5

Two vertical springs, each having spring constant k, support a mass. The lower spring is attached to an oscillator as shown in Fig. 5.1.

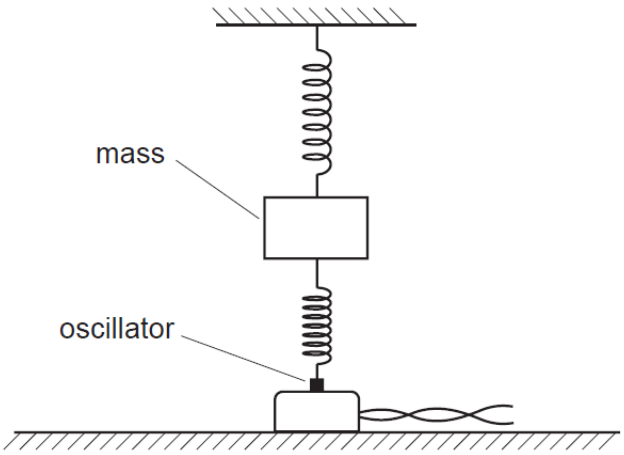

Fig. 5.1

The oscillator is switched off. The mass is displaced vertically and then released so that it vibrates. During these vibrations, the springs remain extended. The vertical acceleration a of the mass m is given by the expression

$$a = \frac{-2kx}{m}$$

where x is the vertical displacement of the mass from its equilibrium position.

(a)

(i)

Define *Simple Harmonic Motion*

……..……

……..……

…… [2]

(ii)

Show that, for a mass of 240 g and springs with spring constant 3.0 N cm^{-1}, the frequency of vibration of the mass is approximately 8.0 Hz.

[4]

(b)

The oscillator is switched on and the frequency *f* of the vibrations is gradually increased. The amplitude of vibration of the oscillator is constant. Fig. 5.2 shows the variation with *f* of the amplitude *A* of vibration of the mass.

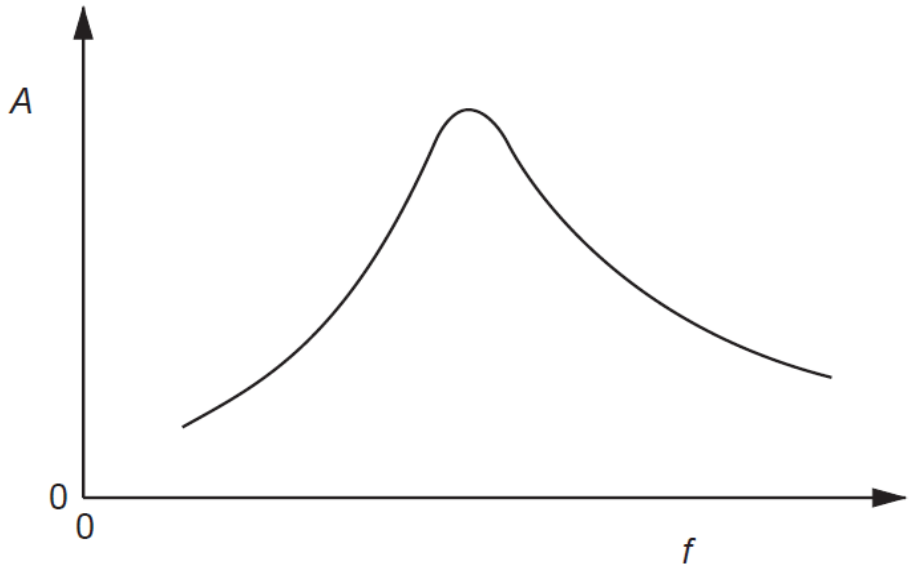

Fig.5.2

(i)

State

1. the name of the phenomenon illustrated in Fig. 5.2,

..... [1]

2. the frequency f_0 at which maximum amplitude occurs.

frequency = ... Hz [1]

(ii)

Explain, in terms of energy, the reason why the maximum amplitude occurs at the frequency stated in **(i) 2**.

……..……

……. [1]

(iii)

Suggest and explain how the apparatus in Fig. 5.1 could be modified to make the peak on Fig. 5.2 flatter, without significantly changing the frequency f_0 at which the peak occurs.

……

……

……

……

…… [3]

[Total: 12]

[Turn over