

0 6

A battery has an emf of 5.30 V and negligible internal resistance.

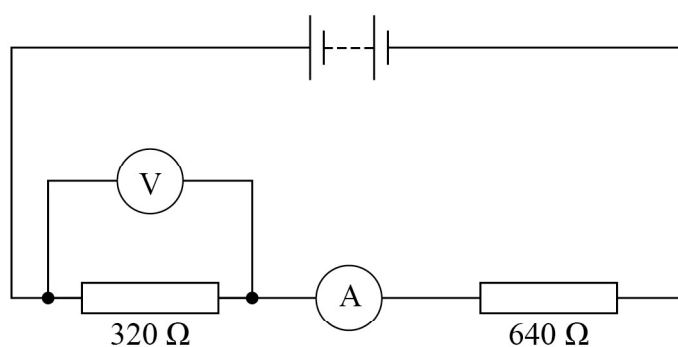
0 6 . 1

State what is meant by an emf of 5.30 V for this battery.

[2 marks]

0 6 . 2

Figure 13 shows the battery connected into a circuit.

Figure 13

The ammeter is ideal.

The voltmeter is non-ideal and has a resistance R .

The reading on the voltmeter is 1.05 V when it is connected across the 320 Ω resistor.

Show that the reading on the ammeter is approximately 7 mA.

[2 marks]

0 6 . 3 Show that the resistance R of the voltmeter is approximately 300Ω .

[3 marks]

0 6 . 4 The voltmeter is now connected across the battery terminals.

Calculate the power dissipated in the voltmeter.

[2 marks]

power = _____ W

Question 6 continues on the next page

Turn over ►



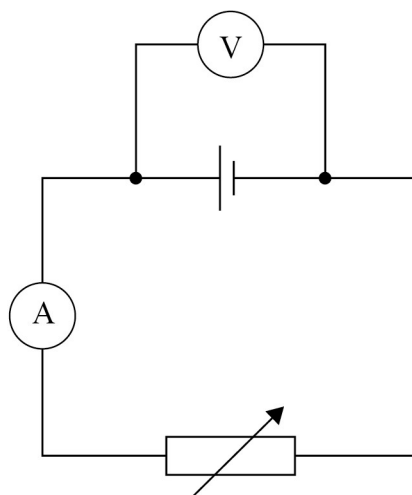
1 9 In a Young's double-slit experiment, monochromatic light is incident on two narrow slits and the resulting interference pattern is observed on a screen.

Which change **decreases** the fringe separation?

[1 mark]

- A** decreasing the separation between the two slits
- B** increasing the distance between the slits and the screen
- C** using monochromatic light of higher frequency
- D** using monochromatic light of longer wavelength

2 0 In the circuit shown, the cell has an emf of 12 V and an internal resistance which is not negligible.



When the resistance of the variable resistor is $10\ \Omega$ the voltmeter reads 10 V and the ammeter reads 1.0 A.

The resistance of the variable resistor is changed to $5\ \Omega$.

What is the new reading on the ammeter?

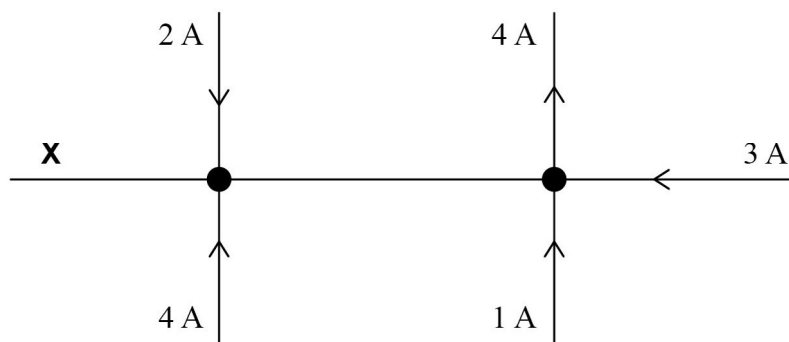
[1 mark]

- A** 1.4 A
- B** 1.7 A
- C** 2.0 A
- D** 2.4 A

Turn over ►



2 9 The diagram shows the currents in a set of wires.

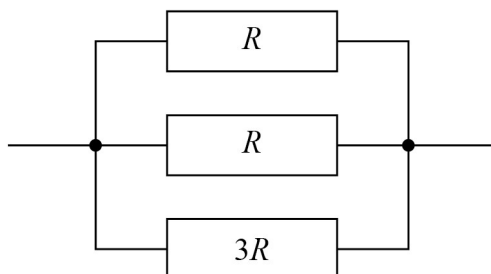


What is the magnitude of the current at X?

[1 mark]

- A zero
- B 2 A
- C 3 A
- D 6 A

3 0 Resistors of resistance R , R and $3R$ are connected as shown.



