SPOOL RACER

ENERGY LESSON

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Time Frame:	Standards:
4 – 30min sessions 2 sessions to build Spool Racer and Come Back Can 2 sessions to test 4th Grade	**4.S.1.2.3** Make describe and/or use models **4.S.1.8.1** Analyze and follow multistep instructions.

Objectives:

SWBAT build models that will show potential and kinetic energy.

Background Information:

This is a fun, exploratory lesson which will allow students to ask the following questions: What is energy? How is energy used? What are two different types of energy? Students will discover the following scientific explanations: Energy is the ability to do work. Energy is used to do work. Work is done whenever force is used to move an object. Two specific types of energy include potential energy and kinetic energy. Potential energy is stored energy. Kinetic energy is energy of motion. In the spool experiment, potential energy is demonstrated through the winding of a rubber band, and kinetic energy is demonstrated when the spool is allowed to move across the floor once the rubber band or stored energy is expended. Previous Knowledge Needed: Following directions and manipulation of building materials.

Materials:

- 2 coffee cans with plastic lids
- 1 rubber band (you will have to experiment to find out which kind of band works best)
- 1 metal nut (as in nuts and bolts)
- 2 toothpicks
- Spools
- rubber bands
- washers
- toothpicks
- masking tape
- "Come Back Can" ball
- tape measure

- marker
- magazines
- glue
- scissors
- construction paper
- two pieces of notebook paper (students)
- pencil (students)

Procedure:

Focus Phase:

Diagnostic Questions:

1. Hold up a ball and ask: Do you think this ball has energy? Tally the answers on the board. Why or why not? What if I drop it or throw it? Do you think it has energy now? Tally the answers on the board. Have students explain their answers. Do you think that the energy the ball has when I am holding it is the same as when I throw it or drop it? Tally the answers on the board. Explain.

2. Have students create theories about the ball's energy. Write theories on the board to come back to later.

Challenge Phase:

1. Allow students to choose partners, stressing that rowdiness or misuse of materials will show that they do not wish to participate in the activities. Pass out all materials (put materials into baggies ahead of time so they are easy to distribute and students can handle one item at a time) to pairs and demonstrate how to put the racer together. Have students construct their racers.

<u>Constructing the spool racer:</u>

1. Pull the rubber band through the spool so there is a loop on either end.
2. Put a toothpick through one loop of the rubber band. Pull tightly and tape with masking tape. Break off the ends of the toothpick so it does not hang over the edge of the spool.
3. Pull the other loop of rubber band through the hole in the metal washer.
4. Put the other toothpick through the untaped loop.
5. Twist the rubber band. Set spool on floor. Watch it go! (allow students to discover this step)

2. Have students play with racers and discover what it can do. Guide students to discover a solution that allows the spool racer to roll across the floor independent of manual assistance (i.e. pushing with finger or throwing).

3. Encourage student to think about how the rubber band affects the movement of the spool.

4. Have students think about and explain to peers how they perceive their spool racer to work. Ask questions such as: Describe the first step of the process to make the spool move. What effect does this step have towards the movement of the spool? Will the spool roll across the floor in the same manner without the first step?

5. Allow students the opportunity to compete in spool races with other students to decipher if variables such as size of the spool, weight of the washer, or tension of the rubber band effect how far or how fast the spool will go.

Concept Introduction:

1. Have students share results from the challenge phase with class. Have students describe and demonstrate how their spool racers work.

2. Using the students' results and understandings from the challenge phase, explain/define energy, potential energy, and kinetic energy. Go back to students' initial theories from the board and incorporate them into the definitions.

3. Discuss how the definitions and the relationship between the two types of energy pertain to the spool racers. Ask students to journal answers to three specific questions:
1) Describe the potential energy of the spool racer.
2) Describe the spool racer's kinetic energy.
3) Define the relationship between the two types of energy by describing how potential energy effects kinetic energy.

Concept Application:

Constructing the "Come Back Can"

1. Cut the ends off of one of the coffee cans
2. Poke a hole in the middle of each of the plastic lids
3. Place one end of the rubber band through the hole of one of the lids
4. Secure rubber band with a toothpick on the outside of the lid

5. Tie the nut in the middle of the rubber band
6. Place lid number one on the can
7. Stretch the rubber band through the can to the other lid
8. Pull the end of the rubber band through the hole of the second lid
9. Secure rubber band with the other toothpick on the outside of the can

Now you can put the can on the floor and give it a nudge. It will roll forward, stop, and then come back! The rubber band is winding as it rolls forward and unwinding as it rolls back. It is because of the weight that it is able to do this. It is fun to have the students guess what is inside the can and then show them one at a time to see if their predictions were correct.

1. Present "Come Back Can". Have students watch the movement of the can several times.

2. Either have students illustrate on a piece of paper how they think the "Come Back Can" is constructed or allow students the opportunity to construct their own "Come Back Can" from various materials.

3. Discuss their hypotheses. Conduct experiments to see if any of the ideas are functional. Compared to the movement of the actual "Come Back Can", guide students to realize how it actually works. Ask questions such as: Remembering how the spool racer works, what do you think starts the motion of the "Come Back Can"? What material allows for this motion to happen? Remembering our definitions of kinetic and potential energy, what can we assume is happening inside of the can during movement? What is one thing the "Come Back Can" does that the spool racers did not do? (It comes back) What do you think is inside of the can that allows it to perform that different task? (A weight)

4. Show students the inside of the "Come Back Can" to verify and test hypotheses. Summarize what was learned about kinetic and potential energy.

Assessment:

Homework: Have students make a collage of pictures of objects from magazines that have both potential and kinetic energy. All journal entries and collages are collected for analysis of comprehension.

Additional Content:

Video clip on you tube @ http://www.youtube.com/watch?v=kaI3c11Wujc
Titled **Zoom Sci - Spool Racers**

Video clip on making a come back is is @
http://www.youtube.com/watch?v=0UW8a1HUPyk

Titled Come Back Can -Kids Craft toy

References:

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