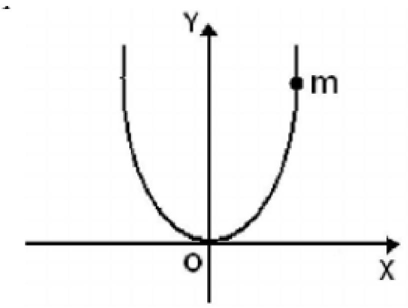
Answer on Question #63996-Physics-Mechanics-Relativity

A bead of mass m is located on a parabolic wire with its axis vertical and vertex directed towards downward as in figure and whose equation is $x^2 = ay$. If the coefficient of friction is μ, the highest distance above the x-axis at which the particle will be in equilibrium is

(a) μa (b) $\mu^2 a$ (c)1/4 μ^2 g (d)1/2μ^ g

Solution



Tangent at any x distance would be

$$tan\theta \ = y' = \frac{2x}{a}$$

The friction is

$$F_{fr} = \mu mg cos\theta$$

Balancing friction with $mgsin(\theta)$ we get,

$$\mu cos\theta = sin(\theta) \to tan\theta \ = \mu$$

So,

$$\frac{2x}{a} = \mu$$

$$x = \frac{a\mu}{2}$$

The highest point would be,

$$y \ = \frac{\left(\frac{a\mu}{2}\right)^2}{a} = \frac{a\mu^2}{4}.$$

Answer: $\boldsymbol{\frac{a\mu^2}{4}}$.

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