



## **K-2 Physical Science**

### **Southern Nevada Regional Professional Development Program**

#### ***Balls and Ramps***

#### **INTRODUCTION**

Most children come to school with some prior experience playing with different kinds of balls and in a variety of ways. They already have some basic knowledge of how balls roll and how easy they are to roll, throw or catch.

#### **WHERE'S THE SCIENCE?**

Students will have the opportunity to explore, observe and compare the properties of balls they will be using during their investigations allowing them to become more closely aware of the materials with which they are working. It also develops background knowledge which they can apply in their future investigations.

After the initial investigation students will begin looking at what they have to do to make the balls roll (apply a force), take the time to roll the balls, make comparisons, and come to some conclusions as to what might be happening.

When ramps are added to the investigations, students can draw on the properties of the balls and begin to notice what happens with regard to the different masses of the balls and how far and fast they roll. The data they collect serves as evidence to support the claims they make.

As simple and straightforward as this seems, these investigations for primary students help to lay the foundation for more in-depth investigations in the upper grades of Newton's Laws of Motion.

## **MATERIALS**

The following materials are enough for a group of 3-4 students:

- 1 tennis ball
- 1 wiffle ball
- 1 ping-pong ball
- 1 golf ball
- 1 small rubber ball (1 inch diameter)
- 1 cardboard ramp (12 x 18 inches)

Note: These can easily be made by cutting out the top section of a box lid from the copy paper box tops.

- Ruler or yardstick
- Wooden blocks

Teacher materials:

- Science notebooks for each student
- Chart paper

## **PROCEDURES**

### ***Lesson One: Properties of Balls***

1. Call the students to the group area. Hold up a small rubber ball and ask the students to identify the object you are holding. (Ball) Ask: Where have you seen balls before? How have you used them? Chart responses.
2. Tell the students that today they are going to closely observe and compare a variety of balls that you brought in. Their task will be to tell you all they can about the balls; in other words, they will describe the properties. What do they look like? How do they feel? Tell the students that they will be describing the properties of the various balls, and they should record observations and notes in their science notebooks.

3. Send the students back to their seats and pass out materials and science notebooks.
4. As students work, move from group to group, checking their observations and making sure they are recording in their science notebooks.
5. When the students are finished, call them back to the group area with their science notebooks and discuss and chart what they observed. **Note:** You can place each of the balls in a small plastic bag and staple or tape it to chart paper labeled, “The Properties of Balls”. Then, under each ball, list the properties the students share about each one.
6. Review what the students learned about the properties of balls today.
7. Instruct the students to return to their science notebooks and record what they learned today. Collect materials and science notebooks.

**Extension:**

Using their science notebooks as a reference tool, students can make a small individual book titled, “The Properties of Balls”. On each page they can draw a picture of a ball and list two properties or write a sentence describing the ball.

**Lesson Two: Rolling Balls**

1. Call the students to the group area and review what they learned about the properties of balls from yesterday’s lesson.
2. Tell them that today they are going to roll the balls and observe and compare how they roll. Demonstrate what you mean by rolling so students are not tempted to throw the balls. Ask the students which ball they think will be the easiest to roll and to explain their reasoning. Have students share out with a partner and then share out predictions whole group.
3. Explain to the students that each group will sit in a circle on the floor and take turns rolling each ball, one at a time, to all

the group members. After the group finishes rolling a ball they should stop and record observations in their science notebooks before moving on to the next ball. **Note:** You may need to move to the lunchroom or playground for this activity so that all the groups work on the same type of surface. In this way, you will be controlling a variable that could affect the results.

4. As the students work, move from group to group, checking their observations and making sure they are stopping to record observations in their science notebooks. Introduce the term **push** by asking the students what they have to do to make the ball move.
5. When everyone is finished rolling each of the balls, collect the materials and return to the group area. Instruct students to bring their science notebooks with them to the group area.
6. Post a new chart labeled “Rolling Balls”. You may want to staple or tape a sample of each ball on the chart to record observations underneath again. Hold up the tennis ball and say: This is the tennis ball. How did it roll? Chart responses. Repeat for the remaining balls. Pose the following questions, “Based on the investigation today, which ball is the easiest to roll? What makes a ball a good roller?”
7. Review what the students learned about both the properties of balls during the first lesson and rolling the various balls during today’s lesson.
8. Instruct the students to return to their science notebooks and record what they learned today. Instruct students to also add the terms **force** and **push** to the vocabulary word bank in their science notebooks, as you add it to the class word wall. Collect science notebooks as the students complete their entry.

