LESSON PLAN: Rubber Band Fling

Description
This activity is meant to extend your students' knowledge of the topics covered in our Physics of Roller Coasters lab. Student teams will be investigating the correlation between stretched length of a rubber band (potential energy) to the distance it travels (kinetic energy).

Grade Levels
2-8

Duration
30-40 minutes

Student Outcomes
Students will:
- Create a model that demonstrates both potential and kinetic energy.
- Graph the relationship between potential and kinetic energy.

Next Generation Science Standards
- *Physical Sciences* **Grade 3:** 3-PS2-2;
- **Grade 4:** 4-PS3-1,2,4; **Grades 6-8:** MS-PS3-1,2,5
- *Engineering Design* **Grade 2:** K-2-ETS1-3;
- **Grades 3-5:** 3-5-ETS1-1; **Grades 6-8:** MS-ETS1-1-4

Common Core Math Standards
- **Grade 2:** 2.MD.1 **Grade 3:** 3.MD.4

Common Core ELA Standards
- **Grade 2:** Speaking and Listening 2.SL.1a-c; 2.SL.2a;2.SL.3
- **Grade 3:** Speaking and Listening 3.SL.1b-d; 3.SL.3
- **Grade 4:** Speaking and Listening 4.SL.1b-d
- **Grade 5:** L&S1.3; SA2.2a-c
- **Grade 6:** Speaking and Listening 5.SL.1b-d
- **Grade 6-8:** Speaking and Listening SL.1b-e

Materials (one set per group of 4 students)

- At least 20 rubber bands of the same size and thickness (all students in the class should have the same size rubber bands)
- Ruler
- Popsicle stick or pencil
- Measuring tape or meter stick
- Masking tape

Vocabulary

Familiarity with these terms and concepts will enhance students' experience in the activity.
- **Kinetic energy:** Energy of motion; energy being expressed through movement.
- **Potential energy**: Energy that is stored for later use; not currently being used.
- **Elastic Potential Energy:** Potential energy that has been stored by compressing or stretching an elastic object; i.e., a spring or rubber band.
- **Tension:** The state of being stretched tight.

Procedure

This activity should be done in a large open space either outside or in the gymnasium/cafeteria.

1. Begin by reviewing potential and kinetic energy. Discuss other places besides roller coasters where potential and kinetic energies can be found.
2. Tape or hot glue the Popsicle stick or pencil perpendicular to the zero end of the ruler so that only 1" of the popsicle stick is sticking up over the numbered side of the ruler. (This should form a lopsided "T" shape)
3. Place the ruler on the edge of a desk or table so that the popsicle stick is against the edge of the table. Tape the ruler down to the table.
    a. If doing this activity outside, the ruler can be taped down to the ground. The bottom part of the popsicle stick will need to be cut off so that the ruler can lay flat on the ground.
4. Students will take turns shooting rubber bands that have been stretched different lengths to see the relationship between potential and kinetic energy.
5. To shoot the rubber band:
    a. Place one end of the rubber band around the popsicle stick.
    b. Pull the rubber band back to the desired distance using the ruler as a guide.
    c. Let go of the rubber band and let it fly!
        i. Try to keep the angle of launch the same for every shot to get the most accurate distance.
2. After each rubber band shot, a student team member should measure and record the distance the rubber band flew. Each stretch distance should be repeated 3-4 times to get more accurate results.
3. Shooting lengths:
    a. 2 inches stretched
    b. 4 inches stretched
    c. 6 inches stretched
    d. 8 inches stretched
    e. 10 inches stretched (if possible)
    f. 12 inches stretched (if possible)
4. Once all the data has been collected, teams will find the average distance for each stretched distance and graph their results (stretched distance (x) vs. travelled distance (y)). Younger students can pick the most common distance as opposed to finding the average.
    a. A blank graph has been provided at the end of this lesson, but students are encouraged to create their own.
5. Once teams have finished graphing, have them compare their results with other teams and discuss the correlation.

Extended Learning

- Try out different sized rubber bands in addition to the different stretched distances. Do longer (or thicker) rubber bands result in a longer distance shot? Why or why not?