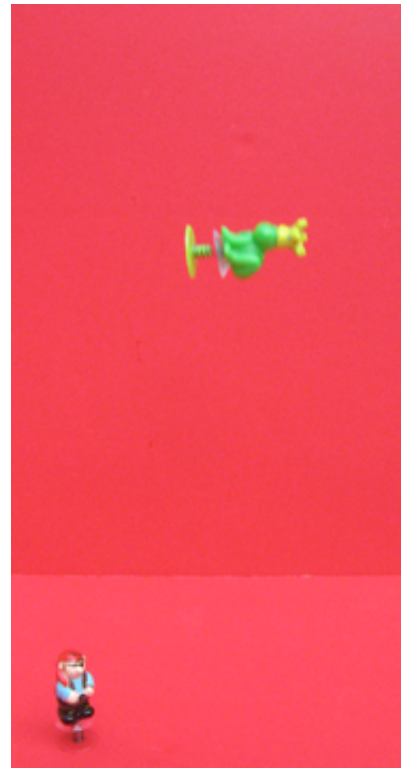


# Pop-Ups

Pop-Ups, or Jumpers, are little spring toys. When the toy is pressed against its base to compress the spring, a suction cup holds them to the base until it releases, whereupon the toy jumps in the air.



**Materials:** Pop-Up

**Assembly:** None!

**To Do and Notice:** Make the Pop-Up jump!

## What's Going On?

The Pop-Up involves a series of energy transformations. The numbered items below describe the sequence of events that takes place when you use the toy, in the order that they actually occur. Choose the appropriate lettered item for each numbered item, and place the letter in the blank. Each lettered item is used once and only once. Correct answers are at bottom of page.

- \_\_\_\_\_ 1. You are pushing on the toy to compress the spring
- \_\_\_\_\_ 2. Spring is fully compressed and the suction cup is holding the toy down
- \_\_\_\_\_ 3. Suction cup has released, and the spring has just reached its full length
- \_\_\_\_\_ 4. Toy is one-fourth of the way up to its maximum height
- \_\_\_\_\_ 5. Toy is halfway to its maximum height
- \_\_\_\_\_ 6. Toy is at its maximum height
- \_\_\_\_\_ 7. Toy is one-fourth of the way down from its maximum height
- \_\_\_\_\_ 8. Toy has hit the ground and lies motionless

- a. gravitational potential energy is maximum and kinetic energy is zero
- b. kinetic energy is less than gravitational potential energy, but neither is zero
- c. kinetic energy is maximum and spring potential energy is zero
- d. kinetic energy is transformed to heat
- e. spring potential energy is maximum
- f. kinetic energy is greater than gravitational potential energy, but neither is zero
- g. mechanical work is being transformed to spring potential energy
- h. kinetic energy and gravitational potential energy are equal

## Going Further

By measuring the maximum height of the Pop-Up, you can determine the speed with which it left the ground (assuming no air resistance):

$$PE_{\text{gain}} = KE_{\text{loss}} \quad mgh = \frac{1}{2}mv^2 \quad v^2 = 2gh \quad v = \sqrt{2gh}$$

answers: 1g; 2e; 3c; 4f; 5h; 6a; 7b; 8d

Pop-Ups.....5/15/08

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