

Overview:

Gravity affects us everyday. In this lesson, students visualize the effect of drag on gravity and discuss how gravity affects weight.

Objectives:

The student will complete a lab to determine the effect of drag on gravity.

Targeted Alaska Grade Level Expectations:**Science**

- [3] SA1.1 The student develops an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.
- [3] SB4.2 The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by recognizing that objects can be moved without being touched (e.g., using magnets, falling objects, static electricity).

Vocabulary:

gravity – an invisible force that pulls together any two objects

drag - to be drawn or hauled along; experienced by moving objects due to friction

Materials:

- Paper (two sheets per group plus two for teacher demonstration)
- Branley, F. *Gravity is a Mystery*. New York, NY: Harper Collins, 2006.
- Ping-Pong® ball (one per group)
- Straw (one per group)
- Stopwatch (one per group)
- Wiffle® ball (one per group)
- transparency film (one square per group)
- Yard stick (one per group)
- VISUAL AID: "Drag"
- STUDENT LAB: "Dropping the Ball"
- STUDENT WORKSHEET: "Gravity Measurement"

Activity Procedure:

Critical Thinking Activity. KWL Chart. Create a KWL chart on the board. The chart is composed of three columns. Label the first column "Know," the second column "Want to Know," and the third column "Learned." Ask students to fill in the first two columns by sharing what they know about gravity and what they want to know. Complete the third column at the completion of the lesson.

1. Ask for two student volunteers to be timers. The volunteers should start the timer when the teacher drops the items and stop the timer when they reach the floor; one timer to each item. Ask students to observe carefully. Take two sheets of paper. Drop both simultaneously. Write down the times on the board.
2. Now, crumble one of the sheets of paper into a ball. Repeat dropping the paper and have students time the fall. Ask the class what changed. Make sure students understand that the weight of the paper is the same; the only difference is the surface area.
3. Explain that surface area creates what is called drag. Drag pulls in the opposite direction that something is moving. Show students VISUAL AID: "Drag." Ask them to think of how a parachute works. This is drag. As the parachute falls, it traps air inside its dome slowing the fall.

4. Divide students into small groups and distribute STUDENT WORKSHEET: "Dropping the Ball" and all necessary supplies to each group. Ask students to time the fall of each of the items specified on the worksheet.
5. When students have completed the lab, ask them to share their results briefly with the class. Did everyone come to the same conclusion? If not, why not?
6. Ask students why the objects fell at all? Were they pushed? Pulled? Does the Earth act like a magnet?
7. Explain that in some ways gravity is like magnetism. It is invisible like magnetism and works without touching; however gravity works on any two objects. Why don't we feel pulled to each other, or the table we're sitting at, or any other objects? The size of the object affects its pull. The Earth is large enough that we feel its pull.
8. Our weight is the measurement of gravity against our bodies. If you were on Mars, where the force of gravity is less, you would weigh less even though your actual body mass had not changed. Your weight on Mars would be $\frac{1}{3}$ your weight on Earth. Your weight on the moon is $\frac{1}{6}$ that of your weight on Earth. (gravity on Earth>Mars>moon)
9. Distribute STUDENT WORKSHEET: "Gravity Measurement." Ask students to complete the worksheet.
10. Complete the KWL chart.

Answers:

STUDENT LAB: "Dropping the Ball"

