8 **(a)** State Lenz's law of electromagnetic induction.

....

....

.... [2]

(b) Two coils of insulated wire are wound on an iron bar, as shown in Fig. 8.1.

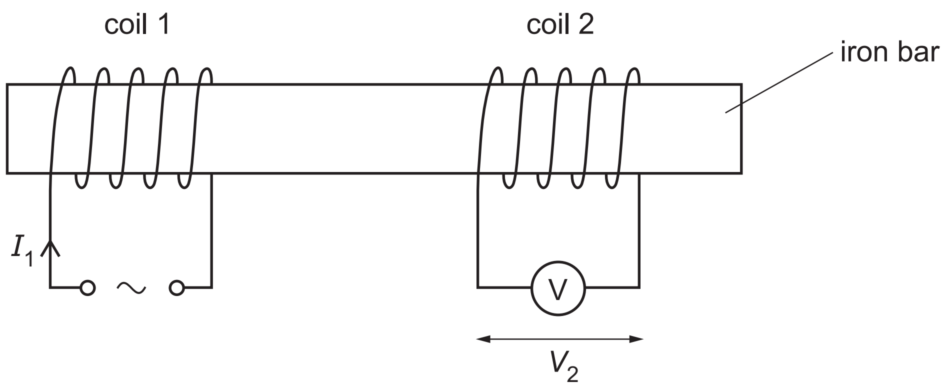

Fig. 8.1

There is a current I_1 in coil 1 that varies with time t as shown in Fig. 8.2.

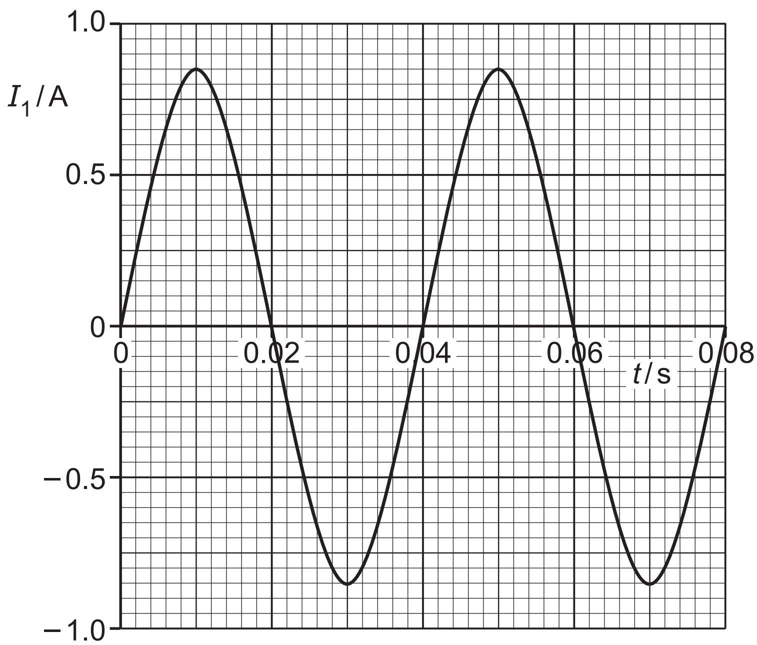

Fig. 8.2

(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. 8.2 to determine the values of X and Y. Give units with your answers.

X = ... unit ....

Y = ... unit ....

[3]

(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. 8.3, sketch a line to show the variation with t of V_2 between t = 0 and t = 0.08 s.

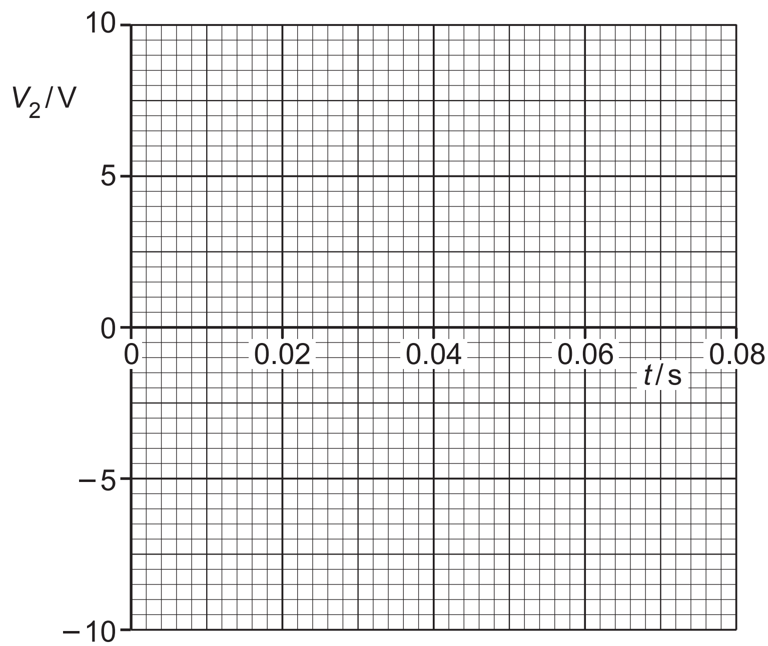

Fig. 8.3

[3]

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

....

....

....

.... [3]

[Total: 11]