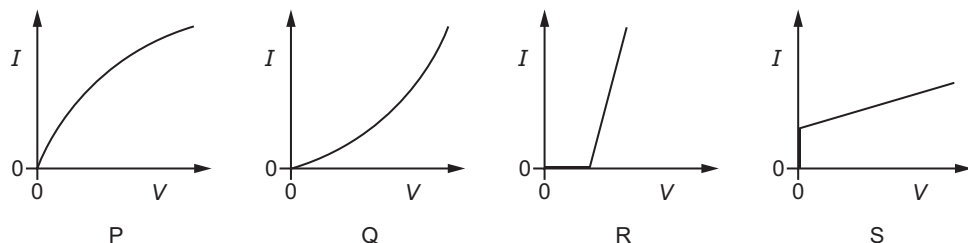


33 The graphs show possible current–voltage (I – V) characteristics for a filament lamp and for a semiconductor diode.



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

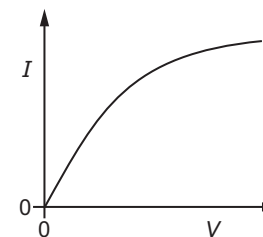
33 A piece of wire X has resistivity ρ , length L and cross-sectional area A . Wire X has a resistance R .

A second piece of wire Y is made of a different metal. It has the same resistance as X but has twice the length of X.

Which row gives possible values for the resistivity and the cross-sectional area of Y?

	resistivity	cross-sectional area
A	$\frac{1}{2}\rho$	$\frac{1}{2}A$
B	$\frac{1}{2}\rho$	A
C	ρ	$\frac{1}{2}A$
D	2ρ	A

32 Which component has the I – V graph shown?



- A** filament lamp
- B** metallic conductor at constant temperature
- C** resistor of fixed resistance
- D** semiconductor diode

34 A copper wire of length 2 m has a circular cross-section. There is a constant current in the wire when it is connected to a mobile phone in order to charge the battery.

The wire has a fault. A 1 m length of the wire has half the diameter of the other 1 m length.

The power dissipated in the thicker length of wire is P .

What is the power dissipated in the thinner length of wire?

- A** $\frac{1}{4}P$
- B** $\frac{1}{2}P$
- C** $2P$
- D** $4P$

5 A student uses a circuit containing an ammeter, a voltmeter and a cell to take measurements to determine the resistance of a length of nichrome wire.

(a) (i) Define resistance.

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

(ii) Draw a circuit diagram to show how the components should be connected. Use the symbol for a resistor to represent the nichrome wire.

[2]

(b) The student also measures the length and the diameter of the wire. Table 5.1 shows the measurements recorded for each quantity.

Table 5.1

quantity	measurement
length	(0.864 ± 0.001) m
diameter	(0.496 ± 0.002) mm
voltmeter reading	(1.38 ± 0.02) V
ammeter reading	(0.276 ± 0.001) A

(i) Show that the resistance of the wire is 5.00 Ω.

[1]

(ii) Calculate, to three significant figures, the resistivity ρ of the nichrome.

$\rho =$ $\Omega \text{ m}$ [3]

(iii) Calculate the percentage uncertainty in ρ .

percentage uncertainty = % [2]

(iv) Determine the absolute uncertainty in ρ .

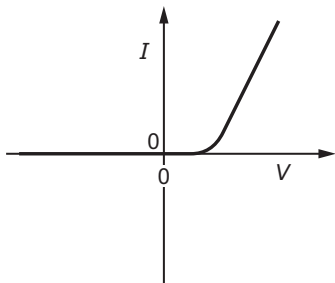
absolute uncertainty = $\Omega \text{ m}$ [1]

[Total: 10]

32 Which expression gives the definition of resistance?

- A current divided by potential difference
- B current multiplied by potential difference
- C potential difference divided by current
- D resistivity multiplied by length

33 The graph shows the I - V characteristic of an electrical component.

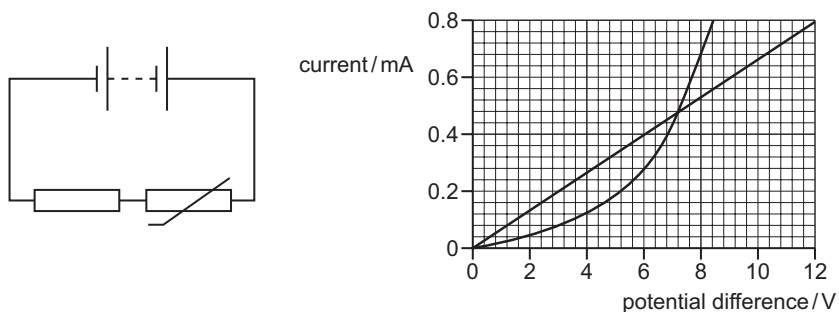


What is the component?

- A a filament lamp
- B a metallic conductor at constant temperature
- C a resistor
- D a semiconductor diode

35 The diagram shows a circuit containing a thermistor, a fixed resistor and a battery.

The graph shows the I - V characteristics of both components.

