Hooke's Law and Dynamic Problems

Elastic Strings and Springs can be introduced into more similar problems to those encountered in A level Mechanics.

Key ideas to Remember:

- **F=ma**
- Maximum displacement occurs when velocity = 0
- Maximum velocity occurs when acceleration = 0

(in a given direction)

- $Fr_{max} = \mu R$

One end of a light elastic string, of natural length 0.5m and modulus of elasticity 20N, is attached to a fixed point A. The other end is attached to a particle of mass 2kg. The particle is held at a point which is 1.5m below A and released from rest. Find:

a) The initial acceleration of the particle

b) The length of the string when the particle reaches its maximum speed.

A particle of mass 0.5kg is attached to one end of a light elastic spring of natural length 1.5m and modulus of elasticity 19.6N. The other end of the spring is attached to a fixed point *O* on a rough plane which is inclined to the horizontal at an angle α where tan α = 3/4.
The coefficient of friction between the particle and the plane is 0.2. The particle is held at rest on the plane at a point which is 1m from *O* down a line of greatest slope of the plane.
The particle is released from rest and moves down the slope. Find its initial acceleration.

Ex 3B
1-2, 4-5

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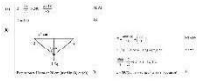
A particle P of mass 1.5 kg is attached to the mid-point of a light elastic string of natural length 0.30 m and modulus of elasticity λ newtons. The ends of the string are attached to two fixed points A and B, where AB is horizontal and AB = 0.48 m. Initially P is held at rest at the mid-point, M, of the line AB and the tension in the string is 240 N.

(a) Show that $\lambda = 400$. **(3)**

The particle is now held at rest at the point C, where C is 0.07 m vertically below M. The particle is released from rest at C.

(b) Find the magnitude of the initial acceleration of P. **(6)**



Ex 3B
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