

## Answer on Question #47650 – Physics – Other

### Question.

A mass of 0.50 kg is hung from a spring and has a frequency of oscillation of 0.113 Hz. What is the spring constant? The mass is replaced with a second unknown mass and the frequency of oscillation is found to be 0.171 Hz. What is the unknown mass?

Given:

$$m_0 = 0.5 \text{ kg}$$

$$\nu_0 = 0.113 \text{ Hz}$$

$$\nu = 0.171 \text{ Hz}$$

Find:

$$k = ?$$

$$m = ?$$

### Solution.

By definition the period of a harmonic oscillator can be approximated by the following formula:

$$T_0 = 2\pi \sqrt{\frac{m_0}{k}}$$

And we know that

$$\nu_0 = \frac{1}{T_0} = \frac{1}{2\pi} \sqrt{\frac{k}{m_0}}$$

Therefore,

$$k = 4\pi^2 \nu_0^2 m_0$$

But  $k$  is constant, so:

$$k = 4\pi^2 \nu_0^2 m_0 = 4\pi^2 \nu^2 m \rightarrow m = m_0 \left( \frac{\nu_0}{\nu} \right)^2$$

Calculate:

$$k = 4\pi^2 \cdot 0.113^2 \cdot 0.5 = 0.252 \frac{N}{m}$$

$$m = 0.5 \left( \frac{0.113}{0.171} \right)^2 = 0.218 \text{ kg}$$

**Answer.**

$$k = 4\pi^2 \nu_0^2 m_0 = 0.252 \frac{N}{m}$$

$$m = m_0 \left( \frac{\nu_0}{\nu} \right)^2 = 0.218 \text{ kg}$$

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