8 **(a)** In Singapore, power is supplied to our homes in the form of alternating current at a root-mean-square (r.m.s.) value of 230 V.

Fig. 8.1 shows typically how this voltage varies with time.

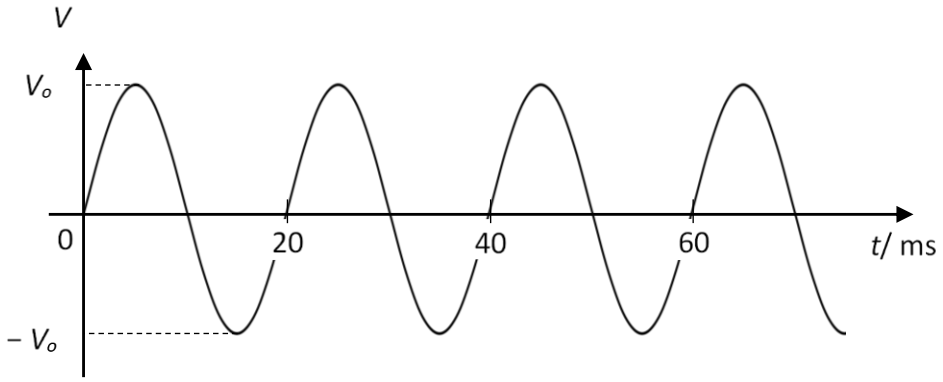

Fig. 8.1

(i) By reference to the heating effect, state what is meant by the r.m.s. value of an alternating current.

……

……

……

…… [2]

(ii) Use Fig. 8.1 and relevant information to determine

1. V_o

V_o = …… V [1]

2. the angular frequency

angular frequency = …… rad s^{-1} [2]

3. the equation relating V and t

[1]

(iii) Show that, for a sinuisodal alternating voltage, the mean power, P_{mean}, in a resistive load R is half the maximum power, P_o.

[1]

(iv) With the use of a circuit diagram, describe how the A.C. power supplied can be converted for our household appliances that requires direct current operating on a much lower potential difference.

……

……

…… [3]

(b) A long bar magnet is suspended in equilibrium from a helical spring such that one pole of the magnet lies within a short cylindrical coil as shown in Fig. 8.2.

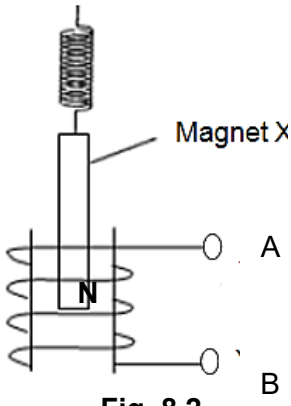

Fig. 8.2

The magnet is made to oscillate vertically with a frequency of 2.0 Hz such that one pole of the magnet oscillates in and out of the coil. The experiment is conducted in a draught free environment.

(i) Indicate on Fig. 8.2, the polarity of point A and B due to the induced e.m.f. with a "+" and "-", when the magnet is just entering the coil. [1]

(ii) Sketch on the axes of Fig. 8.3, with appropriate values, how the induced e.m.f. across terminal AB might vary with time, *t* for a duration of 1.0 s.

Fig. 8.3

[2]

(iii) Use Faraday's Law of electromagnetic induction to explain the variation of the e.m.f. with respect to your graph drawn in Fig. 8.3.

……

……

……

…….. [2]

(c) A resistor is now connected across the terminal AB as shown in Fig. 8.4.

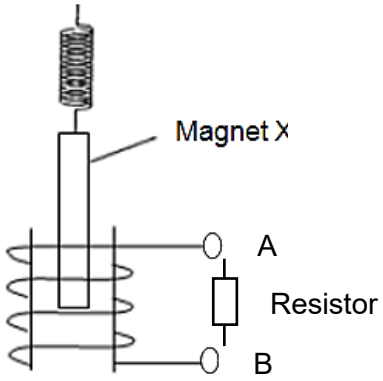

Fig. 8.4

(i) State and explain the change in the amplitude of the oscillation.

……

……

……

……

…….. [3]

(ii) Sketch another graph on Fig. 8.3 to show how the power dissipated in the resistor varies with time for the same time interval of 1.0 s as in **b(ii)**. Label the graph **P**. [2]