PLAY BALL! (1 Hour)

Addresses ITEEA
Level of Difficulty: 2
Grade Range: K-2

OVERVIEW

In this activity, students drop rubber balls in order to observe and measure the effects of elasticity. They use graphs to make predictions for further trials.

Topic: elasticity

Real World Science Topics:

- An exploration of how the height of a rebound is related to the height a ball is dropped from
- An exploration of the elasticity of rubber balls

Objective

Students will gain an understanding of how the height from which a ball is dropped affects how high it bounces. Students will also learn about graphing.

Materials Needed

- rubber ball*
- meter stick or tape measure*
- poster-sized graph paper (grades K-1)
- pencil (grades 2-3)
- crayons (grades K-1)

  * For grades K-1 only one ball and meter stick are needed; for grades 2-3 you will need a ball and meter stick for each team of 2-4 students.

Teacher Notes

Use your discretion on the best way to conduct this activity based on the individual level of your class. For some of the younger K-1 classes, you may wish to perform some or all of the steps of the activity, encouraging children to make predictions and observations. If the group is older or more advanced in their abilities, students can take a more hands-on role in performing the related tasks. Leveled methodologies for K-1 and 2-3 grade levels are provided, where appropriate, throughout the activity. Use your knowledge of each class to determine what the best option is for your particular group.

Teacher Preparation

Create a bar graph titled *Bounce Height* on poster-sized graph paper. The *y*-axis should be labeled *Height* and be marked in increments of 20 cm, 40 cm, 60 cm, 80 cm, and 100 cm. The *x*-axis should be labeled *Trial* and should be long enough to allow for 15 bars to be created. Include a Key in the upper right corner stating "DH = Drop Height."

Standards for Technological Literacy

13. Students will develop the abilities to assess the impact of products and systems. A. Collect information about everyday products and systems by asking questions.

1. **w arm-u p a ctivity:**

Grades K-1 Show students a piece of putty and a rubber band and ask a volunteer to identify each object. Then ask students if they know what the word *elastic* means. Squeeze the piece of putty and ask students to describe what it looks like. Stretch the putty and ask students to describe what it looks like. Stretch the rubber band and let it return to its original shape. Ask the students to describe what it looks like. Then explain that something is said to be **elastic** if it is able to return to its original shape when stretched or squeezed. Ask the students which object they think is more elastic. Students should recognize that the rubber band is more elastic than the putty because it is able to return to its original shape when stretched. Pass the putty and rubber band around so the students have the opportunity to touch/ feel both objects. (Caution students not to stretch the rubber band too far, lest it snap.)

Grades 2-3 Show students a piece of putty and a rubber band. Ask the students which they think is more **elastic**. Students might be confused about the definition of elastic, and so they might pick the putty because it can stretch more easily. Explain that, in science, a substance is said to be **elastic** if it is able to return to its original shape when it is stretched or squeezed. Ask the students again which object they think is more elastic. Students should now recognize that the rubber band is more elastic than the putty. Pass the putty and rubber band around so the students have the opportunity to touch/ feel both objects. (Caution students not to stretch the rubber band too far, lest it snap.)

2. **Grades K–1** You may wish to call on volunteers to help demonstrate this activity. For the activity to work properly, you will need to drop the ball straight down, without giving it any additional energy (i.e., by throwing it). If the ball does not bounce straight up and down, it is possible that the floor is not flat. If that is the case, move to a different area of the classroom. Use a meter stick to measure the height of the bounce. One way to do this is to drop the ball in front of a non-uniform background, such as a bookshelf or a wall with decorations on it. Measure the heights of various distinctive parts of the background and mark the parts with colored masking tape. Write the height measurement on the tape. As you bounce the ball, have the volunteer stand by to show how high the ball bounced by marking a spot on the uniform background with a piece of colored masking tape. This will help you confirm the heights when you measure with the meter stick or tape measure.

Grades 2-3 Divide the class into groups of 2-4 students. Distribute the *Play Ball!* Student Handout and materials to each group. Tell students that the ball should only be used in the manner described in the activity.

For the activity to work properly, students will need to drop the ball straight down, without giving it any additional energy (i.e., by throwing it). Have the students practice dropping the balls without moving their hands, so that the balls bounce straight back upward. (If the ball does not bounce straight up and down, it is possible that the floor is not flat. If that is the case, have students move to a different area of the classroom.) Tell students they will be observing how high the balls bounce. Although students should use a meter stick to measure the height of the bounce, they should also have a way of confirming their observations. One way to do this is to drop the ball in front of a non-uniform background, such as a book shelf or a wall with decorations on it. Students should measure the heights of various distinctive parts of

the background and mark the parts with colored masking tape. Have them write the height measurement on the tape. As students bounce the balls, volunteers stand by to show how high the ball bounced by marking a spot on the uniform background with a piece of colored masking tape. This will help them confirm the heights that they measure with the meter stick or tape measure.

3. Before students start have them create a hypothesis regarding the effect of dropping the ball from a greater height on the height of the bounce.

   Grades K-1 Write some hypothesis on the board.

   Grades 2-3 Divide the class into groups of 2-4 students. Distribute the *Play Ball!* Student Handout and materials to each group. Tell students that the ball should only be used in the manner described in the activity.

