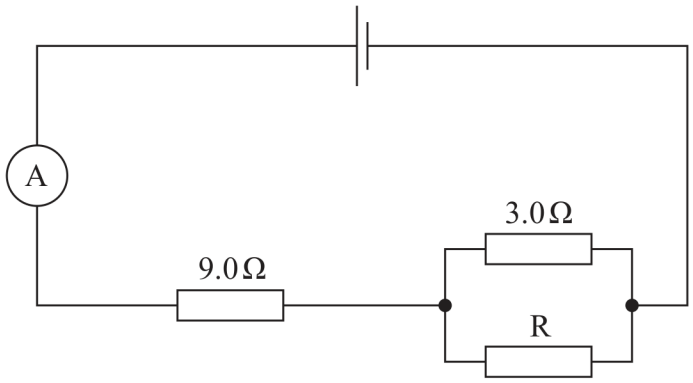
13 A student sets up the circuit shown with a cell of negligible internal resistance.

The ammeter displays a current of 0.14 A.



(a) Calculate a value for the resistance of the resistor R.

e.m.f. of the cell = 1.54 V

(4)

Resistance = ...

(b) The student made the 9.0 Ω resistor using a thin copper wire with a diameter of 0.15 mm.

(i) Show that the cross-sectional area of this wire was about $2 \times 10^{-8}\,m^2$.

(2)

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(ii) Calculate the length of copper wire used by the student.

resistivity of copper = $1.68 \times 10^{-8}\,\Omega m$

(2)

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Length of copper wire = ...

(iii) Calculate the drift velocity of the electrons in this copper wire.

number of charge carriers per unit volume = $8.49 \times 10^{28}\,m^{-3}$
current in copper wire = 0.14 A

(2)

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Drift velocity = ...

(Total for Question 13 = 10 marks)