For Examiner's Use

2 A battery of e.m.f. E and internal resistance r is connected to a variable resistor, as shown in Fig. 2.1.

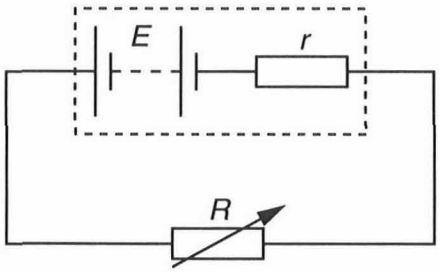

Fig. 2.1

The total power produced in the battery is P_T. The power dissipated in the variable resistor is P_R.

The variations of P_T and of P_R with resistance R of the variable resistor are shown in Fig. 2.2.

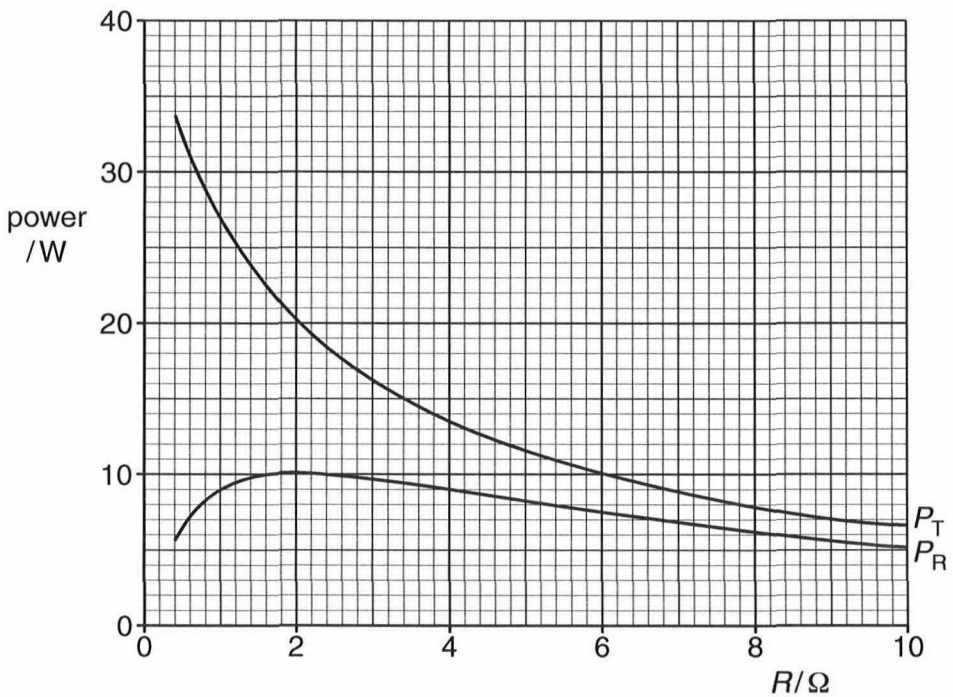

Fig. 2.2

(a) For resistance $R = 4.0\,\Omega$, use Fig. 2.2

(i) to show that the current in the circuit is 1.5 A,

[2]

(ii) to determine the e.m.f. E of the battery.

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E = ... V [2]

(b) For any value of R, the value of P_T is greater than that of P_R.

(i) Suggest what is represented by the quantity $(P_T - P_R)$.

.....

..... [1]

(ii) Use the values of P_T and P_R at $R = 4.0\,\Omega$ and your answer to **(a)(i)** to determine the internal resistance r of the battery.

r = ... Ω [2]

(c) **(i)** Use Fig. 2.2 to state the value of R at which P_R is maximum.

R = ... Ω [1]

(ii) For the value of R stated in **(i)**, determine the efficiency of power transfer from the battery to the variable resistor.

efficiency = ... % [1]

(iii) State how the efficiency of power transfer changes for values of R between 4 Ω and 10 Ω.

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..... [1]