7 A varying current I passes through a resistor of resistance R in the circuit shown in Fig. 7.1.

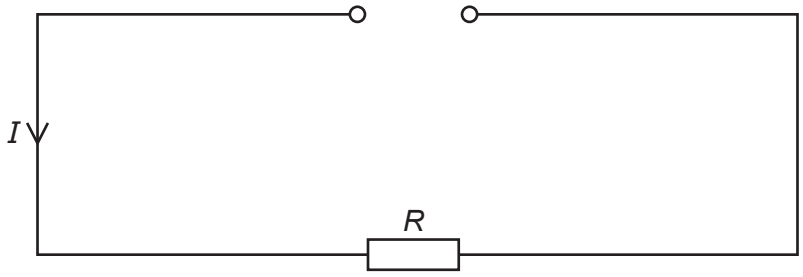

Fig. 7.1

Fig. 7.2 shows the variation with time t of I.

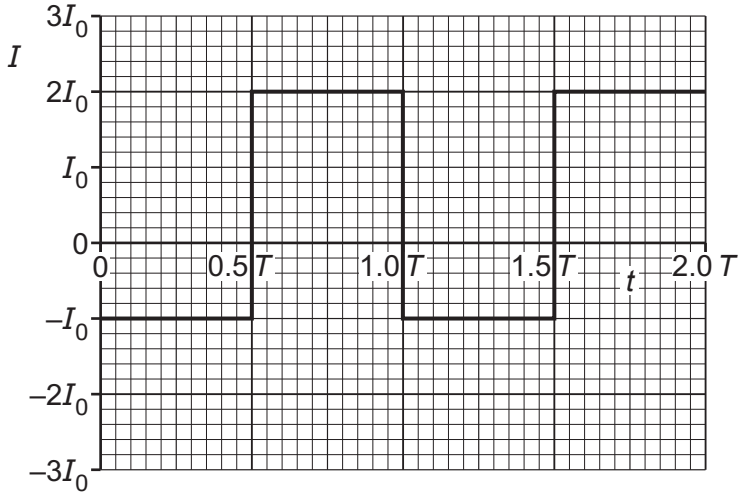

Fig. 7.2

The current has magnitude $2I_0$ when it is in the positive direction and I_0 when it is in the negative direction. The period of the variation of the current is T.

(a) Determine expressions, in terms of I_0 and R, for the power P dissipated in the resistor for the times when:

(i) the current is in the negative direction

P = ... [1]

(ii) the current is in the positive direction.

P = ... [1]

(b) On Fig. 7.3, sketch the variation of P with t between $t = 0$ and $t = 2.0T$. Label the power axis with an appropriate scale.

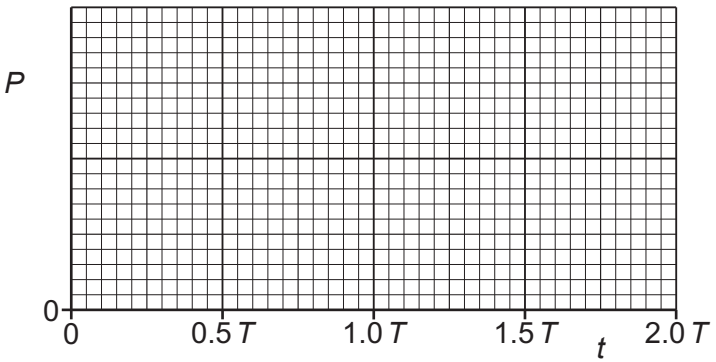

Fig. 7.3

[3]

(c) Use your answer in **(b)** to determine an expression, in terms of I_0 and R, for:

(i) the mean power $\langle P \rangle$ in the resistor

$\langle P \rangle$ = ... [1]

(ii) the root-mean-square (r.m.s.) current $I_{\text{r.m.s.}}$ in the resistor.

$I_{\text{r.m.s.}}$ = ... [2]

[Total: 6]