1 **(a)** A bar magnet is suspended from a helical spring and one end of the magnet is situated in a coil of wire, as shown in Fig. 1.1. The coil is connected in series with a switch and a resistor. The switch is opened.

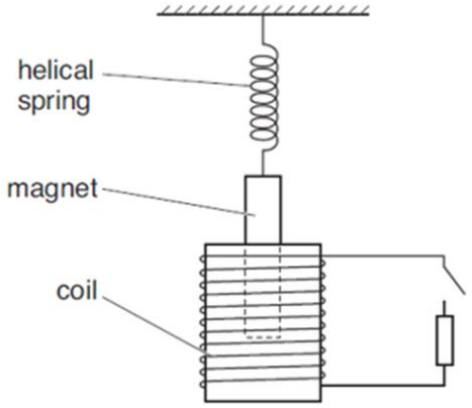

Fig. 1.1

The bar magnet is displaced vertically and then released. As the magnet passes through its rest position, a timer is started. The variation with time t of the vertical displacement of the magnet from its rest position is shown in Fig. 1.2. At t = 4.0 s, the switch is closed.

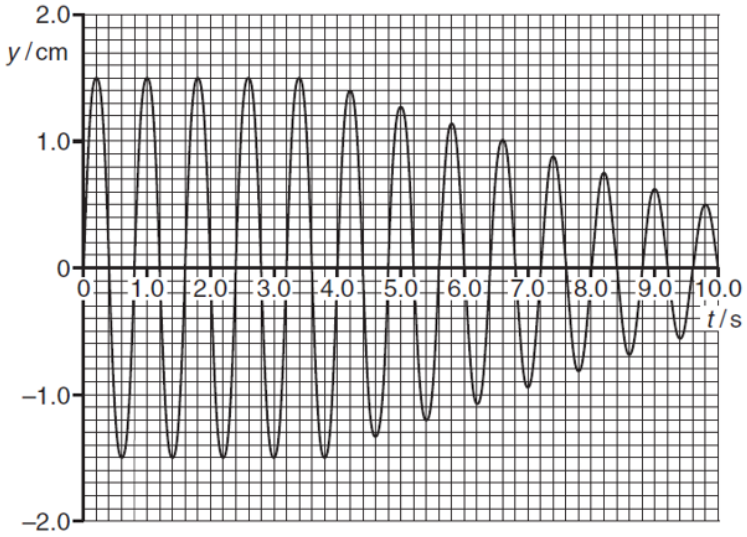

Fig. 1.2

(i) Use Fig. 1.2 to determine the frequency of oscillation of the magnet.

frequency = …… Hz [2]

(ii) State Faraday's Law of electromagnetic induction.

……

……..… [1]

(iii) Use the laws of electromagnetic induction to explain why the amplitude of oscillation decreases after the switch is closed.

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……..… [4]

(b) The set-up in **(a)** is modified by suspending the magnet above the coil and adding an alternating voltage supply source in series with the coil and resistor, as shown in Fig.1.3. The frequency of the voltage source is set at 0.50 Hz. The magnet was at rest initially and starts oscillating when the switch is closed.

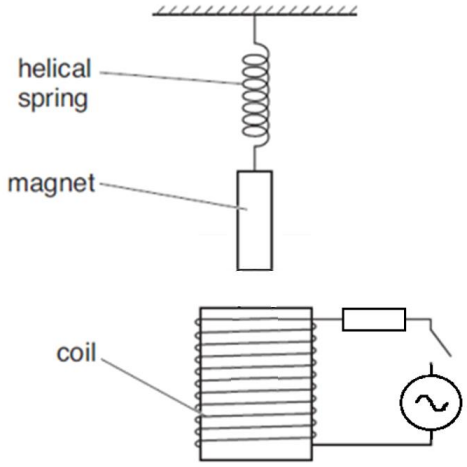

Fig. 1.3

(i) State the frequency of oscillation of the magnet.

frequency of oscillation = …….. Hz [1]

(ii) The frequency of the voltage source is gradually increased to 5.0 Hz. State and explain what will be observed about the amplitude of oscillations of the magnet.

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……

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…… [2]

[Total: 10]