Answer to Question #69061, Physics / Mechanics | Relativity

Question:

1) A car starting from rest attains a speed of 120kmh^-1 in 10 seconds, it then continues with this speed for 10 minutes. The acceleration in the second segment is ?
2) A simple harmonic oscillator has a period of 0.001 second and an amplitude of 0.4m. The magnitude of its velocity at the centre of oscillation is?

Solution:

1) In the second segment the car moves with the constant speed, meaning that the acceleration (the change of speed with time) is zero

$$a = 0 \frac{m}{s^2}$$

2) The period of simple harmonic oscillator can be described as

$$T = 2\pi \sqrt{\frac{m}{k}}$$

So

$$k = \frac{4\pi^2 m}{T^2}$$

The energy stored in the oscillator can be written as

$$P = \frac{kx^2}{2} = \frac{2\pi^2 m}{T^2} x^2$$

Where x is the amplitude of the oscillator
On the other hand this energy is equal to the kinetic energy at the center of oscilation, so

$$K = P$$
$$\frac{mv^2}{2} = \frac{2\pi^2 m}{T^2} x^2$$

And finally

$$v = \frac{2\pi}{T} x = 2512 \frac{m}{s}$$