

Simple Harmonic Motion

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/simple-harmonic-motion/>

Name: _____ Date: _____

Learning objectives

- Identify the restoring force behind simple harmonic motion.
- Relate period to mass and spring constant.
- Describe the exchange between kinetic and potential energy.

Variables to change

- Mass
- Spring constant
- Amplitude

Procedure

1. Set a mass on a spring and measure the period.
2. Increase the mass and measure the period again.
3. Increase the spring constant (stiffer spring) and measure the period.
4. Watch where the speed is greatest and where it is zero.

Observations

Record period versus mass and spring constant, and note where kinetic and potential energy peak.

Questions

1. What provides the restoring force in a mass–spring system?

2. How does increasing mass affect the period?
3. How does a stiffer spring (larger k) affect the period?
4. Where is the mass moving fastest? Where is it momentarily at rest?
5. Does amplitude affect the period in ideal SHM?

Answer key (instructors)

- **1.** The spring force, $F = -kx$, always directed back toward equilibrium.
- **2.** The period increases; $T = 2\pi\sqrt{m/k}$.
- **3.** The period decreases — stiffer springs oscillate faster.
- **4.** Fastest at equilibrium (maximum kinetic energy); at rest at the extremes (maximum potential energy).
- **5.** No — the period is independent of amplitude for ideal simple harmonic motion.

Simple harmonic motion arises from a restoring force proportional to displacement ($F = -kx$). The period $T = 2\pi\sqrt{m/k}$ grows with mass and shrinks with stiffness, and energy shifts continually between kinetic (at center) and potential (at the extremes).