### **Homework:**

Students can interview friends and family members about sports where a ball is part of the game, and then share this data with

the class tomorrow. They might find out the names of sports that use balls, what kinds of balls are used, what type of force moves the balls and so on. You can make a classroom bulletin board labeled “Sports Where a Ball is Part of the Game!”

### **Lesson Three: Balls and Ramps**

1. Call the students to the group area and review what they have learned about balls so far.
2. Introduce the cardboard ramp and tell the students that they will be observing and comparing the balls today as they roll down a ramp.
3. Demonstrate how to set up the ramps for the students, (use one textbook for the incline) and how to release the ball by simply lifting their hand and allowing the ball to roll. **Note:** Mark the release position on the cardboard ramps with a red dot before passing out to avoid variables. Remind the students that in order to roll their balls yesterday, they had to apply a **force** or **push** the ball to make it roll. However, today they just want to simply allow their ball to roll.
4. Pass out materials to the students and allow them time to explore each ball as it rolls down the ramp. **Note:** You may need to move to the lunchroom or playground for this activity so that all the groups work on the same type of surface.
5. As the students work, move from group to group, checking their observations and making sure they are recording observations in their science notebooks. Introduce the term **gravity** by asking the students what is causing the ball to roll down the ramp. Tell the students that gravity is a force that pulls things down to the ground; therefore, gravity is helping their balls roll down the ramp.
6. When everyone is finished rolling each of the balls down the ramp, collect the materials and return to the group

area. Instruct students to bring their science notebooks with them to the group area.

7. Hold up the tennis ball and say: This is the tennis ball. How did it roll down the ramp? Add responses to the chart labeled “Rolling Balls”. Repeat for the remaining balls.
8. Review what the students learned about both the properties of balls and rolling the various balls. Pose the following question to the students again: “What makes a ball a good roller when rolling down the ramp?”
9. Instruct the students to return to their science notebooks and record what they learned today. Make sure the students add the term **gravity** to the vocabulary word bank in their science notebook, as you add it to the word wall. Collect science notebooks as the students complete their entry.

#### **Lesson Four: Collecting Data on Balls and Ramps**

1. Call the students to the group area and review what they learned about balls rolling down ramps. Pose the following question: “Based on your observations from the last lesson, which ball do you think will roll the farthest?” Have the students turn to a partner and share predictions. Share out whole group and chart predictions.
2. **Note:** You need to make arrangements to use either the lunchroom or the playground for this investigation. Instruct the students to have two students at the ramp releasing the balls and two students in the field to measure how far the ball traveled. If you use the lunchroom, the students can use the floor tiles as a form of non-standard measurement. Remind students to record their results in their science notebooks.
3. Explain that they should release each ball three times and record the distance traveled each time. Show how to use the

- meter stick to measure the distance traveled. Don't worry about exact measurements.
4. Line up and move to the investigation area. Show the students where to set up the ramps, making sure everyone has the end of their ramp on the starting line. Pass out materials and science notebooks, and let the investigating begin.
  5. As the students work, move from group to group, checking their observations and making sure they are recording observations and data in their science notebooks.
  6. When everyone is finished, collect the materials and return to the classroom. Instruct the students to meet with their group and discuss and summarize their data. They should decide as a group which ball rolled the farthest. You can also pass out chart paper to each group and let them design a method for sharing their data with the whole class using the chart paper.
  7. Call the students back to the group area and share out results. Pose the following question: "What makes a ball a good roller?" Share and discuss.
  8. If no one mentions weight, ask the students if they think the weight of the ball makes a difference. Introduce the pan balance scale and demonstrate for the students how to measure the weight of their ball; use pennies as a comparison measure. Send the students back to their seats to weigh their balls.
  9. Call the students back to the group area with their science notebooks. Share and discuss measurement results. Ask the students the following, "Looking at your, data does the weight of the ball affect how far it will roll?"
  10. Instruct the students to write what they learned about the balls and ramps today in their science notebooks.

**Lesson Five: Making balls stop, turn and change direction**

1. Call the students back to the group area and review everything they have learned about balls so far.

2. Pose the following questions: “How could we make the balls stop rolling? How might we make them turn? Or change direction?” Chart responses.
3. Introduce the small wooden blocks, and explain to the students that their job today is to select one ball from the set of balls and to investigate how they can make the ball stop, turn or change direction.
4. Pass out materials and let the investigating begin.
5. Move from group to group, checking on student progress and remind the students to record observations in their science notebook.
6. When the students are finished with their investigation, send them to the group area with their science notebooks and the ball they selected. Collect all the other materials.
7. Set up a demonstration ramp at the group area; as you discuss results, call on various groups to demonstrate their procedure for stopping or turning their ball for the class.
8. Review what the students learned today about balls and ask them to record what they learned about balls in their science notebooks.

