Answer on Question #65192, Physics Mechanics Relativity

A mass is attached to a spring, displaced and then released from rest with an angular velocity of 0.5 rad/s. Determine the time when the kinetic energy and potential energy are first equal.

Solution:

In this situation, we have harmonic oscillations: $x(t) = x_{max}\cos(\omega t)$; (t=0; x=A-amplitude)

$$\omega - angular\ velocity = \frac{0.5rad}{s}$$

When kinetic energy and potential energy are equal: $E_{mech} = E_{pot1} + E_{kin1} = 2E_{pot1} = 2E_{kin1}$;

$E_{pot}(t) = \frac{æ*x(t)^2}{2}$; According to law of conservation of energy:

$E_{mech} = const; E_{mech} = 2E_{pot1} = E_{pot(\max)} \Rightarrow 2 * \frac{æ*{x_1}^2}{2} = \frac{æ*{x_{max}}^2}{2} \Rightarrow 2 * {x_1}^2 = {x_{max}}^2;$

$2 * (x_{max}\cos(\omega t))^2 = x_{max} \Rightarrow \cos(\omega t) = \frac{1}{\sqrt{2}}; \Rightarrow \omega t = \frac{\pi}{4}; t = \frac{\pi}{4\omega} = \frac{3.14}{4*0.5} = 1.57s$

Answer: t=1.57s