Catapult **Primary Audience: 3rd – 5th**

Description: Catapults are great for demonstrating transfer of energy. Tension in the catapult will cause an object to travel very far.

Keywords: Elasticity, Potential Energy, Kinetic Energy**,** Transfer of energy

Materials:

- Plastic spoon
- Miniature marshmallow
- Tape measure or meter stick
- Masking tape
- Protractor
- Goggles

Instructions:

1. Have students put on goggles and align teams of students along one side of a set of long tables or a counter so the catapults are aimed across the room. Provide at least 20 feet of open space in front of launching area for a landing area.

2. Make a catapult by taping a spoon against the edge of a table, perpendicular to the tabletop with the bowl of the spoon facing toward the table.

3. Mark the marshmallow for identification. Hold the marshmallow in the bowl of the spoon. Use your thumb to help anchor the spoon handle against the table. Keeping the end of the spoon handle against the table, launch the marshmallow across the room (Don't point it at anyone!!).

4. Experiment with the catapult. Try pulling the spoon back farther (change the angle). What happens if you change the weight/size of the marshmallow? How could you do that? Which technique makes the marshmallow go farther? Higher?

5. Determine the "best" angle for launching the marshmallow the farthest. Pull the spoon back - we'll call this the deflection angle. Decide how much to deflect the spoon and then be consistent each time. (Use a protractor to be sure you always pull back the same amount). Measure the distance the marshmallow

travels. Record this distance in a table. Repeat this two more times and compute the average of the three.

6. Now, change the deflection angle of the catapult and repeat. Record the average distance for several different catapult angles. Record your results. What angle between the spoon and table launches the marshmallow the farthest?

7. Based on your data, predict the optimum deflection angle. Have a class contest to find out who can make a marshmallow fly the farthest.

Further Exploration:

Spoons may be made of several different types of plastic. Bring in other plastic spoons and try this experiment. Compare and contrast the results. Look up the properties of the different types of plastic and relate these properties to the results.

What's going on?

The plastic spoon has an inherent elasticity, which means it will return to its original shape after being deformed. Rubber bands and other elastic objects also have this property. When the spoon is deformed, the force used to cause that deformation is "stored" in the spoon as elastic potential energy. When the spoon is released, the elastic potential energy changes to kinetic energy as the spoon returns to its original shape, carrying the marshmallow along with it. The marshmallow continues to move after the spoon has stopped due to its inertia.

Relevant Ohio Science Content Standards:
Physical Sciences: 1.6, 3.3, 3.4, 7.2, 7.4

Additional Resources:
Look up different properties of different types of plastic and relate these properties to the results.
http://www.teachingplastics.org