Investigation Four – Collision Zone

Standard III
Students will understand the relationship between the force applied to an object and resulting motion of the object.

Objective 2
Demonstrate that the greater the force applied to an object, the greater the change in speed or direction of the object.

Intended Learning Outcomes
1. Use a science process and thinking skills
2. Manifest scientific attitudes and interests

Standard III

Objective 1

Background Information

The forces of push and pull cause changes in a speed or direction of objects. When a greater force is applied, the change in speed or direction will be greater also.

Pre-Assessment/Invitation to Learn

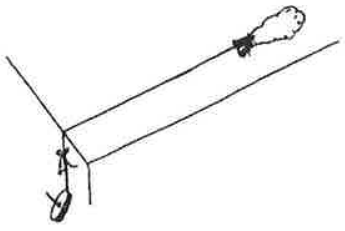
Prepare and perform the following demonstration

Materials
- Socks
- 1 cup of rice
- Piece of string (12")
- Piece of string (36")
- Large paper clip
- 20 washers

1. Fill a sock with one cup of rice and tie it shut with the 12" piece of string.
2. Attach the 36" piece of string to the cuff of the sock.
3. Bend apart the two loops of the paper clip (so it looks like an "S").
4. Pull out the loose end of the larger loop.
5. Attach the smaller loop to the loose end of the 36" piece of string.

Activity:

1. Place the bag of rice on a smooth surface (approx.. 30" from the edge), with the end of the string with the paper clip, hanging off the edge.
2. Predict how many washers will need to be placed on the paper clip before the bag of rice begins to move.
3. Predict how many washers will need to be placed on the paper clip before the bag of rice is pulled over the edge of the table.
4. Start adding washers to the loose end of the paper clip until the bag of rice begins to move and eventually is pulled over the edge of the table. Compare the results of your prediction with the actual results.



The sock filled with rice remains the same weight. As force (washers) is added to the paperclip, it reaches the point where the force is enough to move the weight. The greater the amount of force (number of washers), the greater the effect on the weight (sock); thus making the sock move across the tabletop and over the edge more quickly.

Instructional Procedure

Preparation

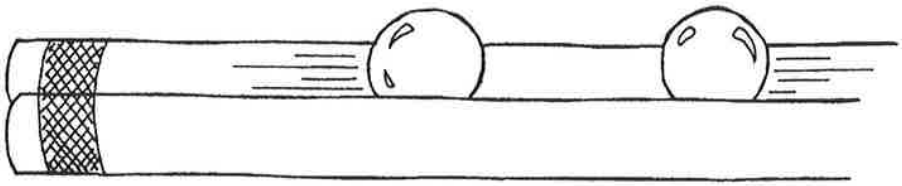
Tape the dowels together at each end.

Materials

- Worksheet: Locating Levers (one per student)
- 2 -3 Foot dowels per group
- Many small balls – marbles, ping pong balls, super balls, metal balls, cork balls, wooden balls

Activity

1. Place the dowels (ramp) on a flat surface.
2. Select the first two balls on the chart and place them on opposite ends of the ramp.
3. Predict what will happen when the two balls collide. Write your prediction on the chart.
4. Use the amount of force, roll the balls towards each other. Write what you observe happening on the chart.
5. Repeat step 3 and 4 until the students have investigated what happens when each ball has collided with another.



Some balls are all the same size but they are not all the same weight. The weight of each ball helps to determine how it will react when it collides with another ball. The materials used to make each ball will also affect the experiment. Some materials absorb more energy.

Name: _____

Collision Zone

	What do you predict will happen when the balls collide	What did you observe happening when the balls collided?
Steel/Cork		
Glass/Wood		
Cork/Rubber		
Glass/Steel		
Wood/Rubber		
Cork/Glass		
Steel/Wood		
Rubber/Glass		
Wood/Cork		
Rubber/Steel		

Curriculum Extensions

Science –

- What a Load! (*ILO 1*)

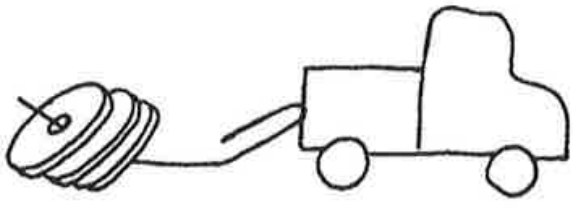
  Preparation

  1. Bend apart the two loops of the paper clip (so it looks like a "S").
  2. Pull out the loose end of the larger loop.
  3. Attach the smaller loop to the back end of the moving toy.

  Activity

  1. Wind-up (or pull the string) on the toy and let it go. Observe the amount of time lapsed and distance traveled before the toy stops moving.
  2. Predict what will happen as washers (weight) are added to the paper clip.
  3. Place four washers on the paper clip, repeat step four. Come the results to the first run.
  4. Place six washers on the paper clip, repeat step four. Compare the results to the first two runs.
  5. Place eight washers on the paper clip, repeat step four. Compare the results to previous runs.
  6. Repeat step four, with two additional washers on each new run, until the toy cannot move the weight. Compare the results of each run with previous runs.
  7. Discuss what is happening in this experiment.

  The force of the car remains the same. Additional weight is added to each run. At first, the amount of washers (weight) added does not affect the toy's performance. Later on, each additional washer (increased weight) makes it more and more difficult to move the load. Finally, the load (weight/washers) cannot be moved by the amount of force applied.



Assessment Suggestions

Did the students complete the Collision Zone chart accurately? Did their predictions become more accurate the further they moved down the chart?

Resources

Books:

- *Tell Me How Fast It Goes (Whiz Kids)* by Shirley Willis (Franklin Watts)
- *Feel the Wind* by Arthur Dorros (Children's Book)
- *The Berenstain Bears Science Fair* by Stan & Jan Berenstain (Randon House, Inc.)
- *Gizmos and Gadgets: Creating Science Contraptions that Work and Knowing Why* by Jill Frankel Hauser (Williamson Publishing)
- *Forces* by Graham Peacock (Steck-Vaughn)

Laser Discs:

- Windows on Science, Primary Vol. 3, Force and Motion Lessons 6-10, 14-17

Web sites:

- http://www.enc.org/weblinks/science/0.1578.1%2DForces.00shtm
- http://www.enc.org/weblinks/science/0.1578.1%2DMotion.00shtm

Homework & Family Connections

Have the students make their own collision zones with the balls they have at home.