6 An alternating supply of frequency 50 Hz and having an output of 6.0 V r.m.s. is to be rectified so as to provide direct current for a resistor R. The circuit of Fig. 6.1 is used.

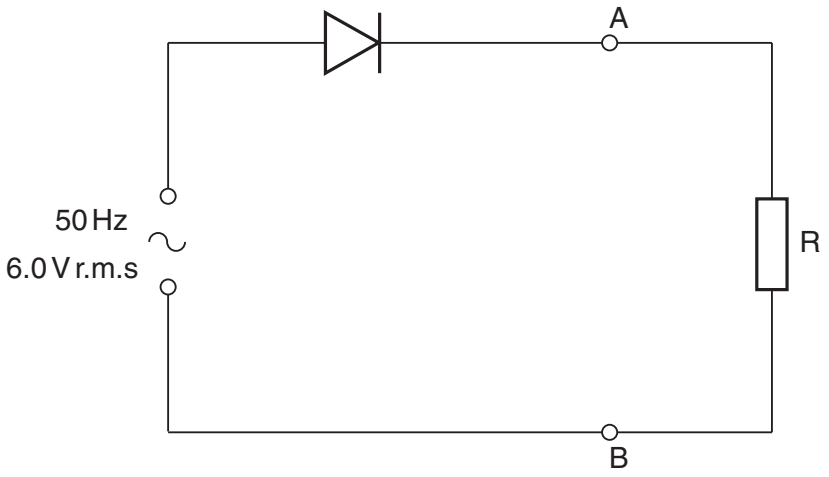

Fig. 6.1

The diode is ideal. The Y-plates of a cathode-ray oscilloscope (c.r.o.) are connected between points A and B.

(a) (i) Calculate the maximum potential difference across the diode during one cycle.

potential difference = ... V [2]

(ii) State the potential difference across R when the diode has maximum potential difference across it. Give a reason for your answer.

.....

..... [1]

(b) The Y-plate sensitivity of the c.r.o. is set at 2.0 V cm^{-1} and the time-base at 5.0 ms cm^{-1}.

On Fig. 6.2, draw the waveform that is seen on the screen of the c.r.o. [3]

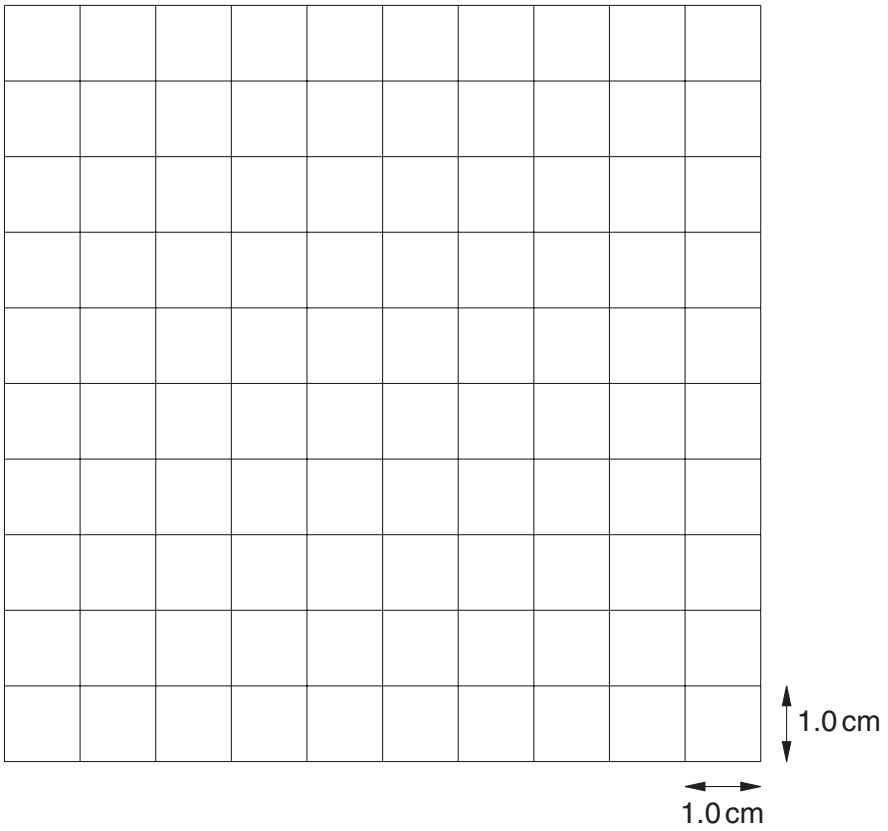

Fig. 6.2

(c) A capacitor of capacitance 180 μF is connected into the circuit to provide smoothing of the potential difference across the resistor R.

(i) On Fig. 6.1, show the position of the capacitor in the circuit. [1]

(ii) Calculate the energy stored in the fully-charged capacitor.

energy = ... J [3]

(iii) During discharge, the potential difference across the capacitor falls to $0.43\,V_0$, where V_0 is the maximum potential difference across the capacitor.

Calculate the fraction of the total energy that remains in the capacitor after the discharge.

fraction = ... [2]