6 A cell has electromotive force (e.m.f.) *E* and internal resistance *r*. It is connected in series with a variable resistor R, as shown in Fig. 6.1.

For Examiner's Use

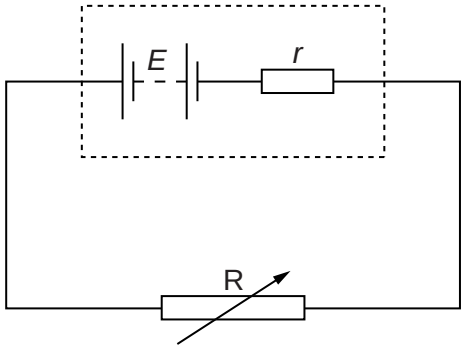

Fig. 6.1

(a) Define electromotive force (e.m.f.).

.....

.....

..... [2]

(b) The variable resistor R has resistance *X*. Show that

$$\frac{\text{power dissipated in resistor R}}{\text{power produced in cell}} = \frac{X}{X + r}.$$

[3]

(c) The variation with resistance X of the power P_R dissipated in R is shown in Fig. 6.2.

For Examiner's Use

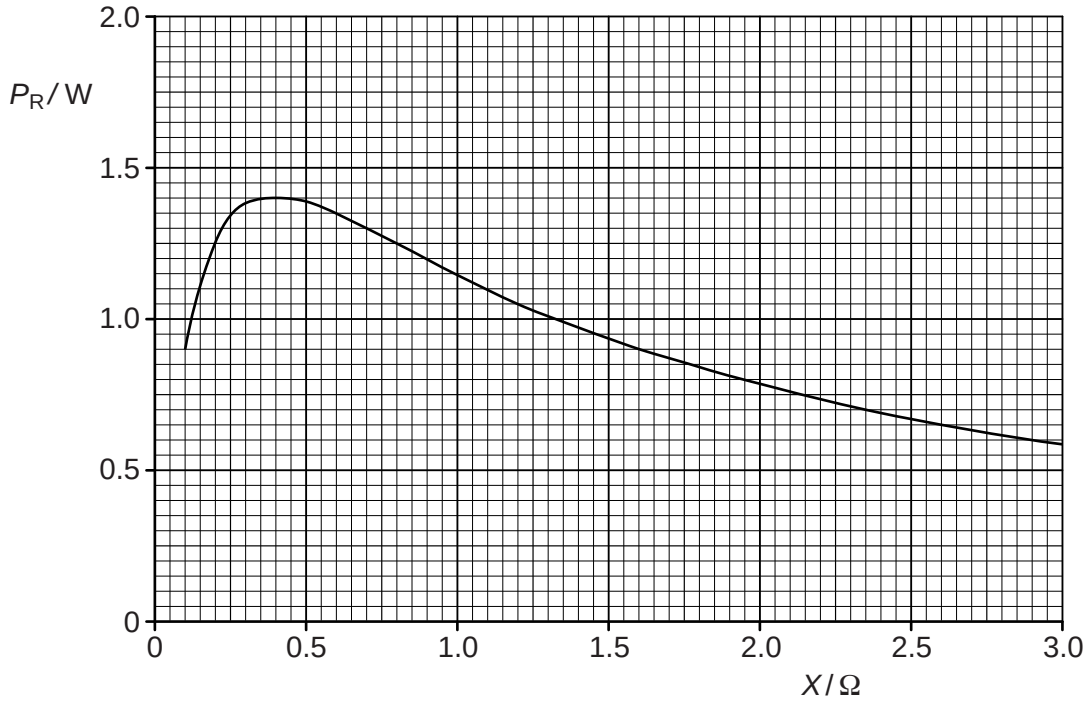

Fig. 6.2

(i) Use Fig. 6.2 to state, for maximum power dissipation in resistor R, the magnitude of this power and the resistance of R.

maximum power = ... W

resistance = ... Ω
[2]

(ii) The cell has e.m.f. 1.5V.
Use your answers in **(i)** to calculate the internal resistance of the cell.

internal resistance = ... Ω [3]

(d) In Fig. 6.2, it can be seen that, for larger values of X, the power dissipation decreases.
Use the relationship in **(b)** to suggest one advantage, despite the lower power output, of using the cell in a circuit where the resistance X is larger than the internal resistance of the cell.

.....

..... [1]