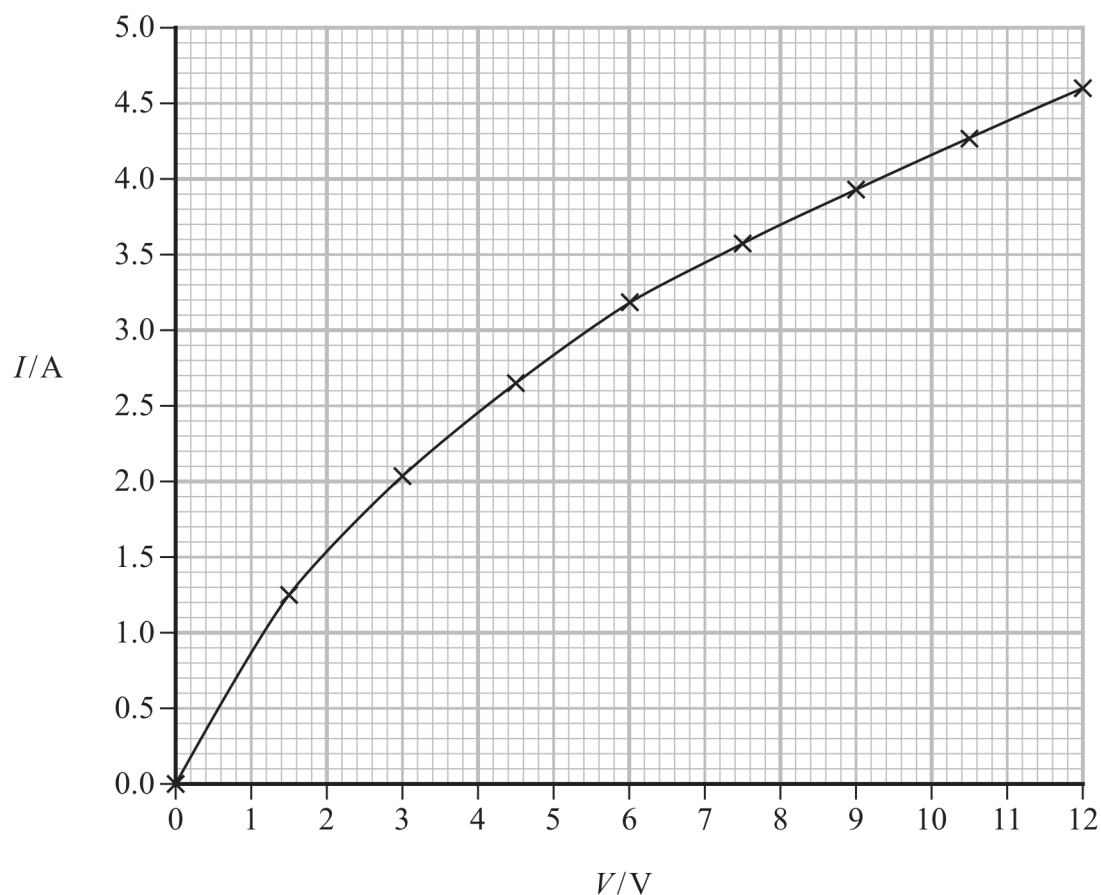


16 Drivers use car headlights to emit light in dark conditions.

The graph shows how current I varies with potential difference V for a car headlight.



The headlight will emit light when it dissipates at least 35 W of power.

(a) Determine the minimum potential difference for which the headlight will emit light.

(3)

Minimum potential difference = V



(b) In a car, two headlights are connected in parallel with a 12.0V battery. The battery has negligible internal resistance.

- (i) Explain the advantages of connecting the headlights in parallel with the battery rather than in series.

(3)

- (ii) A student writes the following statement.

When connected to the 12.0V battery, the combined resistance of two headlights in parallel is one quarter of the combined resistance of two headlights in series.

Deduce whether the student is correct.

Your answer should include calculations using data from the graph.

(3)



- (c) The headlights are connected in the circuit using copper wire. The current in the wire is 4.60 A.

Calculate the drift velocity of electrons in the copper wire.

number of charge carriers per m^3 of copper = $8.49 \times 10^{28} \text{ m}^{-3}$

resistivity of copper = $1.72 \times 10^{-8} \Omega \text{ m}$

resistance per unit length of the copper wire = $1.75 \times 10^{-2} \Omega \text{ m}^{-1}$

(3)

Drift velocity =

(Total for Question 16 = 12 marks)