Kinetic and Potential Energy

Vocabulary:

- kinetic energy — energy of movement
- potential energy — stored energy
- potential chemical energy — stored energy released by chemical changes

Comprehension Questions

1. Explain how speed and weight affect an amount of kinetic energy.
2. Identify three examples of items that can store potential energy.
3. How can energy be transferred back forth between kinetic energy and potential energy?
4. Identify one example of how potential chemical energy is used.
5. Name two kinds of energy that potential and kinetic energy can create.
6. How does kinetic energy apply a force to something else?
7. What type of energy is created when a brick falls from the top of a wall?
8. Explain how kinetic energy can be changed into potential energy.
9. Identify two ways in which a spring has potential energy.

Activities:

#1

❖ Marble Role

OVERVIEW: This lesson is to help students more fully understand the relationship between Potential and Kinetic energy. Students should already know the definitions for work and mechanical energy.

PURPOSE: Students will observe and record the amount of work done by the three different marbles rolling down an inclined plane and hypothesize about the reasons for the differences.

OBJECTIVE(s): Students will:

1. Discover that the larger the mass, and the higher an object is raised, the more energy is stored.
2. Measures the differences in inches and/or centimeters.
3. Compute the average distances.
4. Make predictions, record observations, and create hypothesis.

MATERIALS:
3 marbles (Different sizes &/or weights), inclined plane, ruler, milk carton.

PROCEDURES:

Explanation:
Set up a demonstration of rolling three different sized marbles down an inclined plane. Place the bottom section of a milk carton at the bottom of the ramp to catch the marble and measure the distance that it moves the carton.

Pre Lesson: Questions

1. Who can tell me the meaning of work?

2. What is mechanical energy?

3. Which marble could have more mechanical energy? (sitting on flat plane)

*4. If I put the marbles up on the inclined plane, would they have energy? Why?

This energy is called potential energy: (PE) Energy at the point of release or stored energy. The energy of a moving object is Kinetic energy. (KE) PE changes to KE as the marble rolls down the ramp.

* Which marble do you think has the most PE?

* Ask students to predict how many centimeters each marble will move the milk carton, and which marble will move it the most. (write on a piece of paper)

Demonstrate one marble and record the distance the milk carton was moved. Repeat five times and take the average distance. Demonstrate the second and third marbles using the same process.

Compare student's predictions with outcomes.

* Which marble had the most energy? Why?

* What would happen if the smaller marble was let go at twice the height of the larger one? Why? (Demonstrate)

TYING IT ALL TOGETHER:
* What are some examples of storing and using energy in our environment? (Teeter-toter, Wrecking ball, dam, Elevators)

* What factors affect the amount of work an object can do? (Mass and Height)

On the paper that students wrote their predictions, have them explain why their predictions were right or wrong.

Activity #2

❖ Potential and Kinetic Energy: Jumping Jacks

1. Have students assume a standing X position, with arms above their shoulders in a wide V and legs apart in an inverted V.

2. Tell them to hold the position, and explain that they are storing potential energy, just waiting to be converted into kinetic energy -- energy in motion.

3. Allow them to do a jumping jack. Explain that, as they move, they're creating kinetic energy; at each pause their bodies are holding potential energy.

Activity #3

❖ Potential Chemical Energy: Cork Experiment

An interactive experiment that 3rd graders will love.

Purpose:

Demonstrate the relationship of potential energy and chemical energy using vinegar and baking soda.

Explain that vinegar and baking soda are made of molecules that contain potential energy in their chemical bonds, or potential chemical energy.

Materials:

baking soda, 20 sets of goggles, vinegar, 5 plastic flasks with corks and 5 measuring cups.

Procedure:

1. Have students write a one sentence prediction of what will happen when baking soda, vinegar and water are mixed together.
2. Break students into 5 groups of 4.

3. Instruct students to put their goggles on.
4. Have students mix half a cup each of water and vinegar in a plastic flask.
5. Put a teaspoon of baking soda in a coffee filter.
6. Insert it in the flask.
7. Place cork securely on flask.
8. Quickly move away.
9. After the cork pops off the flask have students write a paragraph about the steps of the experiment and the results. They should write it on the same sheet of paper as the prediction.

The energy created -- kinetic energy created when chemical interaction converts potential energy -- will blow the cork right off the flask.

(For a less messy -- but also less dramatic -- experiment, pour vinegar over a pile of baking soda and watch the energy conversion occur.)

Activity #4

❖ Potential Energy and Gravity

A bouncing ball is an interesting way to demonstrate a rapid conversion from potential to kinetic energy and back, created by gravity. Allow students to hold a ball over their heads, let it bounce off the pavement and allow it to continue bouncing. Explain that gravity is the force that converts the ball's potential energy to kinetic energy; when it hits the pavement, it possesses potential energy for an instant, and then the force of the ground converts it to kinetic again as it bounces upward.

Activity #5

❖ Potential and Kinetic Energy: Rubber Band

Rubber bands provide an excellent vehicle for explaining potential energy to sixth-grade students. Give a rubber band to each student. Ask them to hold it tightly and stretch it almost as tightly as possible. Explain that the stretched rubber band exemplifies potential energy, which they can feel in the tension as the rubber band pulls against their hands. Then let them let go of the rubber band -- pointing it at the

wall and not at each other. Explain that movement in the rubber band demonstrates potential energy being converted to kinetic energy.