

LESSON: Gravity

INSTRUCTOR: Jodi Rees

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DISTRICT: Davis

GRADE LEVEL: 2

CORE CURRICULUM

Science Standard 3: Physical Science

Objective 1: Communicate observations about falling objects.

Intended Learning Outcomes:

(P) When science investigation is done the way it was done before, we expect to get a very similar result.

(N) Sometimes people aren't sure what will happen because they don't know everything that might be having an effect.

(C) In doing science, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.

Lesson Objective: The students will experiment with various objects observing how gravity affects the objects. Students will test the effects of gravity on themselves and other objects.

INTRODUCTION

When you throw an object in the air, you exert a force that causes it to fly. It continues to fly until the effects of gravity become stronger than the force you used. Gravity pulls the object back toward Earth. Gravity is strong and pulls objects without touching them. Gravity is always working. It is a constant force, which means it never stops! The farther an object falls, the faster gravity makes it travel. Gravity can work in our favor; when we ride a bike down a hill, we go faster and faster as we near the bottom. Gravity can also work against us; when we ride a bike up a hill and it becomes more difficult to pedal.

Very light objects, such as feathers or seeds, fall slowly or even seem to float in the air. They are so light that air can hold them up against the force of gravity. Air and air resistance can cause objects to fall slowly to the ground. Air can slow an object, but it can't stop gravity.

A common misconception is that heavier or larger objects will fall faster than objects that are smaller or lighter.

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INVITATION TO LEARN

- Ask: "If I dropped a basketball and a marble at the same time, which one would hit the ground first?" Students will make a prediction. "Why did you choose that answer?"
- Drop both items from a high vantage point. Allow students to observe and record their observations in their science journals.
- Repeat the experiment three more times to model good experimentation.
- Make a comment such as, "That was odd, don't you think? The basketball is heavier than the marble, isn't it?"
- Think aloud about this question. Then tell the students, "I think this is something we need to experiment with and try with other objects in our groups."

INSTRUCTIONAL PROCEDURES

Why Things Fall

- Choose several items from your classroom (*paper, pens, pencils, books, etc.*) and drop them.
- Pick up an unsharpened pencil.
- Ask: "What will happen if you drop it?" (It will fall) "Which direction will it fall?" (Down) "Are you sure?"
- Do not drop the pencil at this point.
- Play the **Looney Tunes video clip** (*see Lesson Materials*) of the coyote chasing the roadrunner and defying gravity. Discuss with students if they think that this is something that could really happen or not.
- Give every student a new, unsharpened pencil. Have them pick up their pencils, hold them out in front of their body and let go.
- Ask: "What happened? Why?"
- Ask: "What is gravity?"
- As a class, come up with a good definition of gravity. Have students record their definition on their **Gravity page**.
- Ask: "If gravity is pulling us toward Earth, why can we still walk around and jump into the air?" (We can temporarily overcome the effects of gravity.)
- On the **Gravity page**, have the students make a list of things that can fall to the Earth. (Rain, snow, leaves, stars, a ball thrown in the air, etc.)
- Create a class list from the ideas of the students.
- Ask: "Are there any items on our list that might never fall all the way to Earth? Why?" Discuss student answers as a class.

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- Ask: "What are some of the reasons why things may not fall to Earth?" (Landing on another object such as your hand or a house; meteorites: the atmosphere stops/slows them)
- Ask: "Are there things that slow the rate at which things fall to the Earth?" (Air)
- Assign students the task of watching for falling objects in the world around them. Have them to name the item and what they saw when the item was falling. "Was there anything that kept the item from reaching the ground? Did the item fall fast or slow?" Students can report back to the class about the falling items they found.

