03-01 Work-Energy Theorem and Spring Constants *Name: _____*

Objective

- Find the spring constant of a toy using the work-energy theorem.

Materials

- Pop-up toy (available at OrientalTrading.com)
- Meter stick
- Balance

Procedure

1. Hold a meter stick vertically on your desk.
2. Push a pop-up toy down so that the suction cup locks it in place. When the toy jumps up, estimate the height of the jump. Repeat 5 times.

   _____, _____, _____, _____, _____
3. Find the average height. h = _____ m
4. Use the height to find the final speed as in lesson 01-06 Falling Objects. v_f = _____ m/s
5. The speed you just calculated is also the speed of the toy when it jumped because projectile motion is symmetric.
6. What was the initial velocity of the toy before it jumped? v_0 = _____ m/s
7. Find the mass of the toy. m = _____ kg
8. The work-energy theorem states that $W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_0^2$. Find the work the spring did on the toy. W = _____ J
9. The energy of a spring is $W = \frac{1}{2}kx^2$. Since the spring did the work to make the toy jump, the work from step 8 is the same as the energy in this equation. Use the work and the distance the spring was compressed to find the spring constant. k = _____
10. What would happen to the height the toy jumped if the spring constant were higher? _____
11. How much force did you apply to the toy to push it down? (Hint: Find the force of a spring equation from last unit.) F = _____