

Question #58345, Physics / Mechanics | Relativity

A spring has a frequency of 5 Hz when a 20 N weight is suspended from it. How far would the spring stretch from equilibrium when a 50 N weight is suspended from it?

Solution:

According to Hooke's Law:

$$F = kX;$$

where k is the spring stiffness;

X is spring deformation;

F is the force applied to the spring (50 N)

Therefore,

$$X = \frac{F}{k}$$

The frequency of a mass attached to a spring:

$$f = \frac{1}{2\pi\sqrt{m/k}};$$

$$k = 4m\pi^2 f^2;$$

$$m = \frac{W}{g}; \text{ (} W \text{ – is the suspended weight of 20 N)}$$

$$k = \frac{4W\pi^2 f^2}{g};$$

$$X = \frac{Fg}{4W\pi^2 f^2}$$

$$X = \frac{50 \times 9.8}{4 \times 20 \times \pi^2 \times 5^2} = 0.025 \text{ m}$$

Answer: 0.025 m or 25 mm