3 A spring is hung vertically from a fixed point. A mass M is hung from the other end of the spring, as illustrated in Fig. 3.1.

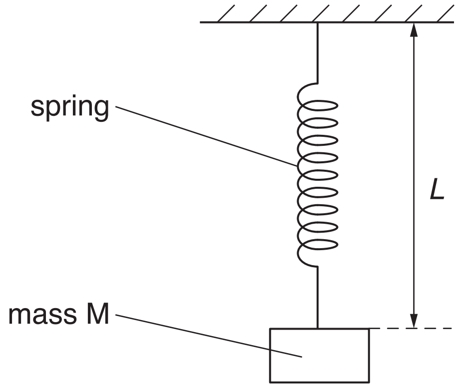

Fig. 3.1

The mass is displaced downwards and then released. The subsequent motion of the mass is simple harmonic.

The variation with time t of the length L of the spring is shown in Fig. 3.2.

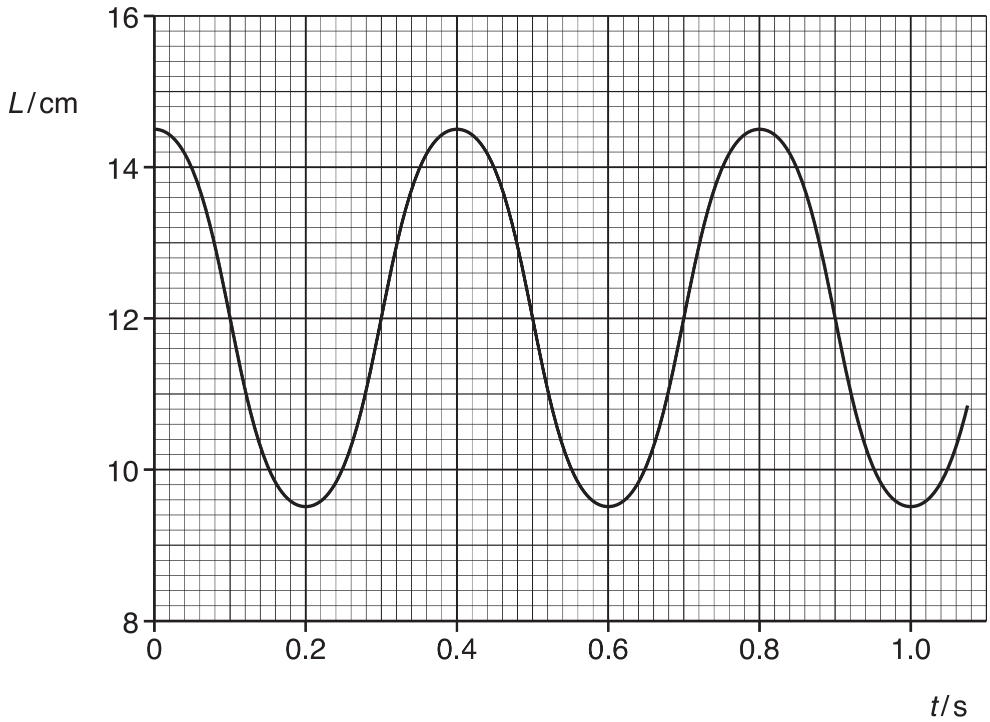

Fig. 3.2

(a) State:

(i) one time at which the mass is moving with maximum speed

time = ... s [1]

(ii) one time at which the spring has maximum elastic potential energy.

time = ... s [1]

(b) Use data from Fig. 3.2 to determine, for the motion of the mass:

(i) the angular frequency ω

ω = ... rad s^{-1} [2]

(ii) the maximum speed

maximum speed = ... m s^{-1} [2]

(iii) the magnitude of the maximum acceleration.

maximum acceleration = ... m s^{-2} [2]

(c) The mass M is now suspended from two springs, each identical to that in Fig. 3.1, as shown in Fig. 3.3.

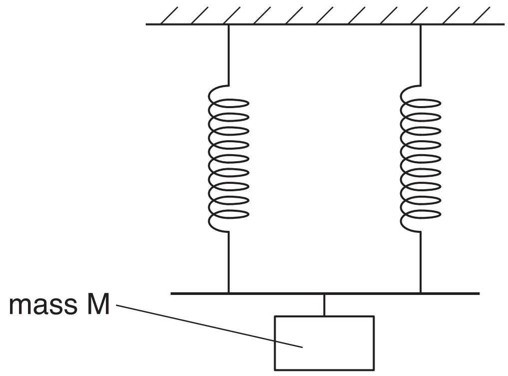

Fig. 3.3

Suggest and explain the change, if any, in the period of oscillation of the mass. A numerical answer is not required.

....

....

.... [2]

[Total: 10]