2 A long bar magnet is suspended from the free end of a helical spring. One pole of the magnet lies within a coil of wire, as shown in Fig. 2.1.

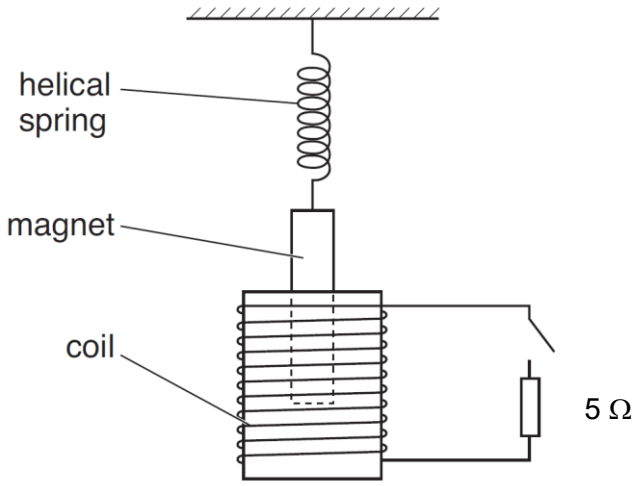

Fig. 2.1

The coil is connected in series with a switch and a 5 Ω resistor. The switch is open.

The 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 *y* of the magnet from its rest position is shown in Fig. 2.2.

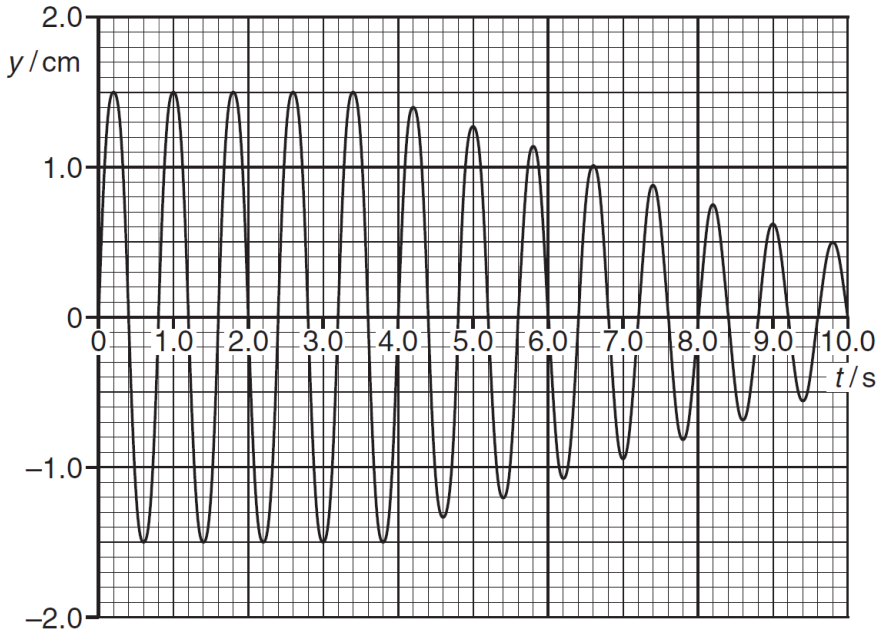

Fig. 2.2

At time $t = 4.0$ s, the switch is closed.

(a) Explain why, after time $t = 4.0$ s, the amplitude of oscillation of the magnet decreases.

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…… [4]

(b) The spring is removed and an oscillator is attached to the magnet so that the magnet undergo a periodic motion in the coil.

The switch is closed. The potential difference V measured across the resistor is given by

$$V = 27.0 \cos (15.7\, t)$$

V is in millivolts and the time t is in seconds.

(i) Determine the mean power dissipated from the 5 Ω resistor.

mean power = ... W [3]

(ii) Sketch the variation with time t of the power P dissipated from the resistance in Fig. 2.3. (Include appropriate values in your graph.)

Fig 2.3

[3]

[Total: 10]

Question 3 begins over the page.