

FM1 – Mechanics Chapter 3

Exam Questions: Hooke's Law (Equilibrium)

Q1.

A particle P of mass m is attached to one end of a light elastic string of natural length a and modulus of elasticity $3mg$.

The other end of the string is attached to a fixed point O on a ceiling.

The particle hangs freely in equilibrium at a distance d vertically below O .

Show that $d = \frac{4}{3}a$.

(3)
(Total 3 marks)

Q2.

A particle P of mass 0.5 kg is attached to one end of a light elastic spring, of natural length 1.2 m and modulus of elasticity λ newtons. The other end of the spring is attached to a fixed point A on a ceiling. The particle is hanging freely in equilibrium at a distance 1.5 m vertically below A .

Find the value of λ .

(Total 3 marks)

Q3.

A particle P of mass m is attached to one end of a light elastic string of natural length l and modulus of elasticity $3mg$.

The other end of the string is attached to a fixed point O on a rough horizontal table.

The particle lies at rest at the point A on the table, where $OA = \frac{7}{6}l$.

The coefficient of friction between P and the table is μ .

Show that $\mu \geq \frac{3}{2}$.

(Total 4 marks)

Q4.

A light elastic string has natural length $2a$ and modulus of elasticity $4mg$.

One end of the elastic string is attached to a fixed point O . A particle P of mass m is attached to the other end of the elastic string.

The particle P hangs freely in equilibrium at the point E , which is vertically below O

Find the length OE .

(Total 4 marks)

Q5.

A light elastic string of natural length 0.4 m has one end A attached to a fixed point. The other end of the string is attached to a particle P of mass 2 kg. When P hangs in equilibrium vertically below A , the length of the string is 0.56 m.

(a) Find the modulus of elasticity of the string.

(3)

A horizontal force is applied to P so that it is held in equilibrium with the string making an angle θ with the downward vertical. The length of the string is now 0.72 m.

(b) Find the angle θ .

(3)

(Total 6 marks)