Answer on Question #58378, Physics / Mechanics | Relativity |

A particle of mass 100g performs linear SHM along a path of length 20cm with a frequency of 60hz .Find the value of momentum when it is at a distance of 2cm from positive extremity?

Solution:

Let:

v is the velocity at displacement x from the mid-point,

f = 60 Hz is the frequency,

k is the spring constant,

m = 100 g is the mass,

A = 10 cm is the amplitude.

An object experiencing simple harmonic motion is traveling in one dimension, and its one-dimensional motion is given by an equation of the form

$$x = A\cos\omega t$$

The velocity is given by

$$v = \omega A\cos\omega t$$

From first equation

$$\cos\omega t = \frac{x}{A} = \frac{2\ cm}{10\ cm} = 0.2$$

Thus,

$$v = \omega A\cos\omega t = 2\pi f A\cos\omega t = 2\cdot\pi\cdot 60\cdot 0.1\cdot 0.2 = 7.54\ \mathrm{m/s}$$

The momentum is

$$p = mv = (0.1\ kg)\cdot(7.54\ m/s) = 0.754\ kg\cdot m/s$$

Answer: $0.754\ kg\cdot m/s$