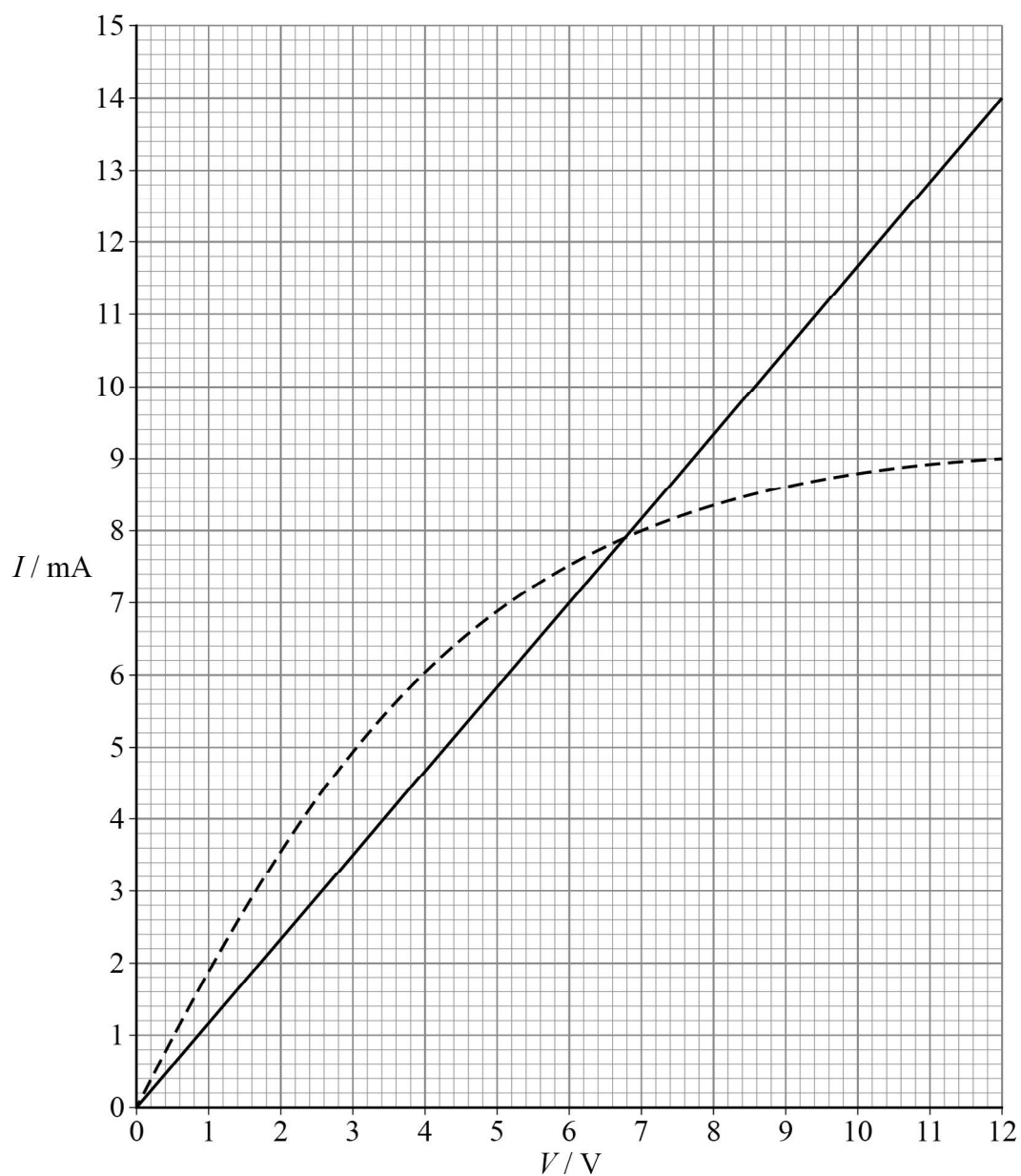
What is the resistance of the arrangement?

[1 mark]

- A $\frac{3R}{7}$
- B $\frac{7R}{3}$
- C $\frac{5R}{6}$
- D $\frac{6R}{5}$



3 1 The graph shows the current–voltage (I – V) characteristics for two components.



The two components are connected in parallel with a 12 V battery that has negligible internal resistance.

What is the current in the battery?

[1 mark]

- A** 7.9 mA
- B** 14.5 mA
- C** 15.8 mA
- D** 23.0 mA

Turn over ►



3 3

Measurements are taken to determine the resistivity of a uniform metal wire. The table shows the quantities measured and their percentage uncertainties.

Quantity	Percentage uncertainty
potential difference across wire	0.3%
current in wire	5.0%
diameter of wire	4.0%
length of wire	0.2%

What is the percentage uncertainty in the calculated value for the resistivity of the metal of the wire?

[1 mark]

A 1.6%

B 9.5%

C 13.5%

D 21.5%

3 4

Superconductors are used to

[1 mark]

A increase the strength of electricity cables.

B make light dependent resistors.

C produce strong magnetic fields.

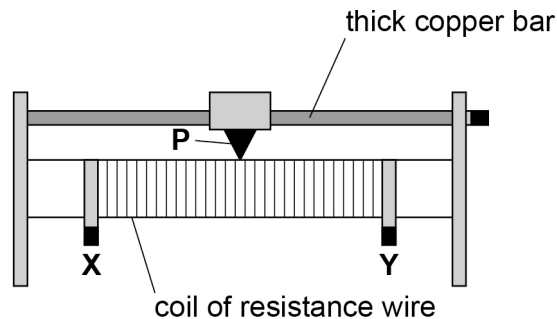
D increase the rate of heat energy transfer.

