

5D Horizontal Oscillation

For an elastic string or spring on a smooth horizontal surface:

Spring compared with string:

15. A particle P of mass 0.6 kg rests on a smooth horizontal floor attached to one end of a light elastic string of natural length 0.8 m and modulus of elasticity 16 N. The other end of the string is fixed to a point A on the floor. The particle is pulled away from A until AP measures 1.2 m and released.
- a) Show that, while the string remains taut, P moves with simple harmonic motion.
- b) Calculate the speed of P when the string returns to its natural length.
- c) Calculate the time that elapses between the point where the string becomes slack and the point where it next becomes taut.
- d) Calculate the time taken by the particle to return to its starting point for the first time.

Two springs or strings between two fixed points:

16. A particle P of mass 0.8 kg is attached to the ends of two identical light elastic springs of natural length 1.6 m and modulus of elasticity 16 N. The free ends of the springs are attached to two points A and B which are 4 m apart on a smooth horizontal surface. The point C lies between A and B such that ABC is a straight line and $AC = 2.4$ m. The particle is held at C and then released from rest.

a) Show that the subsequent motion is simple harmonic motion.

b) Find the period and amplitude of the motion.

c) Calculate the maximum speed of P.