5 **(a)** Explain why the terminal potential difference (p.d.) of a cell with internal resistance may be less than the electromotive force (e.m.f.) of the cell.

.....

.....

.....[2]

(b) A battery of e.m.f. 4.5 V and internal resistance r is connected in series with a resistor of resistance 6.0 Ω, as shown in Fig. 5.1.

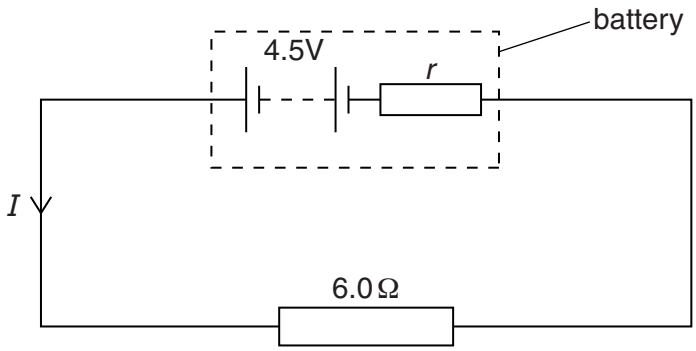

Fig. 5.1

The current I in the circuit is 0.65 A.

Determine

(i) the internal resistance r of the battery,

r = ... Ω [2]

(ii) the terminal p.d. of the battery,

p.d. = ... V [2]

(iii) the power dissipated in the resistor,

power = ... W [2]

(iv) the efficiency of the battery.

efficiency = ... [2]

(c) A second resistor of resistance 20 Ω is connected in parallel with the 6.0 Ω resistor in Fig. 5.1.

Describe and explain qualitatively the change in the heating effect within the battery.

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.....

.....

.....[3]