Balanced and Unbalanced Forces

Lesson Overview

Activity video available at edu.zspace.com

Students will demonstrate their knowledge of how balanced and unbalanced forces affect objects through this two-part activity. First, using only the materials provided, they will create a simple presentation of a balanced and unbalanced force. Second, they will design their own demonstration of forces and observe and record their observations of the effects of the forces on the soccer ball's motion.

Grade Level: 2nd – 4th

Lesson Time: 30 Minutes

Key Terms:

Balanced
Force
Motion
Predict
Unbalanced

Resources:

Answer Key
Balanced and Unbalanced Forces Demo
USB Drive

Objectives

- Design and run an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of a soccer ball
- Predict outcomes and answer questions based on their observations upon running the investigation

Standards (NGSS and Common Core)

For state specific standards visit edu.zspace.com

Next Generation Science Standards

- Physical Science – Motion and Stability
    - 3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Common Core Connections

- Language Arts
    - RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

Differentiation

- Students may be grouped heterogeneously to allow students with a strong command of the English language to assist in reading or interpreting questions
- Provide a handout with a list of vocabulary terms & definitions that will appear in their activity
- Allow students to provide answers that are handwritten, typed, or verbal
- Work in partners or small groups
- Enrichment: Students could work on the discussion questions and lead the class discussion
- Enrichment: Students could build models of concept
- Specific differentiations are indicated in this document with a Δ symbol

Introduction

Students need basic prior knowledge of balanced and unbalanced forces and their effects on the motion of objects before beginning this activity.

Ask students if they have ever played a game of tug of war. When students respond (and inevitably tell you their stories!), ask how many of them have ever experienced a tie game in tug of war. If any students respond that they have experienced a tie game, ask them to share their experience, making sure to mention why they think no team was able to win. Guide the discussion for students to come to the conclusion that it is possible to tie in a game of tug of war if both teams pull with the same amount of force. Lead the discussion into the concept of force, and how forces can either be balanced or unbalanced. Using zView, show students the "Balanced and Unbalanced Forces Demo" activity.

Break the students into groups and tell them that they will be designing their own demonstration of balanced and unbalanced forces in Newton's Park on the zSpace stations. Have students open the "Balanced and Unbalanced Forces" activity in Newton's Park.

Upon opening the activity, students will see a soccer ball sitting in the middle of an otherwise empty Sandbox.

Activity – Balanced and Unbalanced Forces

1. Predict: What will happen to your object when an unbalanced force is applied in your investigation?
2. Design and build your own demonstration of how unbalanced and balanced forces affect the motion of the soccer ball. You may use any of the supplies in your inventory. Take a screenshot of your setup before running your experiment.
3. Run your experiment.
4. Gather Data: After running your experiment, what was the outcome? How did applying an unbalanced force to your object affect its motion?
5. Communicate Results: Take a screenshot of the outcome of your experiment to show how the unbalanced force affected the motion of your object.

Δ Have students obtain more balls from the "Balls" inventory and apply varying amounts of force to each ball. Have them predict outcomes, gather data, and document results.

Δ Have students use two or more Force Areas from the "Forces" inventory to apply force to a ball. They should attempt to apply balanced force to the ball and document the results, either through writing, taking a screenshot, or taking a video.

Teacher Note

Students should notice that when an unbalanced force is applied, the ball will move, and when balanced forces are applied, the ball does not move.

While observing the students create their demonstrations, identify any that would be useful for presenting to the class. Export the activities to a USB disk and show via zView on the teacher station.

Closing

The teacher will use zView and a USB disk to show chosen student demonstrations to the class. Together, they will discuss experimental results. The class will participate in a whole-group discussion of the effects of balanced and unbalanced forces on the motion of objects. The following Questions for Discussion that are associated with the "Balanced and Unbalanced Forces" activity can be used at the teacher's discretion.

Questions for Discussion

1. How did you know that all the forces were balanced on your object before you ran your demonstration?

   Answers will vary. Sample Answer: I knew that all the forces were balanced on my object because the object did not move.

2. How does adding an unbalanced force to an object affect its motion?

   Answers will vary. Sample Answer: Adding an unbalanced force to an object might cause the object to move, if the force is great enough.

3. If I applied a greater amount of force to that same object than I applied before, how would you expect the motion of the object to change?

   Answers will vary. Sample Answer: I would expect that the ball would move farther than it did in the first demonstration.

4. Can you think of any examples of objects being affected by balanced forces?

   Answers will vary.

∆Investigate Further

Extension Activity: Take students outside and have them play a quick game that requires force (kickball, tug of war, tennis, etc.). Have them list all the instances of any object either applying a balanced or unbalanced force, or all the instances of any object having a balanced or unbalanced force applied to it. Have the students describe how they knew a force was applied.

Answer Key – Balanced and Unbalanced Forces

Activity Questions Provided in Newton's Park

1. Predict: What will happen to your object when an unbalanced force is applied in your investigation.

   Answers will vary. Sample Answer: I expect that when an unbalanced force is applied to my ball, the ball will move in the direction of the force.

2. Design and build your own demonstration of how unbalanced and balanced forces affect the motion of the soccer ball. You may use any of the supplies in your inventory. Take a screenshot of your setup before running your experiment.

3. Run your experiment.

4. Gather Data: After running your experiment, what was the outcome? How did applying an unbalanced force to your object affect its motion?

   Answers will vary. Sample Answer: When I applied an unbalanced force to my ball, it moved in the direction of the force.

5. Communicate Results: Take a screenshot of the outcome of your experiment to show how the unbalanced force affected the motion of your object.