6 An a.c. power supply is connected to a resistor *R*, as shown in Fig. 6.1.

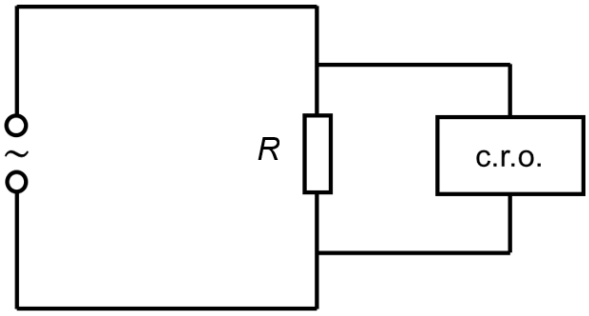

Fig. 6.1

A cathode ray oscilloscope (c.r.o.) is used to show the potential difference (p.d.) across *R*. The screen of the c.r.o. displays the variation with time of the p.d. across *R*, as shown in Fig. 6.2.

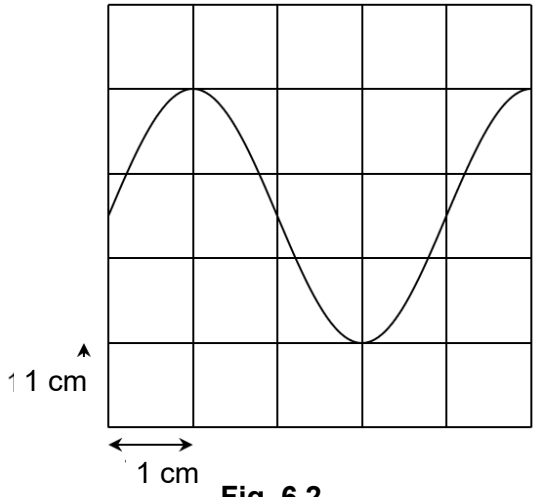

Fig. 6.2

(a) Explain, by reference to direct current, what is meant by the *root-mean-square* (r.m.s.) value of an alternating current.

……
……

……
……

……
[2]

(b) The voltage *V* of the power supply is given by the expression

$$V = 6.0\sin(100\pi t)$$

V is measured in volts and the time t is measured in seconds.

Determine the Y-gain and time-base of the c.r.o.

Y-gain = ... V / cm

time-base = ... ms / cm

[2]

(c) A diode is then connected in series with the resistor *R*, as shown in Fig. 6.3.

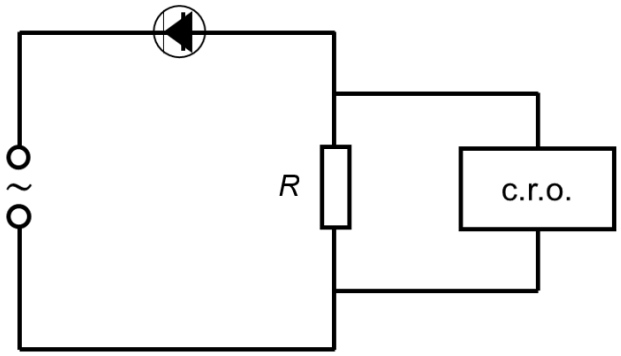

Fig. 6.3

(i) Sketch in Fig. 6.4, for 2 periods of the alternating p.d., the variation with time of the power *P* dissipated in *R* when *R* is 20 Ω, where *T* is the period. Indicate the peak power value in your sketch. [2]

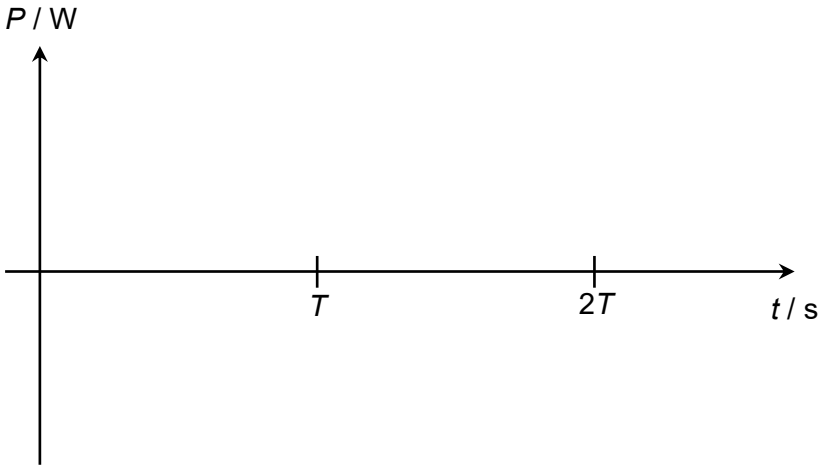

Fig. 6.4

(ii) Draw a line in Fig. 6.4 to represent the average power dissipated in *R*. Indicate its value on the y-axes. [1]

(iii) Calculate the root-mean-square current in *R*.

root-mean-square current = ... A [2]

[Total: 9]