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5 **(a)** A variable resistor is used to control the current in a circuit, as shown in Fig. 5.1.

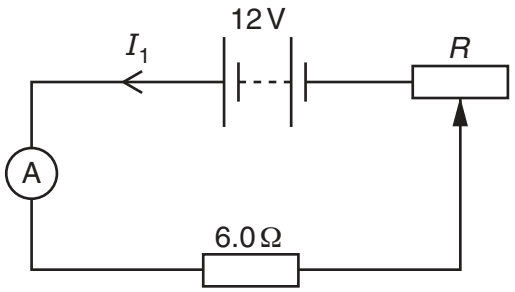


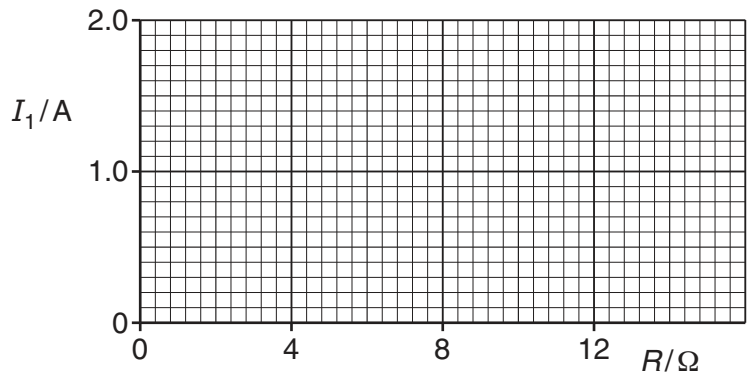
Fig. 5.1

The variable resistor is connected in series with a 12 V power supply of negligible internal resistance, an ammeter and a 6.0 Ω resistor. The resistance R of the variable resistor can be varied between 0 and 12 Ω.

(i) The maximum possible current in the circuit is 2.0 A. Calculate the minimum possible current.

minimum current = ... A [2]

(ii) On Fig. 5.2, sketch the variation with R of current I_1 in the circuit.



[2]

Fig. 5.2

(b) The variable resistor in **(a)** is now connected as a potential divider, as shown in Fig. 5.3.

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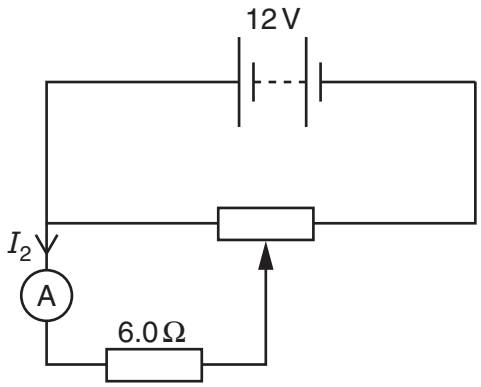


Fig. 5.3

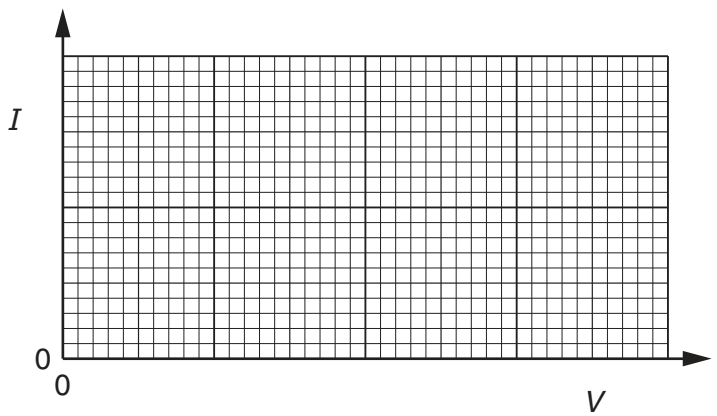
Calculate the maximum possible and minimum possible current I_2 in the ammeter.

maximum I_2 = ... A

minimum I_2 = ... A

[2]

(c) **(i)** Sketch on Fig. 5.4 the $I - V$ characteristic of a filament lamp.



[2]

Fig. 5.4

(ii) The resistor of resistance 6.0 Ω is replaced with a filament lamp in the circuits of Fig. 5.1 and Fig. 5.3. State an advantage of using the circuit of Fig. 5.3, compared to the circuit of Fig 5.1, when using the circuits to vary the brightness of the filament lamp.

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