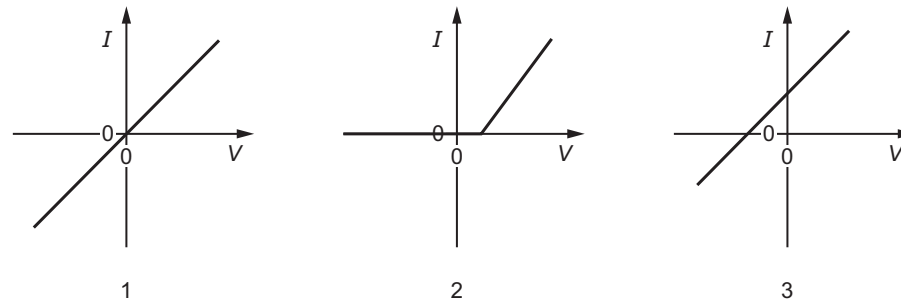


The battery has an e.m.f. of 12V and negligible internal resistance.

What is the current in the fixed resistor?

- A 0.36 mA
- B 0.40 mA
- C 0.48 mA
- D 0.80 mA

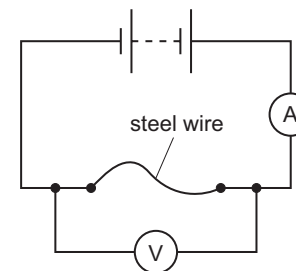
33 The I - V characteristics for three electrical components are shown.



Which components obey Ohm's law?

- A 1, 2 and 3
- B 1 and 2 only
- C 1 and 3 only
- D 1 only

34 A steel wire with a length of 2.20 m is connected to a battery as shown.



The reading on the voltmeter is 1.50 V and the reading on the ammeter is 4.90 A.

The resistivity of steel is $6.90 \times 10^{-7} \Omega \text{ m}$.

What is the diameter of the steel wire?

- A $1.76 \times 10^{-4} \text{ m}$
- B $3.52 \times 10^{-4} \text{ m}$
- C $1.26 \times 10^{-3} \text{ m}$
- D $2.51 \times 10^{-3} \text{ m}$

- 7 A nichrome resistance wire has length 150 cm, cross-sectional area $2.45 \times 10^{-7} \text{ m}^2$ and resistivity $1.12 \times 10^{-6} \Omega \text{ m}$.

(a) Calculate, to three significant figures, the resistance of the wire.

resistance = Ω [3]

- (b) The nichrome wire forms part of a potentiometer circuit together with a cell of electromotive force (e.m.f.) 1.2 V and negligible internal resistance, as shown in Fig. 7.1.

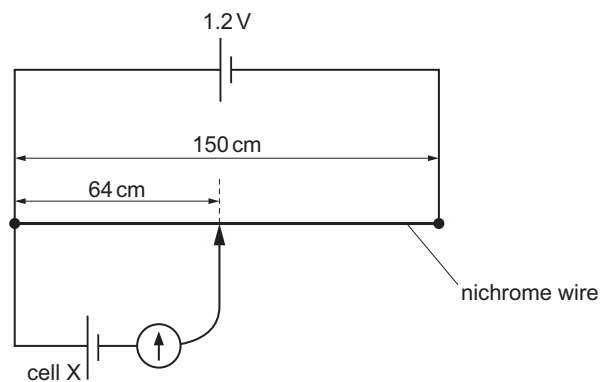


Fig. 7.1 (not to scale)

The circuit is used to determine the e.m.f. of cell X.

The galvanometer is used in a null method to find the null point 64 cm from the left-hand end of the nichrome wire.

- (i) Explain what is meant by a null method.

.....
 [1]

- (ii) Calculate the e.m.f. of cell X.

e.m.f. = V [2]

- (iii) The cell of e.m.f. 1.2 V is replaced by a new cell with the same e.m.f. but with an internal resistance that is **not** negligible.

State and explain the effect, if any, of the internal resistance of the new cell on the position of the null point.

.....

 [2]

[Total: 8]

- 5 (a) (i) State and explain the effect, if any, on the resistance of a filament wire in a lamp as the current in the wire decreases.

.....
 [1]

- (ii) On Fig. 5.1, sketch the I - V characteristic of a filament lamp.

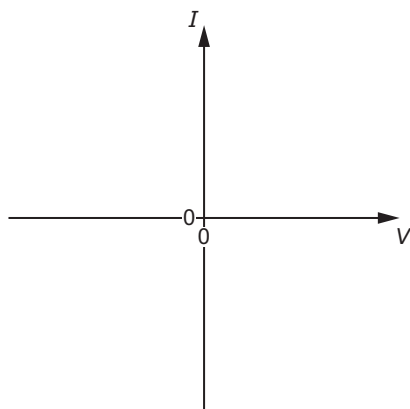


Fig. 5.1

[2]

- (b) A battery of electromotive force (e.m.f.) E and negligible internal resistance is connected in parallel with two filament lamps A and B, as shown in Fig. 5.2.

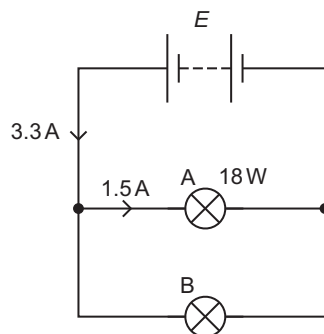


Fig. 5.2

The current in the battery is 3.3 A and the current in lamp A is 1.5 A. The power dissipated in lamp A is 18 W.

- (i) Calculate the e.m.f. E of the battery.

$E = \dots\dots\dots$ V [2]

- (ii) The filament wire of lamp B has a cross-sectional area of $1.4 \times 10^{-9} \text{ m}^2$. The number of free (conduction) electrons per unit volume in the metal of the filament wire is $3.4 \times 10^{28} \text{ m}^{-3}$.

Calculate the average drift speed of the free electrons in the filament wire of lamp B.

average drift speed = $\dots\dots\dots$ ms^{-1} [3]

[Total: 8]