5 **(a)** State Kirchhoff's second law.

.....

.....

..... [2]

(b) Three identical cells, each of electromotive force (e.m.f.) 1.5 V and internal resistance 590 mΩ, are connected in parallel across a conductor, as shown in Fig. 5.1.

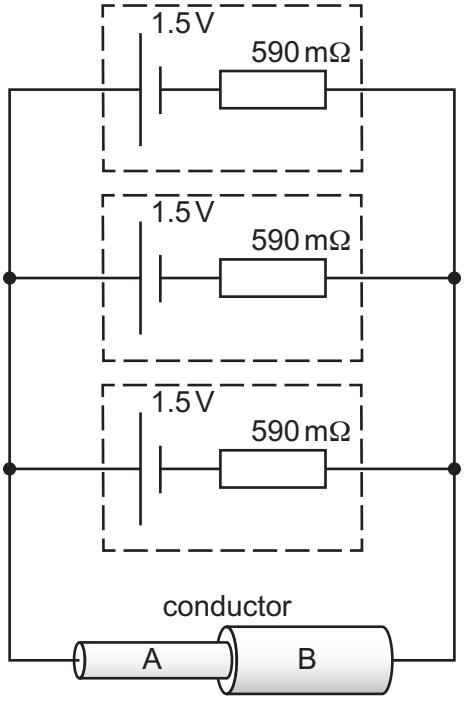

Fig. 5.1

The conductor is composed of two cylindrical sections A and B.
The total resistance of the circuit is 2.2 Ω.

(i) Show that the resistance of the conductor is 2.0 Ω.

[2]

(ii) Calculate the current in the conductor.

current = ... A [2]

(c) The two cylindrical sections A and B of the conductor in Fig. 5.1 are made from the same material and have the same length.
The diameter of section A is 4.3 mm and the diameter of section B is 7.6 mm.
The resistance of section A is R_A and the resistance of section B is R_B.

(i) Calculate the ratio $\frac{R_A}{R_B}$.

$\frac{R_A}{R_B}$ = ... [3]

(ii) Calculate the ratio

$$\frac{\text{average drift speed of free electrons in section A}}{\text{average drift speed of free electrons in section B}}.$$

Explain your reasoning.

ratio = ... [2]

(d) The circuit of Fig. 5.1 is altered by removing one of the cells.

State and explain the effect, if any, of this change on the potential difference across the conductor.

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..... [3]