# Energy Analysis of
# Masses and Springs

Go to http://www.colorado.edu/physics/phet (or Google "phet")
Click on **Simulations**, then **Masses and Springs** picture in the center of the screen.

**Learning Goals**

- Using a mass oscillating on a spring, students will be able to explain the distribution and transfer of different types of energy: kinetic, elastic potential, gravitational potential, and thermal.
- Students will also be able to explain the Conservation of Mechanical Energy concept using kinetic, elastic potential, and gravitational potential energy of a mass oscillating on a spring. Students will study what happens when there is also thermal energy of a mass oscillating on a spring.

****NOTE**** Move the friction slider to none and leave the planet as Earth. You can use **Pause** or change the Time Rate for closer analysis and use the ruler for more accurate results and answers.

1. What does *Elastic Potential Energy* mean? What causes it?

2. What does *Gravitational Potential Energy* mean? What causes it?

3. What does *Kinetic Energy* mean? What causes it?

4. What does *Thermal Energy (Heat)* mean? What causes it?

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**Read questions 5 through 7 before experimenting.**

5. Observe the Gravitational Potential Energy as the mass oscillates. When is the **Gravitational Potential Energy** at its maximum? Make sure you test your ideas with pulling down the mass different amounts (or not at all). **Sketch a picture that shows this.**

6. **When is the Gravitational Potential Energy at its minimum**? Make sure you test your ideas with pulling down the mass different amounts (or not at all). **Sketch a picture that shows this.**

7. Observe the Gravitational Potential Energy as the mass oscillates**. When is the Gravitational Potential Energy zero?** Make sure you test your ideas with pulling down the mass different amounts (or not at all). **Sketch a picture that shows** this including an explanation why the location where the Gravitational Potential Energy is zero makes sense.

8. By investigation, **determine where the Elastic Potential Energy is zero**.

**Sketch a picture that shows this.**

9. By investigation, **determine where the Elastic Potential Energy is at its maximum**. **Sketch a picture that shows this.**

10. By investigation, **determine where the Kinetic Energy is zero**.

11. By investigation, **determine where the Kinetic Energy is at its maximum**. Write a clear paragraph detailing your results, including an explanation why the location where the Kinetic Energy is at its maximum makes sense.

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12. Put a mass on a spring and observe the total energy graph as the mass oscillates. Pay attention to details of the energy distribution and transfer. Write a clear paragraph detailing your observations.

13. How can you get the Total Energy bar to exceed the Total Energy dotted line? Why does this not break the rule of Conservation of Energy? Write a clear paragraph detailing your results.

14. Put *friction* on. Put a mass on a spring and observe the total energy graph as it oscillates. Pay attention to details of the energy distribution and transfer. Write a clear paragraph detailing your observations, contrasting your observations from #14 (when friction was off).

15. How does a skater's energy distribution as he rides back and forth on a half-pipe *compare and contrast* to that of a mass oscillating on a spring? Write a clear paragraph detailing your results.