Turn over for the next question

Turn over ►

0 8

Figure 11 shows a variable resistor that has a maximum resistance of 25Ω . A sliding contact **P** is mounted on a thick copper bar. **P** can be set to any position between **X** and **Y**.

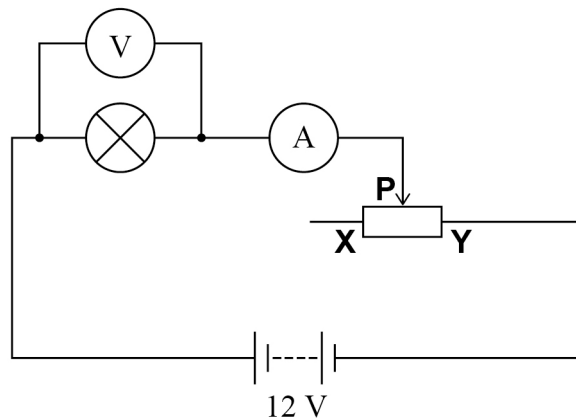
Figure 11

0 8 . 1

Figure 12 shows the variable resistor being used to investigate the variation of current with voltage for a filament lamp.

The normal operating voltage of the lamp is 12 V .

The 12 V battery has negligible internal resistance.

Figure 12

The position of **P** is adjusted so that the reading on the voltmeter is at its minimum value of 0.75 V .

Calculate the resistance of the lamp when the voltmeter reading is 0.75 V .

[2 marks]

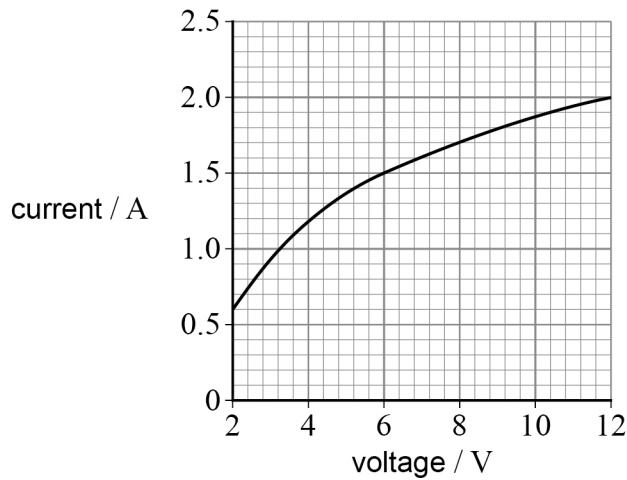
resistance = _____ Ω



0 8 . 2

Figure 13 shows the variation of current with voltage for the lamp between 2 V and 12 V.

Figure 13



Calculate the resistance of the lamp when the voltage across the lamp is 8.0 V.

[2 marks]

resistance = _____ Ω

0 8 . 3

Explain, in terms of electron movement, why the resistance of the filament lamp changes as the voltage changes as shown in **Figure 13**.

[3 marks]

Question 8 continues on the next page

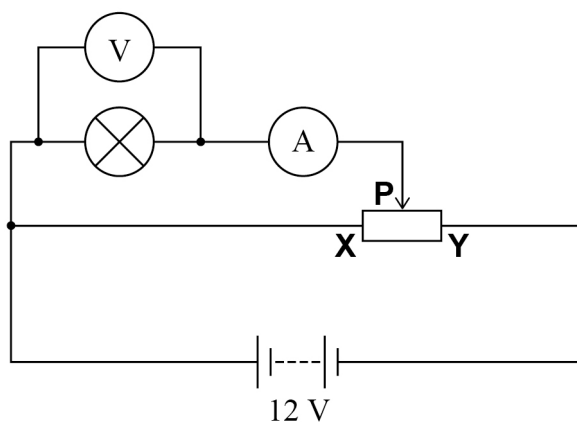
Turn over ►



0 8 . 4

Figure 14 shows an alternative circuit used to investigate the variation of current with voltage for the lamp.

Figure 14



The circuit components are the same as in **Figure 12**.
When the voltage across the lamp is 12 V its resistance is 6.0 Ω .

P is moved to position **Y**.

Calculate the total resistance of the circuit.

[2 marks]

total resistance = _____ Ω

0 8 . 5

Calculate the power transferred by the battery when **P** is at position **Y**.

[2 marks]

power = _____ W



0 8 . 6

A student wants to control the brightness of the lamp.

He gives two reasons why the circuit in **Figure 14** is better than the circuit in **Figure 12** for controlling the brightness. The two reasons are:

- the **Figure 14** circuit can achieve a greater range of voltages across the lamp
- the **Figure 14** circuit is more efficient at transferring energy to the lamp.

Discuss, without calculation, whether either of these two reasons is correct.

[3 marks]

14

END OF QUESTIONS

