

5E Vertical Oscillation

A particle hanging on a spring or string, pulled down and released:

In equilibrium the extension e satisfies:

Spring compared with string:

17. A particle P of mass 1.2 kg is attached to one end of a light elastic spring of modulus of elasticity 60 N and natural length 60 cm. The other end of the spring is attached to a fixed point A on a ceiling. The particle hangs in equilibrium at the point B.

a) Find the extension of the spring.

The particle is now raised vertically a distance 15 cm and released from rest.

b) Prove that P will move with simple harmonic motion.

c) Find the period and amplitude of the motion.

d) Find the speed of P as it passes through B.

- e) Find the speed of P at the instant when the spring has returned to its natural length.

Elastic potential energy:

Energy considerations:

18. A particle P of mass 0.2 kg is attached to one end of a light elastic string of natural length 0.6 m and modulus of elasticity 8 N. The other end of the string is fixed to a point A on a ceiling. When the particle is hanging in equilibrium the length of the string is L m.

- a) Calculate the value of L.

The particle is held at A and released from rest. It first comes to instantaneous rest when the length of the string is K m.

- b) Use energy considerations to calculate the value of K.

- c) Show that while the string is taut, P is moving with simple harmonic motion.

The string becomes slack again for the first time T seconds after P was released from A .

d) Calculate the value of T .