

- 6 (a) A battery of electromotive force (e.m.f.) 7.8 V and internal resistance r is connected to a filament lamp, as shown in Fig. 6.1.

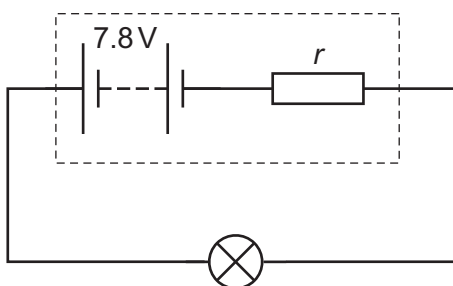


Fig. 6.1

A total charge of 750 C moves through the battery in a time interval of 1500 s . During this time the filament lamp dissipates 5.7 kJ of energy. The e.m.f. of the battery remains constant.

- (i) Explain, in terms of energy and without a calculation, why the potential difference across the lamp must be less than the e.m.f. of the battery.

.....
 [1]

- (ii) Calculate:

1. the current in the circuit

current = A [2]

2. the potential difference across the lamp

potential difference = V [2]

3. the internal resistance of the battery.

internal resistance = Ω [2]

(b) A student is provided with three resistors of resistances $90\,\Omega$, $45\,\Omega$ and $20\,\Omega$.

- (i) Sketch a circuit diagram showing how **two** of these three resistors may be connected together to give a combined resistance of $30\,\Omega$ between the terminals shown. Label the values of the resistances on your diagram.



[1]

- (ii) A potential divider circuit is produced by connecting the three resistors to a battery of e.m.f. 9.0 V and negligible internal resistance. The potential divider circuit provides an output potential difference V_{OUT} of 3.6 V . The circuit diagram is shown in Fig. 6.2.

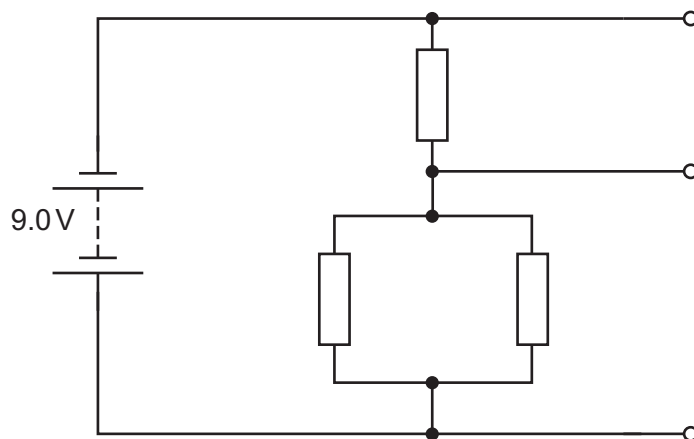


Fig. 6.2

On Fig. 6.2, label the resistances of all three resistors and the potential difference V_{OUT} .

[2]

[Total: 10]