# Energy Analysis of a Mass Oscillating on a Spring
## Masses and Springs Simulation

Using your ipad or computer, 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. Select **Lab.**

**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 damping slider to none and leave the planet as Earth.

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?

Note: The instructions "Write a clear

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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). Write a clear paragraph detailing your results, including an explanation why the location where the Gravitational Potential Energy is at its maximum makes sense.

6. Observe the Gravitational Potential Energy as the mass oscillates. 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). Write a clear paragraph detailing your results, including an explanation why the location where the Gravitational Potential Energy is at its minimum makes sense.

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). Write a clear paragraph detailing your results, including an explanation why the location where the Gravitational Potential Energy is zero makes sense.

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**Read questions 8 through 10 before experimenting. What you will observe with Elastic Potential Energy may be different depending on mass, stiffness, initial displacement.**

8. By investigation, determine where the Elastic Potential Energy is zero. Write a clear paragraph detailing your results, including how you determined the Elastic Potential Energy Zero location(s) and explain why the position(s) for zero make(s) sense.

9. By investigation, determine where the Elastic Potential Energy is not zero. Write a clear paragraph detailing your results, including an explanation why where the Elastic Potential Energy is not zero makes sense.

10. By investigation, determine where the Elastic Potential Energy is at its maximum. Write a clear paragraph detailing your results, including an explanation why where the Elastic Potential Energy is at its maximum makes sense.

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**Read questions 11 through 13 before experimenting.** *Simulation hint: The KE will not be calculated when you are moving the mass with the mouse.*

11. By investigation, determine where the Kinetic Energy is zero. Write a clear paragraph detailing your results, including an explanation why the position(s) for Zero Kinetic Energy make(s) sense.

12. By investigation, determine where the Kinetic Energy is not zero. Write a clear paragraph detailing your results, including an explanation why the location(s) where the Kinetic Energy is not zero make(s) sense.

13. 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.

14. Keep *damping* on 'none'. 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.

15. How can you get the Total Energy bar to increase? Why does this not break the rule of Conservation of Energy? Explain your answer using the concept of work.

16. Put *damping* on 'Lots'. 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).

17. 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.