5(a) State Lenz's law of electromagnetic induction. [1]

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(b) Two coils of insulated wire are wound on an iron bar, as shown in Fig. 5.1.

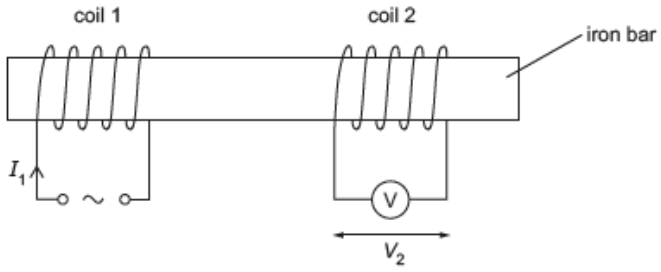

Fig. 5.1

There is a current I_1 in coil 1 that varies with time t as shown in Fig.5.2.

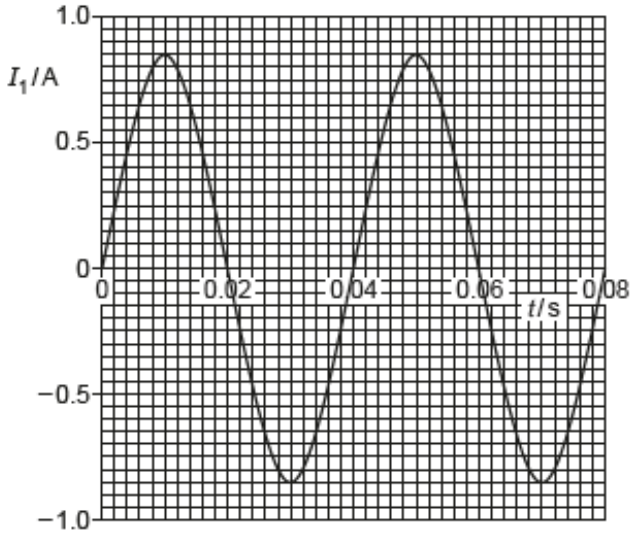

Fig. 5.2

(i) The variation with t of I_1 can be represented by the equation

$I_1 = X \sin Yt$, where X and Y are constants.

Use Fig. 5.2 to determine the values of X and Y. Give units with your answers. [3]

X = ……

Y = ……

(ii) The current in coil 1 gives rise to a magnetic field in the iron bar.
Assume that the flux density of this magnetic field is proportional to I_1.
An alternating electromotive force (e.m.f.) is induced across coil 2. The p.d. across coil 2 is measured using the voltmeter and has a root-mean-square (r.m.s.) value of 4.6 V.

On Fig. 5.3, sketch a line to show the variation with t of V_2 between t = 0 and t = 0.08 s. [3]

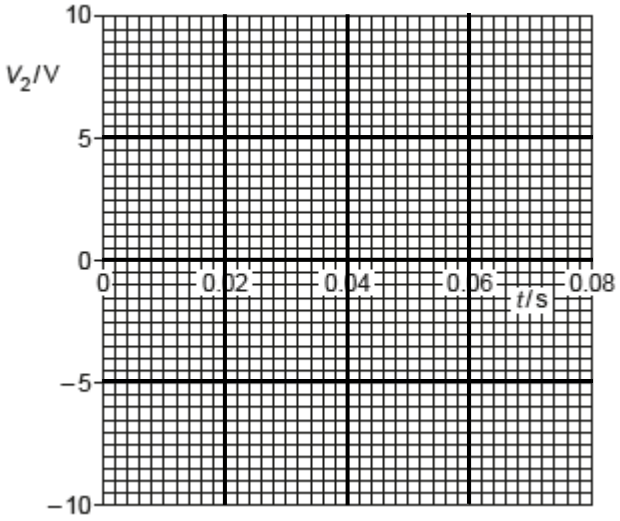

Fig. 5.3

(iii) Use the laws of electromagnetic induction to explain the shape of your line in (b)(ii). [3]

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