Answer on Question #68090 – Physics – Mechanics | Relativity

If an oscillator makes 100 vibrations per minute and its velocity at the mean position is 15 ft/sec. find the amplitude of vibration. What is its velocity half way between its mean position and extreme position?

Solution.

Angular frequency of oscillations:

$$\omega_0 = 2\pi\nu = \frac{2\pi N}{t} = 2\pi\frac{100}{60} = \frac{10\pi}{3}\ rad\ s^{-1};$$

At the mean position $v = v_m$, therefore $v_m = 15$ ft/sec

We find the amplitude of vibration:

$$v_m = \omega_0 A;\ \ A = \frac{v_m}{\omega_0} = \frac{15\times 3}{10\pi} \approx 1.43 \text{ ft};$$

We find velocity at the position $x = \frac{1}{2}A$:

$$\frac{1}{2}A = A\sin\varphi;\ \ \sin\varphi = \frac{1}{2};\ \ v = v_m\cos\varphi = 15\sqrt{1-(1/2)^2} = \frac{15\sqrt{3}}{2} \approx 13 \text{ ft } s^{-1};$$

Answer:

$A \approx 1.43$ ft
$v \approx 13$ ft s^{-1}