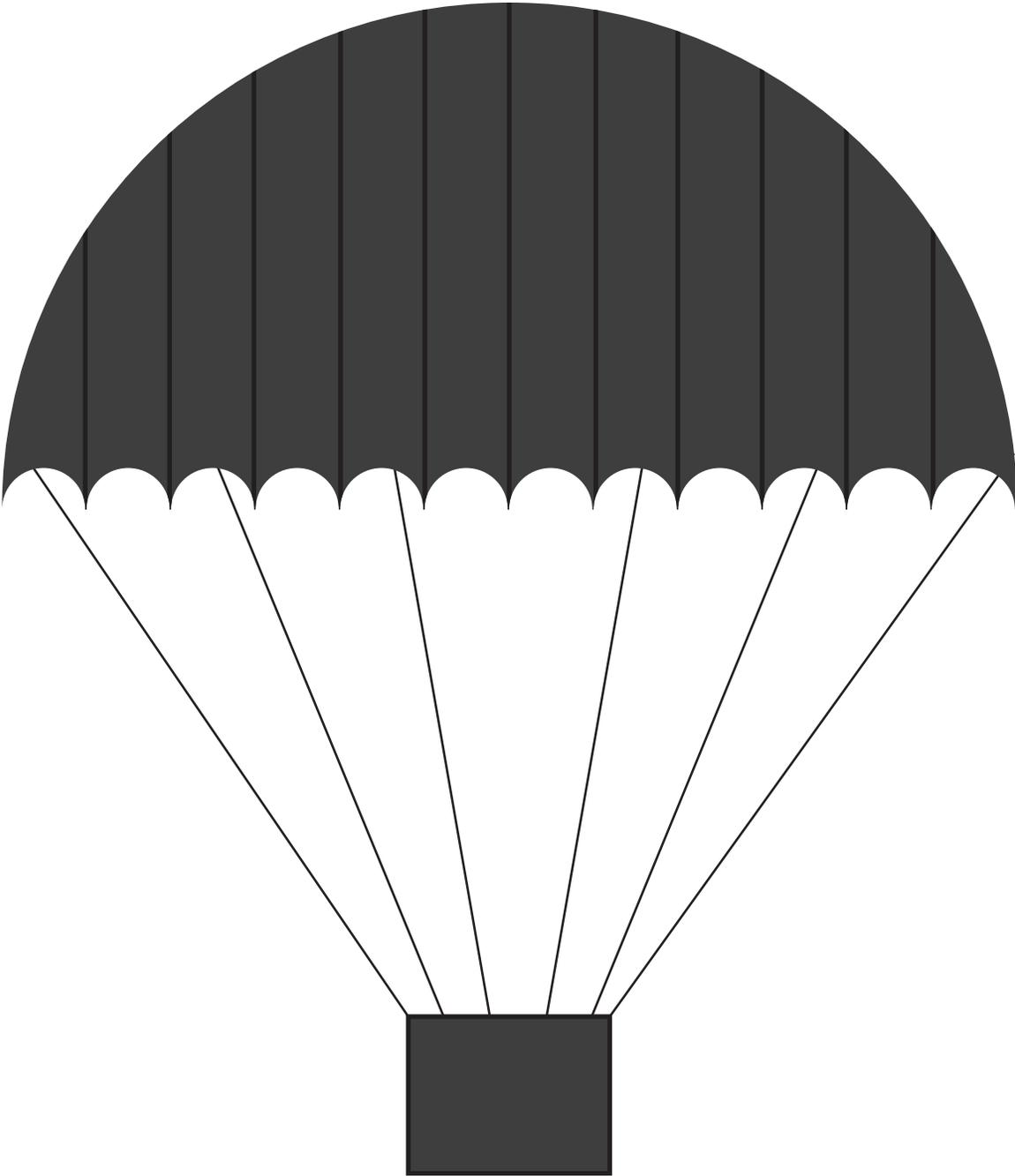
Answers will vary.

STUDENT WORKSHEET: "Gravity Measurement"

Answers will vary but should be mathematically correct.

DRAG

VISUAL AID



NAME: _____
DROPPING THE BALL

Testable Question:

Does surface area affect how fast an item falls?

Hypothesis:

Write a hypothesis based on your observation on the two sheets of paper.

Investigation:

Materials:

- Ping-Pong® ball
- Paper (crumpled into a ball)
- Straw
- Stopwatch
- Yard stick
- Wiffle® ball Paper
- Transparency film square

Procedure:

1. Select one student to act as the timer. He or she will time the fall.
2. Select another student to be the one to drop the items.
3. Drop each item from a height of one yard. Time the fall from the moment it leaves the student's hand to when it hits the ground. Repeat each test three times and take the average. Enter all data into the Data chart below.

Data:

1. Describe the data to be collected. A sample data table is provided below.

Test Items	Fall Time (seconds)			Average Time
	#1	#2	#3	
Ping-Pong® ball				
Wiffle® ball				
Paper (flat sheet)				
Paper (crumpled ball)				
Straw				
Transparency film square				

2. Did the items fall faster or slower than each other? _____

NAME: _____
DROPPING THE BALL

STUDENT LAB
(page 2 of 2)

Analysis of Data:

3. Which item dropped the fastest and why? Which item dropped the slowest and why?

Conclusion:

4. What is the major difference between each item?

A. Weight

C. Surface area

B. Shape

D. answer

5. Was your hypothesis proven or disproven? Explain _____

Further Questions:

6. What other items could you test? Explain why they would be good choices. _____

NAME: _____
GRAVITY MEASUREMENT

STUDENT WORKSHEET

Directions: Answer the questions below.

1. What is your approximate weight? _____

2. Your weight on Mars would be $\frac{1}{3}$ your weight on Earth. What would your weight on Mars be? Show your work below.

3. Your weight on the moon would be $\frac{1}{6}$ your weight on Earth. What would your weight on the moon be? Show your work below.

4. Would your weight on Jupiter be higher or lower than on Earth? Why?