4. **Grades K-1** Hold a meter stick such that the 0 cm mark is touching the floor. For the first trial, drop the ball from the 20 cm mark on the meter stick. Have a volunteer make sure the bottom of the ball is aligned with the 20 cm mark before you drop it. The volunteer should measure the height of the bounce by observing how far up along the non-uniform background the bottom of the ball reaches on the bounce and place a piece of colored masking tape on the background to mark the height. Measure and record the height. Perform three trials from this height, calling on a different volunteer each time.

   Hang the *Bounce Height* graph from Teacher Preparation on the board. Help a volunteer to mark the height of the first trial on the graph and turn it into a bar. Label that bar *Trial 1*, (below include) *DH = 20 cm*. Then allow the student to fill in the bar with crayon. Repeat this step for the remaining two trials labeling those bars *Trial 2, DH = 20 cm* and *Trial 3, DH = 20 cm.*

   Grades 2-3 Each group should hold a meter stick such that the 0 cm mark is touching the floor. For the first trial, each group should drop its ball from the 20 cm mark on the meter stick. They should make sure the bottom of the ball is aligned with the 20 cm mark before they drop it. They should measure the height of the bounce by observing how far up the meter stick the bottom of the ball reaches on the bounce and place a piece of colored masking tape on the background to mark the height. Students can then use the meter stick to measure the height and record their observations in the table on the handout. Have them perform three trials from this height.

5. **Grades K-1** Repeat the ball drop from 40 cm and 60 cm with three trials at each drop height. Record the results on the *Bounce Height* graph using the same methodology used for the 20 cm drops. Have students use the graph to make predictions about what will happen if you drop the ball from 80 cm and 100 cm. Repeat the ball drop from 80 cm and 100 cm. Perform three trials at each height, and record the observations on the graph.

   Guide the class in a discussion about this activity using the questions from the Student Handout.

Grades 2-3 Students should repeat the ball drop from 40 cm and 60 cm. They should perform three trials at each height. Again, have the students record their observations on the table in the Student Handout.

Have students use their table data to make predictions of how high the balls will bounce when they are dropped from 80 cm and 100 cm. Students should repeat the ball drop from 80 cm and 100 cm. They should perform three trials at each height, and record their observations on the table.

Have students answer the questions in the Student Handout.

6. w rap-up a ctivity: For this wrap up activity, you will drop another ball made of a different material (for example, a tennis ball, golf ball, table tennis ball, or bean-bag ball) from 100 cm. Before you drop the ball, pass it around to the students so that they can see how it feels. Then have students make a prediction of how high the ball will bounce.

Have student volunteers come to the front of the class to measure the height of the bounce for the ball. Perform three trials, and record the results on the board. Compare it to the students' predictions.

Lead a discussion of how elasticity caused the ball to bounce. Ask students what happens when the ball hits the ground. If students need help, show them something else being squashed, like a ball of paper or putty. Then ask them what happens to an elastic object when it is squashed. Students should remember from the introduction that the object returns to its original shape. Tell students that this elastic force causes the ball to bounce.

Play Ball! extension a ctivities

For the extension activity, students can compare the elasticity of a variety of materials. To do this, they can perform the experiment above using different objects. To save time and reduce the number of variables, they should drop all objects from the same height (100 cm is suggested, as it will produce the highest bounces and therefore probably allow for the most accurate measurements). Students should create a bar graph displaying the bounce heights for the objects they selected. They should use this information to compare the elasticity of the different objects. Encourage them to identify factors that might affect the results (such as the shapes of the objects).

w hat does it mean when something is elastic?

When people think about something being elastic, they usually think of that object being able to be stretched. For example, rubber bands can be stretched well beyond their original length without breaking. However, this is not what makes them elastic. Scientifically speaking, a substance is elastic if it quickly returns to its original shape after it is stretched. Substances (such as putty) that stretch easily but do not return to their original shapes are not elastic.

w hat are some real world uses of elastic materials?

Elastic materials have many real world uses. Many common objects, such as rubber bands, make use of elastic materials. Springs of all kinds are elastic. The elasticity of the spring comes primarily from its coiled shape. Elastic materials are used in many types of clothing, particularly those such as professional swimsuits, which are intended to closely hug the body. The elasticity of rubber allows the material to be used in many applications where a material must rebound from repeated stresses. These include car tires and running shoes.

Key vocabulary

elastic: describes a material that can be stretched or squeezed and return to its original shape

Siemens SCIENCE Day
LEARNING BY DOING

Answer the following questions:

1. How do you think the original height of the ball will affect the height of the bounce?

[I think dropping the ball from a greater height will lead to a higher bounce.]

Height	Trial 1	Trial 2	Trial 3
20 cm			
40 cm			
60 cm			
80 cm			
100 cm			

2. What is your prediction for the height of the bounce for 80 cm and 100 cm?

[It will not have enough to eat.]

3. Did your observations support your hypothesis? Explain your answer.

[My data supported my hypothesis. The ball bounced higher when we dropped it from a greater height.]

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Name:

Date:

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Height	Trial 1	Trial 2	Trial 3
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40 cm			
60 cm			
80 cm			
100 cm			

2. What is your prediction for the height of the bounce for 80 cm and 100 cm?

3. Did your observations support your hypothesis? Explain your answer.