.

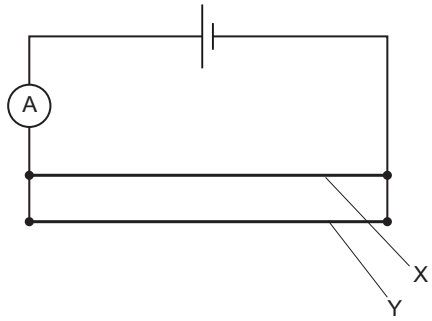


Fig. 6.2

State and explain the effect, if any, of this change on:

(i) the reading on the ammeter

.....

.....

..... [2]

(ii) the average drift speed of the charge carriers in X.

.....

..... [1]

[Total: 9]

1 In this experiment, you will investigate a light-dependent resistor (LDR).

(a) • Connect the circuit shown in Fig. 1.1.

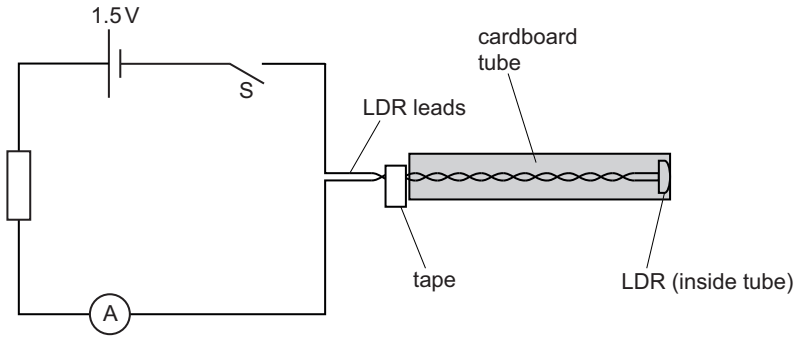


Fig. 1.1

- Ensure that the switch S is open.
- Slide the LDR leads into the tube until the front of the LDR is just level with the open end of the tube, as shown in Fig. 1.1.
- With the LDR in this position, attach a piece of adhesive tape to the leads as a marker at the other end of the tube, as shown in Fig. 1.1.
- Slide the tube until the LDR is approximately half-way along it, as shown in Fig. 1.2.

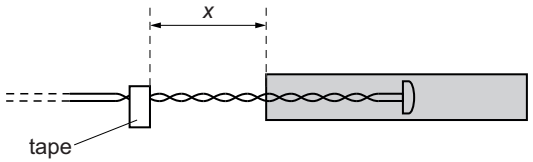


Fig. 1.2

- The distance between the tape and the tube is *x*.

  Measure and record *x*.

  x = ...

- Close S and record the ammeter reading I.

  I = ...

- Open S.

[2]

(b) Change *x* by moving the LDR to a new position inside the tube, with *x* in the range 4 cm to 18 cm. Record *x* and I.

Repeat until you have six sets of values of *x* and I.

Record your results in a table. Include values of $\sqrt{I}$ in your table.

[10]

(c) **(i)** Plot a graph of $\sqrt{I}$ on the *y*-axis against *x* on the *x*-axis. [3]

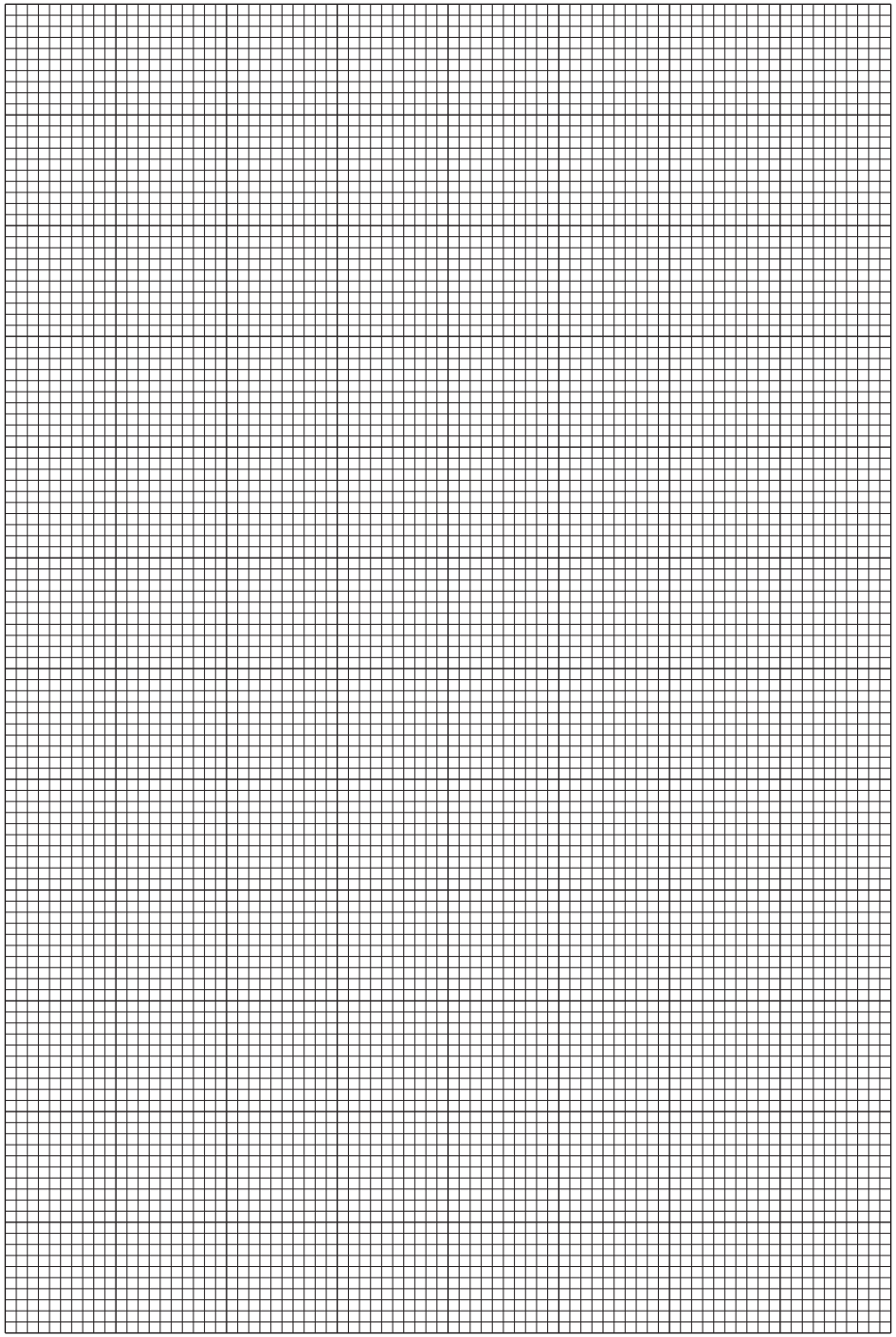
(ii) Draw the straight line of best fit. [1]

(iii) Determine the gradient and *y*-intercept of this line.

gradient = ...

y-intercept = ...

[2]



(d) It is suggested that the quantities I and x are related by the equation

$$\sqrt{I} = ax + b$$

where a and b are constants.

Using your answers in **(c)(iii)**, determine the values of a and b.
Give appropriate units.

a = ...

b = ...
[2]

[Total: 20]

You may not need to use all of the materials provided.