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

.....

.....

.....

.....[2]

(b) A battery is connected in parallel with two lamps A and B, as shown in Fig. 5.1.

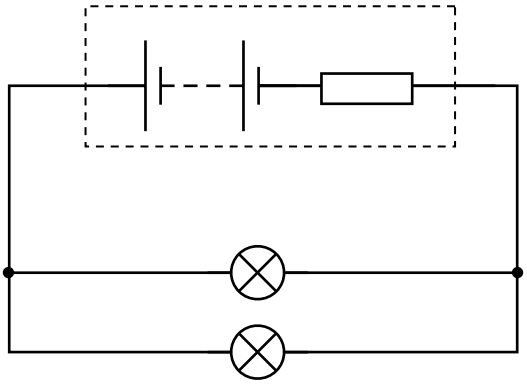

Fig. 5.1

The battery has electromotive force (e.m.f.) 6.8 V and internal resistance *r*.

The *I*–*V* characteristics of lamps A and B are shown in Fig. 5.2.

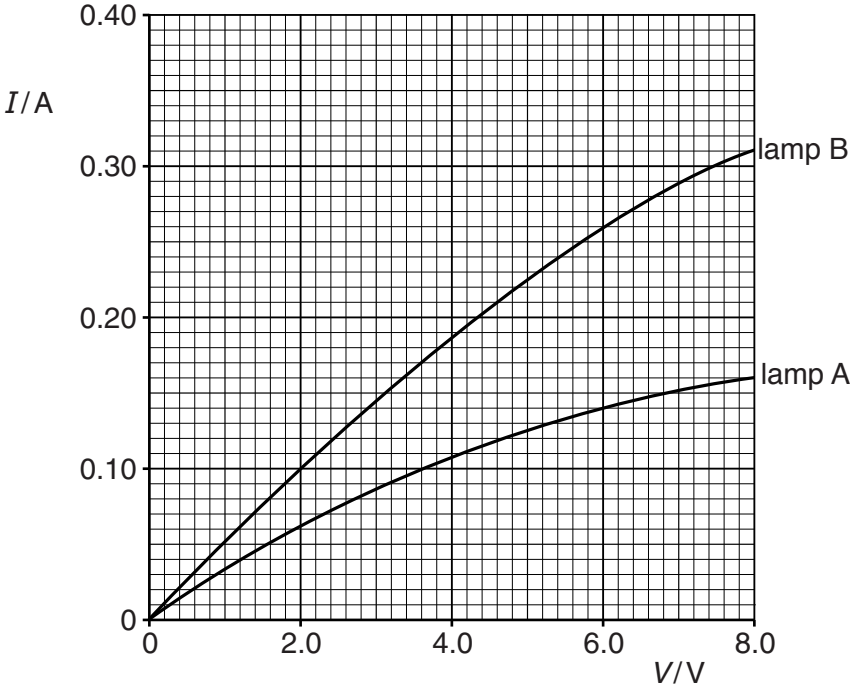

Fig. 5.2

The potential difference across the battery terminals is 6.0 V.

(i) Fig. 5.2 to show that the current in the battery is 0.40 A.

[2]

(ii) Calculate the internal resistance r of the battery.

r = ... Ω [2]

(iii) Determine the ratio

$$\frac{\text{resistance of lamp A}}{\text{resistance of lamp B}}.$$

ratio = ... [2]

(iv) Determine

1. the total power produced by the battery,

power = ... W [2]

2. the efficiency of the battery in the circuit.

efficiency = ... [2]

[Total: 12]