LESSON PLAN: Balloon Hovercrafts

Description
This activity is meant to extend your students' knowledge of the topics covered in our Physics of Roller Coasters lab. Through this activity, your students will deepen their understanding of potential and kinetic energy and learn that these energies are not only found in roller coasters!

Grade Levels
4-8

Duration
40 minutes

Student Outcomes
Students will:
- Describe potential and kinetic energy as it is observed in the hovercraft.
- Explain the relationship of friction, force, and energy seen in this activity.

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

Common Core ELA Standards
- **Grades 2-5:** Writing W.7; W.8
- **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:** Speaking and Listening 5.SL.1b-d
- **Grades 6-8:** Speaking and Listening SL.1b-e

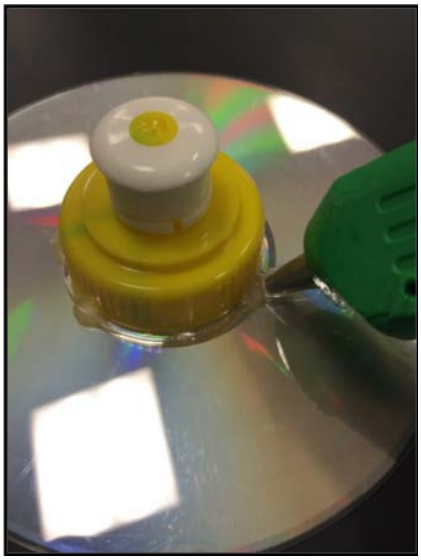
Materials (These materials can be purchased at RAFT or found around the house)

- Old CD's
- Duct tape and/or hot glue
- Balloons
- Balloon hand-pumps
- Sport top bottle cap with push/pull closure

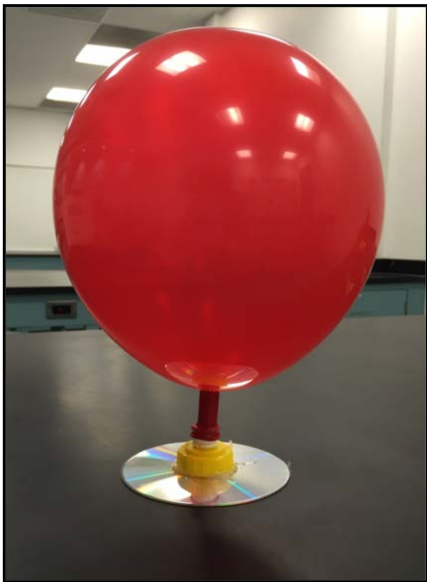
Vocabulary

Familiarity with these terms and concepts will enhance students' experience in the activity.
- **Energy (from Greek, meaning "activity, operation"):** The capacity to do work.
- **Friction**: The force resisting the relative motion of solid surfaces, fluid layers, and/or material elements sliding against each other. It may be thought of as the opposite of "slipperiness."
- **Hover**: To remain floating, suspended, or fluttering in the air.
- **Kinetic energy:** Energy being used which is gained from being in motion.
- **Potential energy**: Stored energy, energy that has the potential to be used but it is not in use.

Procedure



1. Students will work in pairs for this activity. Each pair receives one set of materials (one CD, two balloons (one per student), one bottle top, and a glue gun or tape).
    a. Ask students what they can make with the materials that will demonstrate both potential and kinetic energy.
    b. If they do not come up with hovercraft, try to lead them to hovercraft by giving clues or showing pictures of hovercrafts.
2. *To make the hovercraft*: Glue the bottle top over the hole in the CD; close the sport top by pushing it closed. If you can't find enough sport top bottle caps, have students bring in plastic water or soda bottles. The top of the bottle can be cut off and glued onto the CD to give a similar air distribution as the sport top. You will just need to add a binder clip to keep the balloon closed until ready for motion.
3. Have one partner blow up the balloon (using the hand pump) to the desired fullness. Do NOT tie off the balloon. Have students hold it by the end.
    a. Ask students what type of energy is being stored in the balloon (potential).
    b. Have students compare which balloons have more stored energy and what that could mean for their hovercraft.
    c. Give students the opportunity to change how much energy is stored in their balloon.



4. Now pairs will attach the end of their balloon to the sport top cap on the CD. Have students make hypotheses on:
    a. How far they think their hovercraft will go
    b. Which direction they think their hovercraft will go
    c. The speed at which their hovercraft will travel
5. When ready, pairs will pull the sport top up opening the cap and allowing the stored energy in the balloon to propel the hovercraft.
6. Ask students what type of energy the potential energy was converted to when the cap was opened. (Kinetic)
7. Students should record the distance and direction travelled by their hovercraft and compare with their hypotheses. Were they correct? Why did their hovercraft do what it did?

Extended Learning

- Measure both balloon circumference (when full) and distance travelled to determine relationship between stored energy and distance travelled. Test at least five different balloon circumferences two times each to guarantee a large sample size. Students could then create a table and graph showing this relationship of balloon circumference vs. distance travelled.
- Ask students what they think could affect the speed and distance travelled by their hovercraft. Are there other variables besides the fullness of the balloon?
    - Have a variety of balloon sizes and/or shapes available and have students write a brief explanation for why they chose the particular shaped balloon and how they think it will affect the energy required to move their hovercraft.
    - Have a variety of terrain textures for hovercrafts to glide over. Students should compare how their hovercraft performed on each type of terrain and explain what could have caused the changes in performance.