Falling Objects

- Divide students into small groups of two to four.
- Hand each group a **Falling Objects** paper and the materials needed to complete the experiment (*see Lesson Materials*).
- Allow students to work in their groups for 10-15 minutes to complete the experiment.
- Students should record their data collection on the **Falling Objects** paper.
- Answer any questions that arise as you help the groups experiment.
- Have students share the information they collected during the experiment.
- Create a class chart of the findings from each group. Make the **Falling Objects** paper poster size to make the chart.
- Students will discover that objects similar in shape, but with different weights, hit the ground at the same time. However, they will also discover that the unfolded sheet of paper will hit the ground later than the ping pong ball. Or perhaps the feather will fall much slower than the marble.
- Lead students to the knowledge that mass does not affect the rate at which objects fall, but shape definitely makes a difference.
- Ask: "Does gravity change?" (No. Gravity remains constant. Shape changes; gravity does not).
- Ask: "Why is it important to know about gravity?" Help students discover that without gravity we would fly off the earth. Gravity helps us understand how things move around us in our physical world.
- In their science journal, have students write a paragraph that states three important things they have learned about gravity from this experiment. (Objects similar in shape but with different weights will hit the ground at the same time.)

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How High Can You Jump?

- Ask: "How high do you think you can jump?"
- Show students the meter sticks and have them guess how high they can jump.
- Ask: "Will holding a weight affect how high you can jump?"
- Tell students that they are going to find out the answer to these questions in the experiment they are about to do.
- Prior to starting this experiment, tape a meter stick to the wall with zero down at the floor.
- Each student needs a partner to watch his or her jump. They will need to record their jumps on the **How High Can You Jump** paper.
- Each student should jump at least three times while his/her partner records his/her results.
- The observing student should sit on the floor and watch the bottom of the feet of the jumping student. The height of the bottom of the feet is the height that should be recorded.
- Next, students should hold small weights in their hands while they jump. Two, three, and five-pound weights would be ideal.
- Students hold one weight in their hand while they jump.
- Students will follow the same observation guidelines as with the non-weight jumps.
- Students will change places so that every student gets a chance to jump.
- Finish this activity by asking students to record their results and observations in their science journal.
- Have students write a paragraph stating how jumping with weights was different than jumping without them.

LESSON MATERIALS

- Classroom items: paper, pencils, books, etc.
- Looney Tunes Clip: <http://www.spike.com/video/looney-tunes-coyote/2758279>
- Unsharpened pencils for every student
- Gravity Page
- Falling Objects paper
- Ping pong balls, marbles, paper, feathers, pencils, paper clips, erasers
- Science journals
- Meter sticks
- Masking tape
- How High Can You Jump? paper

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- Check to be sure that students have filled in the correct information on their Gravity page, Falling Objects paper, and How High Can You Jump? paper.
- Assess students through their participation in class discussions and activities.

POSSIBLE EXTENTIONS/ADAPTATIONS/INTEGRATION**Writing Fun with Gravity**

- Have the students write a story about gravity. Possible topics include:
 - "A Day Without Gravity": What would happen if you woke up to find that the Earth had no gravity? What would you do? What tasks would be easier? What would be harder?
 - "My Battle with Gravity": Choose an object to be (a ball, a leaf, etc.) and describe the effects that gravity has on you. What is it like to fall to the Earth because of gravity? Describe the experience.
- The book *Waking Upside Down* (see book list) can be used as a way to get students thinking creatively about gravity, or the lack of it.

RESOURCES: BOOKS, MEDIA, ARTICLES, WEB SITES, AND ORGANIZATIONS**BOOKS**

Forces Make Things Move, by Kimberly Brubaker Bradley, ISBN: 0-06-028907-4

Why Don't Things Fall Up?, by Disney, ISBN: 1-57973-143-0

Waking Upside Down, by Philip Heckman, ISBN: 0-689-31930-4

The Science of Gravity, by Science World, ISBN: 0-7398-1323-4

I Fall Down, by Vicki Cobb, ISBN: 0-688-17843-X

MEDIA

Bill Nye the Science Guy: Gravity; Disney; ISBN 1932644954

School House Rock, Science Rock: A Victim of Gravity; Disney; ISBN 0-7888-2925-4

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Retrieved from the World Wide Web on December 12, 2009:

