Question #37220

A 0.75-kg metal sphere oscillates at the end of a vertical spring. As the spring stretches from 0.12 m to 0.23 m (relative to its unstrained length), the speed of the sphere decreases from 6.7 to 3.2 m/s. What is the spring constant of the spring?

Solution

Let

$m = 0.75\ kg$

$S_1 = 0.12\ m$

$S_2 = 0.23\ m$

$v_1 = 6.7\ m/s$

$v_2 = 3.2\ m/s$

$k = ?$

According to the law of conservation energy

The change of the kinetic energy of sphere is equal to the change of potential energy of the spring

$\Delta E_k = \Delta E_p$

$\Delta E_k = \frac{1}{2} m(v_1 - v_2)^2$

$\Delta E_p = \frac{1}{2} k(S_2 - S_1)^2$

Following this

$$\boldsymbol{k = m\frac{(v_1 - v_2)^2}{(S_2 - S_1)^2}}$$

$$\boldsymbol{k = 0.75\frac{(6.7 - 3.2)^2}{(0.23 - 0.12)^2} = 760\ N/m}$$

Answer 760 N/m.