7 A 240 V a.c. mains is connected to a step-down transformer, a full wave rectifier and a motor as shown in Fig. 7.1. The electric motor requires an operating peak power of 6.6 W.

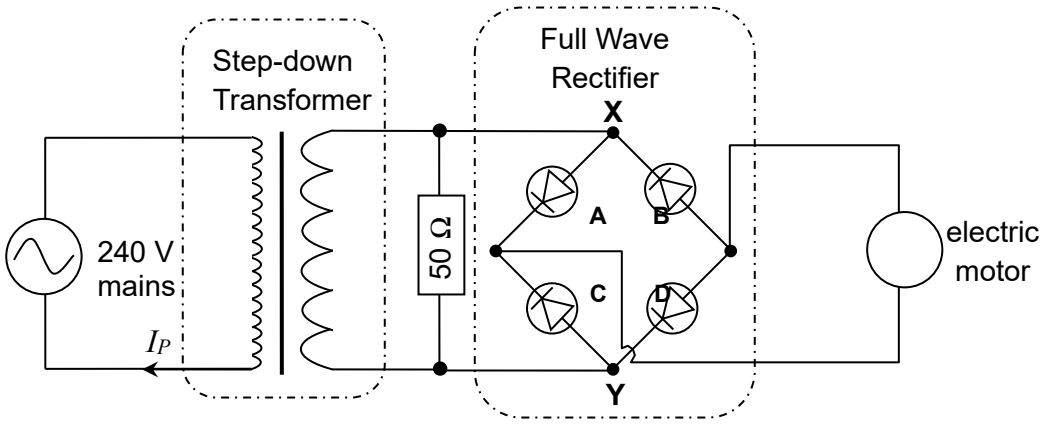

Fig. 7.1

The variation of potential difference across the 50 Ω resistor with time is shown in Fig. 7.2.

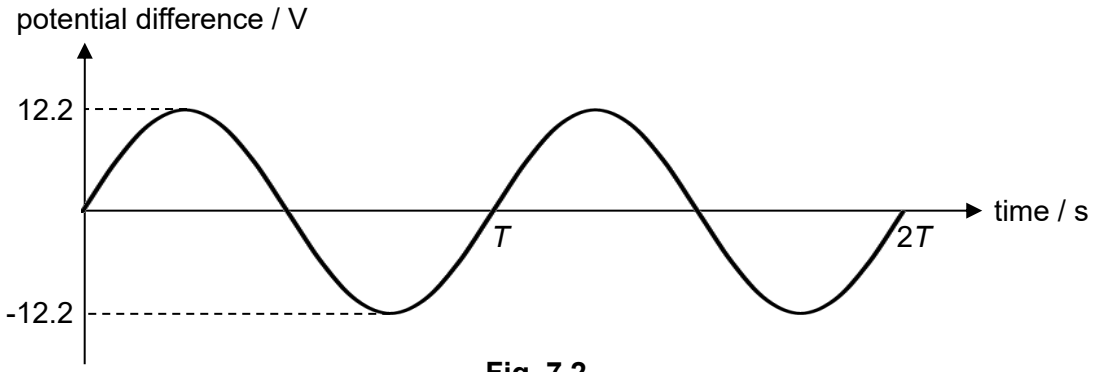

Fig. 7.2

(a) Determine the turns ratio of primary coil to secondary coil in the step-down transformer.

turns ratio = ... [2]

(b) (i) For half a period *T*, the potential at X is higher than that at Y.

On Fig. 7.1, draw an arrow to indicate the direction of current, if any, across the four diodes A, B, C and D during this half of a period.

[1]

(ii) Sketch, on Fig. 7.3, the variation of potential difference across the electric motor with time. Numerical calculation is not required.

[1]

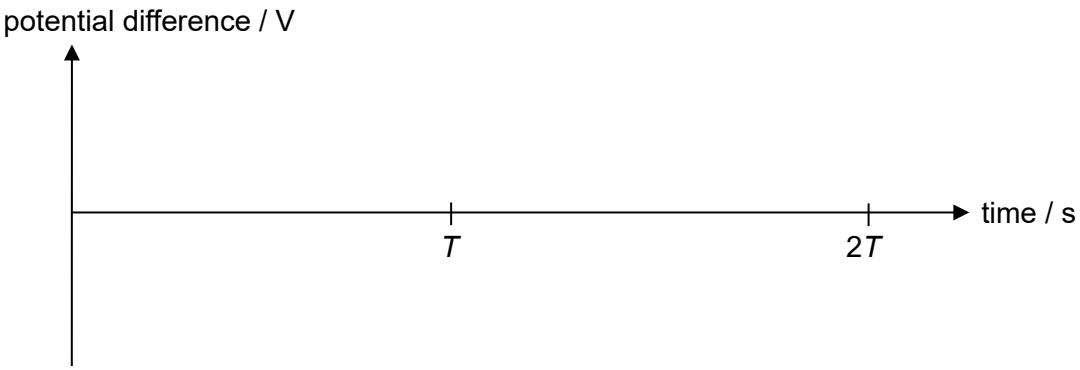

Fig. 7.3

(iii) Hence, sketch, on Fig. 7.4, the variation of output power of the step-down transformer with time when the electric motor is operating at its normal operating power. Include appropriate values in the output power axis.

Fig. 7.4

[2]

(c) Given that the transformer is 80% efficient, determine the r.m.s. current flowing through the primary coil.

current = ... A [2]

[Total: 8]