Answer on Question #49808-Physics-Mechanics-Kinematics-Dynamics

A person wants to find the gravity on another planet. There is a 1kg mass hanging from a thin wire with a length of $l = 5m$. By plucking the wire they can tell that the resulting wave takes $t = 0.5s$ to travel the length. The wire has a mass of $M = 100g = 0.1\ kg$. What is the gravity?

Solution

The speed of the wave is given by the formula

$$v = \sqrt{\frac{T}{\mu}},$$

where T is the tension and equal to the gravitational force on the weight M ($T = W = Mg$), $\mu = \frac{1\text{kg}}{5\text{m}} = 0.2\,\frac{kg}{m}$.

Thus

$$v = \frac{l}{t} = \sqrt{\frac{Mg}{\mu}}.$$

The acceleration of the gravity is

$$g = \frac{\mu}{M}\left(\frac{l}{t}\right)^2 = \frac{0.2}{0.1}\left(\frac{5}{0.5}\right)^2 = 500\,\frac{m}{s^2}.$$

Answer: $\mathbf{500\,\frac{m}{s^2}}$.