6 A student uses a 240 V, 50 Hz sinusoidal alternating supply, a transformer and a diode to design a circuit. The circuit produces a direct voltage of peak value 6.0 V across a load of resistance 4.0 Ω. Both the transformer and diode can be assumed to be ideal.

The partially completed circuit diagram is shown in Fig. 6.1.

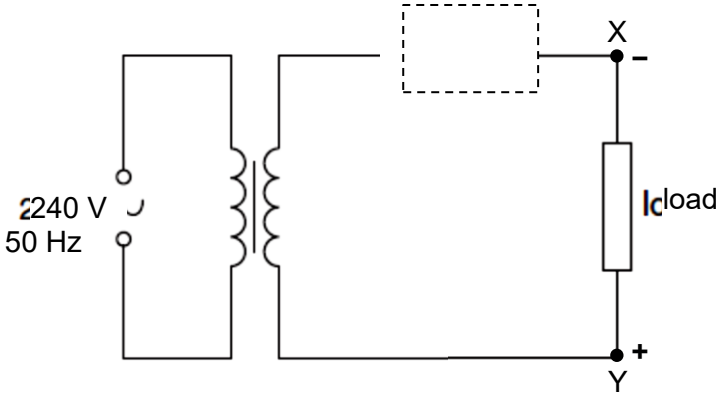

Fig. 6.1

(a) In the dotted box of Fig. 6.1, draw the symbol representing the diode that needs to be connected such that Y has a higher potential than X across the load.

[1]

(b) The root-mean-square (r.m.s.) voltage of the alternating supply is 240 V.

Explain what is meant by root-mean-square voltage.

.....

.....

..... [1]

(c) Calculate the ratio

$$\frac{\text{number of turns on the secondary coil}}{\text{number of turns on the primary coil}}.$$

ratio = ... [2]

(d) On Fig. 6.2, sketch a graph to show for the load, the variation with time t of the potential of X with respect to Y (V_{XY}) for up to $t = 0.060$ s.

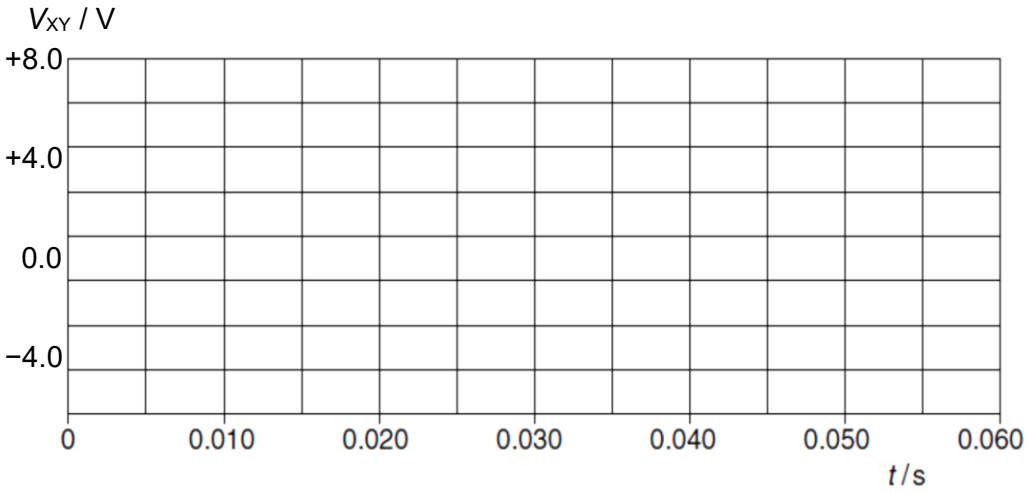

Fig. 6.2

[2]

(e) Calculate, for the load,

(i) the r.m.s. voltage,

r.m.s. voltage = ... V [1]

(ii) the mean power dissipated.

mean power = ... W [1]