### **Lesson Six: Which ball will roll the fastest?**

1. Call the students to the group area with their science notebooks and review what they have learned about balls rolling down ramps. Pose the following question: “Based on everything you have learned about balls so far, which one of the balls, do you think will roll the fastest?” Have the students record their predictions in their science notebooks and explain their reasoning. Share out whole group and chart predictions.
2. Demonstrate for the students that they will be setting up a ramp three feet from the wall and then release their ball from the starting position (red dot) at top of the ramp. They will need a time keeper to record how long it takes each ball to reach the wall and they should test each ball three times.

- Note:** You need to make arrangements to use either the lunchroom or the playground for this investigation. Remind students to record their results in their science notebooks.
3. Line up and move to the investigation area. Show the students where to set up the ramps, making sure everyone has the end of their ramp on the starting line so that their ramp is three feet from the wall. Pass out materials and science notebooks, and let the investigating begin.
  4. As the students work, move from group to group, checking their investigations and making sure they are recording both observations and data in their science notebooks.
  5. When everyone is finished, collect the materials and return to the classroom. Instruct the students to meet with their group and discuss and summarize their data. They should decide as a group which ball rolled the fastest.
  6. Call the students back to the group area and share out results. Pose the following question: “What makes a ball roll fast?” Do balls that roll fast also roll far? Share and discuss.
  7. Instruct the students to write what they learned about the balls and ramps today in their science notebook.

### **Lesson Seven: Investigating Inclines**

1. Call the students back to the group area with their science notebooks and open the lesson by asking each of them to share one thing that they have learned about balls.
2. Tell the students that yesterday they were investigating which ball rolled the fastest. Review their results. **Note:** Have two ramps set up in the group area, one with one textbook as an incline and one with two textbooks as an incline. Call the students’ attention to the ramps and pose the following questions: “What do you notice about these two ramps? (one is higher than the other) Will the higher ramp make the balls roll faster?” Ask students to record their predictions in their science notebooks and then share out with the whole group.

3. Line up and move to the lunchroom or playground to set up the same investigation as in lesson six, only this time students will set up a ramp using two textbooks for the **incline**. Pass out materials to the students as they finish setting up their ramps. Remind them to have a time keeper and to roll each ball three times and record the data.
4. As the students work, move from group to group, checking their investigations and making sure they are recording both observations and data in their science notebooks.
5. When everyone is finished, collect the materials and return to the classroom. Instruct the students to meet with their group and discuss and summarize their data. They should decide as a group if the **incline** or slope of the ramp made each of the balls roll faster.
6. Call the students back to the group area and share out results. Pose the following question: “Did the incline make each of the balls roll faster?” Share and discuss.
7. Instruct the students to write what they learned about the balls and ramps today when they used a steeper incline for their ramp in their science notebook. Add incline to the science word wall and instruct the students to add it to their word bank page in their science notebook. Students should draw a picture after the word to help them remember what it means.

Homework: Bring your favorite ball to share at school tomorrow and list the properties of your ball. You should also be ready to tell us why it is your favorite ball. Take a picture of each student with his/her favorite ball and make a class big book.

### **Vocabulary:**

**Force:** a push or pull that causes an object to move, stop, or change direction.

**Gravity:** a force that pulls things toward the Earth

**Incline:** slope, angle

- Motion:** the act of moving
- Pull:** to use or apply force to move something towards us; tug, drag
- Roll:** to move by turning over and over

### **Additional Resources**

*Science in Motion* (big book) <http://www.newbridgeonline.com>

Students investigate the forces of motion including pushing, pulling, starting, stopping, changing direction, and friction.

### **Nevada State Standards**

P2B1 Students know the position and motion of an object can be changed by pushing or pulling. E/S

P2B2 Students know things move in many different speeds (e.g., straight line, zigzag, vibration, circular motion, fast/slow). E/S

P2A4 Students know different objects are made of many different types of materials. E/S

N2A1 Students know how to make observations and give descriptions using words, numbers and drawings. E/S

N2A2 Students know tools can be used safely to gather data and extend the senses. I/L

N2B2 Students know that, in science it is helpful to work in a team and share findings with others. E/L

**Safety Reminder: N/A**