[http://www.teachertube.com/viewVideo.php?video_id=126337&title=Nye Tunes GRAVITY](http://www.teachertube.com/viewVideo.php?video_id=126337&title=Nye+Tunes+GRAVITY)

Retrieved from the World Wide Web on December 12, 2009:

[http://www.teachertube.com/viewVideo.php?video_id=126336&title=Bill Nye on Gravity](http://www.teachertube.com/viewVideo.php?video_id=126336&title=Bill+Nye+on+Gravity)

Retrieved from the World Wide Web on December 15, 2009:

<http://www.sciencenetlinks.com/lessons.php?BenchmarkID=4&DocID=158>**ORGANIZATIONS****FAMILY CONNECTIONS**

- Challenge the students to design and make a paper airplane that will defy gravity by flying in the straightest and furthest path.
- Have the students bring their airplanes to school the next day for test flights. For the remainder of this activity, see "Activity Connected to Lesson" section.

LESSON AND ACTIVITY [TIME SCHEDULE]

- Each lesson is 55 minutes.
- Each activity is 30 minutes.
- Total lesson and activity time is 85 minutes.

ACTIVITY CONNECTED TO LESSON**Gravity Test**

- Make a ramp with a slight tilt. A binder will work well for this.
- Take two marbles of different sizes and line them up at the top of the ramp.

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- Use a ruler to act as a gate which will hold the marbles in place at the top of the ramp.
- Lift the ruler (gate) quickly so the marbles release at the same time.
- Watch the finish line closely to see which marble comes in first (or if it is a tie).
- Keep a sharp eye out for the winner. Complete the race 4-5 times for accuracy.
- Have students record their findings on the Testing Gravity page.

Airplane Contest

- The students should have a pre-made airplane at school (*see Family Connections*).
- Have one student at a time fly his/her airplane. This is best done in a hall with a tile floor. If that is not an option, tape can be placed on the floor as the optimal line of flight.
- Record the results as students fly their planes. To determine each student's result, count how many tiles away from the starting line, then subtract the number of tiles off course (to the left or right).
- If using a tape line, measure the distance from the starting line and subtract the distance from the line of flight (to the left or right).
- Analyze which airplanes were the most successful in meeting the criteria and why.
- Are there some variables in the experiment that could influence the results? How could we control those variables?

ACTIVITY MATERIALS

- Marbles
- Binders
- Rulers
- Science Journals
- Paper for airplanes
- Recording sheet (student class list)
- Masking tape
- Measuring tape or ruler/yardstick

Name: _____

Date: _____

Gravity: Student Page

1. Gravity is _____

2. List as many things as you can that fall to the Earth:

3. What item did you watch fall? _____

What did you see as the item fell? _____

Did anything stop the item from hitting the ground? _____

4. Which two balls is your teacher going to drop?

a. _____

b. _____

Name: _____

Date: _____

5. Predict which ball will hit the ground first. _____

Why do you think that? _____

6. What did you observe about the balls when your teacher dropped them?

Name: _____

Falling Objects

Objects Dropped		Which will this the ground first?	Which object actually hit the ground first?
Ping pong ball	Marble		
Flat paper	Feather		
Pencil	Paper clip		
Crumpled paper	Eraser		
Paper clip	Ping pong ball		

Name: _____

How High Can You Jump?

Jumping without extra weight...

Jump #1: _____ inches

Jump #2: _____ inches

Jump #3: _____ inches

Now pick up a weight. How much does it weigh? _____

Jumping with extra weight...

Jump #1: _____ inches

Jump #2: _____ inches

Jump #3: _____ inches

How did holding the weight in your hand change your jumping ability?

Name: _____

Testing Gravity

In the table below, record the results of your gravity test by circling the marble that finished first. If it is a tie, circle both.

Test #	Marble #1	Marble #2
1	Large	Small
2	Large	Small
3	Large	Small
4	Large	Small
5	Large	Small
6	Large	Small
7	Large	Small

Which marble won most often?

What did you learn about gravity from this test?
