

8. An object of mass m is attached to a horizontal spring with force constant k on a frictionless surface. The system is displaced from equilibrium a distance ℓ and released with an initial velocity of v_0 back toward the equilibrium position.

- What is the frequency of the SHO?
- What is the initial potential energy of the mass and spring system?
- What is the initial kinetic energy?
- What is the motion's amplitude?



a. $f = \frac{1}{2\pi} \omega, \omega = \sqrt{\frac{k}{m}}$

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}}$$

b. $U_i = \frac{1}{2} k \ell^2$

c. $K_i = \frac{1}{2} m v_0^2$

d. $K_i + U_i = \frac{1}{2} k A^2$
 $\frac{1}{2} m v_0^2 + \frac{1}{2} k \ell^2 = \frac{1}{2} k A^2$

$$A = \sqrt{\frac{m}{k} v_0^2 + \ell^2}$$