

14.47. Model: The block attached to the spring is in simple harmonic motion.

Solve: (a) The frequency is

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}} = \frac{1}{2\pi} \sqrt{\frac{2000 \text{ N/m}}{5.0 \text{ kg}}} = 3.183 \text{ Hz}$$

(b) From energy conservation,

$$A = \sqrt{x_0^2 + \left(\frac{v_0}{\omega}\right)^2} = \sqrt{(0.050 \text{ m})^2 + \left(\frac{1.0 \text{ m/s}}{2\pi \cdot 3.183 \text{ Hz}}\right)^2} = 0.0707 \text{ m}$$

(c) The total mechanical energy is

$$E = \frac{1}{2}kA^2 = \frac{1}{2}(2000 \text{ N/m})(0.0707 \text{ m})^2 = 5.0 \text{ J}$$