

5 A student is deriving an equation for the total resistance of resistors in series.

She writes the following steps but does not justify them.

Step 1 $V = V_1 + V_2$

Step 2 *but* $V = IR$

Step 3 *so* $IR = I_1R_1 + I_2R_2$

Step 4 *but* $I = I_1 = I_2$

Step 5 *Therefore* $R = R_1 + R_2$

Which step is justified using conservation of charge?

- A Step 1
- B Step 2
- C Step 3
- D Step 4

(Total for Question 5 = 1 mark)



- 7 A series circuit consists of two resistors with resistances R_1 and R_2 and a battery of potential difference V .

Which of the following gives the potential difference across the resistor with resistance R_2 ?

- A $\frac{R_1}{R_2} V$
- B $\frac{R_2}{R_1} V$
- C $\frac{R_1}{R_1 + R_2} V$
- D $\frac{R_2}{R_1 + R_2} V$

(Total for Question 7 = 1 mark)

- 8 A light dependent resistor and a negative temperature coefficient thermistor are connected in series.

Which of the following combinations of illumination and temperature will result in the highest combined resistance?

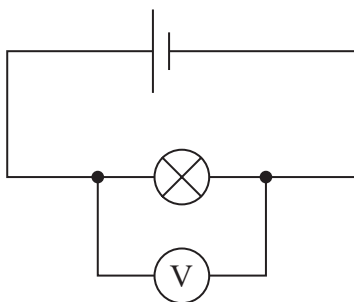
- A dark and cold
- B dark and hot
- C light and cold
- D light and hot

(Total for Question 8 = 1 mark)



9 A torch uses a 1.5 V dry cell. Over time, the light intensity produced by the torch decreases as the cell 'goes flat'.

(a) Student A sets up the following circuit in an attempt to measure the e.m.f. of a cell.



Explain why the voltmeter reading will **not** be the e.m.f. of the cell.

(2)

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(b) Student B correctly determined the e.m.f. of an unused cell as 1.63 V and its internal resistance as 1.15 Ω .

He repeated this after the cell had been used for several weeks. When a voltmeter was connected directly across the used cell, the reading was 1.36 V.

A bulb of resistance 5.92 Ω was then connected across the used cell and the reading fell to 0.84 V.

Student A suggests that the cell goes flat as it is used because the e.m.f. decreases.

Student B suggests it is because the internal resistance increases.

Determine whether either student is correct about the changes in the cell as it goes flat.

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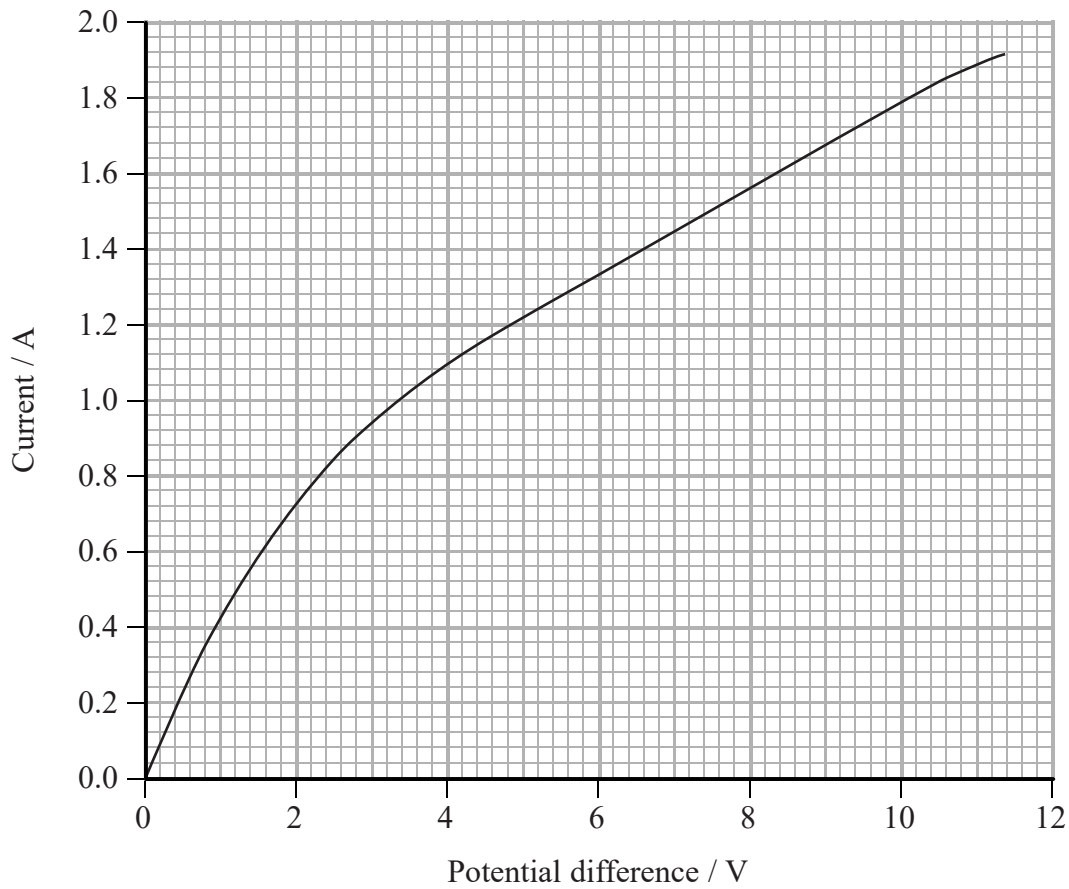
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(Total for Question 9 = 7 marks)



- 14 The graph shows how the current through a filament bulb varies with the potential difference across the bulb.



- (a) Determine the resistance of the filament bulb when the potential difference is 7.0 V.

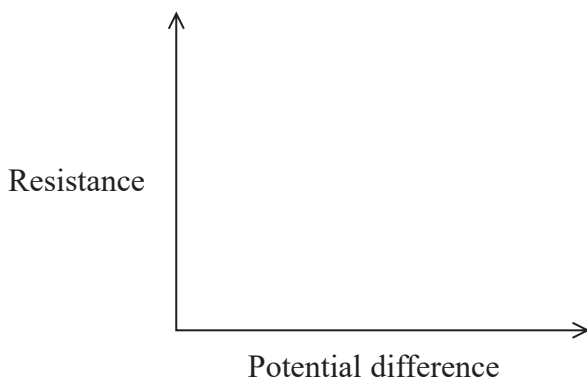
(2)

Resistance =



(b) Sketch a graph of resistance against potential difference for the filament bulb over the range 0 V to 7 V.

(3)



*(c) Explain the variation of resistance with potential difference for the filament bulb in terms of particle behaviour.

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(Total for Question 14 = 11 marks)

TOTAL FOR SECTION A = 56 MARKS

