Main Topic	Energy
Subtopic	Conservation of Energy
Learning Level	Middle
Technology Level	Low
Activity Type	Student

Description: Experimentally find the kinetic, potential, and elastic energy for a toy "popper" and relate results to applied force.

Required Equipment	"Popper" toy, meter stick, electronic balance, pencil
Optional Equipment	Triple-beam balance

Educational Objectives

- Experimentally find the kinetic, potential, and elastic energy for a toy "popper."

Concept Overview

Students will calculate the potential and kinetic energy of a popper toy using simple formulas. Potential energy is found by observing the maximum height. Kinetic energy is found by using a dynamics formula to find the popper's starting velocity. Students will find that the popper reaches a greater height than it should, given the amount of kinetic energy it started with!

The discrepancy is resolved by finding the amount of energy stored in the elastic deformation of the popper.

To learn more about the elastic properties of the popper, students will treat the popper as a spring and find its spring constant.

Lab Tips

Significant digits and **units** are important in this lab!

Remember… **Take your measurements 1st**, then worry about the Sig. Figs!

Popper Energy Name: ___________________
Class: ____________________

Goal:

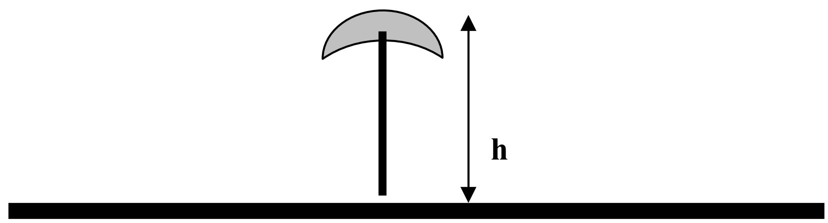
Experimentally find the kinetic, potential, and elastic energy for a toy "popper."

Materials:

"Popper" toy, meter stick, electronic balance, pencil

Procedure:

1. Obtain a "popper" from your Physics teacher & record the mass.* **Mass** of "popper" (in kg) _______
2. Place a pen or pencil on the floor with the eraser end up as shown in the diagram below. Measure the **height** from the floor to the top of the "popper" (nearest 0.1 cm)



3. Invert the "popper" and record the exact **distance** you compressed the popper to invert it.
   Compression Distance of "popper" (in m) _______
4. Using the set-up above, compress the popper and set it on the pencil. When the "popper" pops, your lab partner must attempt to measure the **maximum height** the "popper" reaches. Repeat this for **10 trials.** REMEMBER! To find the maximum **height** reached by the popper, be certain to **subtract the pencil distance**.
5. **Complete Data Table**

Trial #	1	2	3	4	5	6	7	8	9	10
Height [m]										

* **Average Height** of "popper" (in m) _________

6. Using the formula, **PE = mgh**, determine the **Potential Energy** for the "popper".

PE of Popper

7. Next, using **ONLY** this motion formula, $\mathbf{V_f^2 = V_i^2 + 2ad}$, determine the **final velocity** of the "popper" **just** before it hits the ground.

Popper Energy

Name: ____________________

Class: ____________________

V_f of Popper

8. Using **ONLY** your answer for the **Velocity** of the popper from question #7, find the **Kinetic Energy** [**KE = 1/2 mv^2**] of the "popper" just before it hits the ground.

KE of Popper

9. Compare the **Potential Energy** to the **Kinetic Energy** for the popper.

	Energy [J]
PE	
KE	

10. Was **Energy conserved** in this case? ________________

11. **If** the kinetic energy and the potential energy are **not conserved**, give a reason why this might not be the case.

12. Using the equation for the **PE of a Spring** [**$PE_s = ½ k x^2$**], determine **the Spring Constant [k]** for YOUR Popper.

k for YOUR Popper

13. Find 2 other lab group answers for k and draw a **conclusion** about height **h** and **k**.

14. What **2 ways** the toy manufacturer could engineer a popper to make it go **higher**?

15. What **Force** did you apply in compressing the Popper? ***Hint→F = kx**