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A 0.40kg mass is attached to a spring with a force constant of 26 N/m and released from rest a distance of 3.2cm from the equilibrium position of the spring.

1) Give a strategy that will allow you to find the speed of the mass when it is half way to the equilibrium position.

2) Determine the speed.

$m = 0.40kg$

$A = 3.2cm = 3.2E\text{-}2m$

$k = 26\ N/m$

1) Use energy conservation.

$$E = \frac{1}{2}kA^2$$

and

$$E = \frac{1}{2}kA^2 = \frac{1}{2}mv^2 + \frac{1}{2}kx^2$$

half-way to the equilibrium position

$$x = \frac{1}{2}A$$

so

$$\frac{1}{2}kA^2 = \frac{1}{2}mv^2 + \frac{1}{2}k\left(\frac{1}{2}A\right)^2$$

$$\frac{1}{2}kA^2 = \frac{1}{2}mv^2 + \frac{1}{2}\left(k\right)\left(\frac{1}{4}\right)A^2$$

$$\frac{kA^2 - \frac{1}{4}kA^2}{m} = v^2$$

$$\sqrt{\frac{\frac{3}{4}kA^2}{m}} = v$$

2)

$$\sqrt{\frac{\frac{3}{4}\left(26\ N/m\right)\left(3.2E\text{-}2\ m\right)^2}{0.40\ kg}} = \boxed{0.22\ \frac{m}{s}}$$