

EXPLORING GRAVITY

BIG IDEA 5: EARTH IN SPACE AND TIME

BENCHMARKS AND TASK ANALYSES

SC.K.E.5.1 Explore the Law of Gravity by investigating how objects are pulled toward the ground unless something holds them up.

The student:

- drops a variety of objects.
- predicts what will happen when different objects are dropped.
- observes and discusses what happens to objects as they are dropped.
- explores ways to keep objects from falling.

SC.K.N.1.1 Collaborate with a partner to collect information.

The student:

- works with a partner to gather information during classroom investigations.

KEY QUESTION

What happens when you drop different objects?

TEACHER BACKGROUND INFORMATION

Gravity is a force. It pulls everything on our planet towards the center of the Earth. This is why things don't float away off of the Earth. The more massive an object is the more gravity it has (the Sun is much more massive than everything else in our solar system, so it has more gravity, which means it pulls us more than we pull it and that is why we orbit the Sun). Another example is our moon. Earth is more massive than the moon, so Earth has more gravity, which means it pulls the moon into orbit around the Earth.

MATERIALS

Teacher

I Fall Down by Vicki Cobb

***One item per child* such as:**

feather
bouncy ball (kickball)
golf ball
paper (flat)
paper (crumpled)
beads
coins
stuffed animal
block
thin book
balloon (one inflated, one deflated)
paper airplane
rock
shell
marble
fabric
pipe cleaner
empty plastic baggie



SAFETY

- Always follow OCPS science safety guidelines.
- Be careful while dropping heavy objects and make certain that students have enough personal space.

TEACHING TIPS

Each student should receive only one of the items in the materials list. Lead students to the discovery that not just heavy or hard things fall, soft and light things are also pulled to the ground by the force gravity.

ENGAGE

Hold up a marker and ask: *What do you think will happen if I let go of the marker?* Allow students to respond and then let go of the marker. *Discuss what happened to the marker and why this happened? (It fell down because you let it go.)* Ask: *Why didn't the marker fall when it was in my hand? (Your hand was holding it up.)* *Can you think of anything that would not fall down when dropped? (various answers)*

EXPLORE

Gather students in a circle around the items from the materials section. Call a student up and allow him to choose one of the items. Have the student hold the item up and ask: *What do you predict will happen when the item is dropped? (various answers)* Allow the student to drop the item and ask: *What happened when the item wasn't being held up anymore? (it fell down)* Repeat the process until each child has had a turn dropping an item.

EXPLAIN

What do you think made the items fall down? (various answers)

Did any item NOT fall to the floor? (They may say the feather floated, but point out that it still eventually fell to the floor.)

Does anyone know what pulls things toward the ground? (various answers)

It's a force called GRAVITY.

What does gravity do? (pull things toward the ground)

EXTEND AND APPLY

Read *I Fall Down* by Vicki Cobb. Allow students to come up with something in the room that they would like to drop to see if gravity will pull it to the ground. Allow time for students to drop the item they chose. Discuss what made it fall down.

ASSESSMENT

As you observe your students, look for these behaviors:

- Do they realize that the different objects are all falling to the ground?
- During the extend and apply portion of this lab, do students use the term gravity in a correct way?
- Do they begin to recognize the pattern that all things will eventually fall to the ground?

GRAVITY AND PARACHUTES

BIG IDEA 5: EARTH IN SPACE AND TIME

BENCHMARKS AND TASK ANALYSES

SC.K.5.1 Explore the Law of Gravity by investigating how objects are pulled toward the ground unless something holds them up.

The student:

- drops a variety of objects.
- predicts what will happen when different objects are dropped.
- observes and discusses what happens to objects as they are dropped.
- explores ways to keep objects from falling.

KEY QUESTION

What will happen when we toss a parachute in the air?

TEACHER BACKGROUND INFORMATION

Gravity is a force. It pulls everything on our planet towards the center of the Earth. This is why things don't float away off of the Earth. The more massive an object is the more gravity it has (the Sun is much more massive than everything else in our solar system, so it has more gravity, which means it pulls us more than we pull it and that is why we orbit the Sun). Another example is our moon. Earth is more massive than the moon, so Earth has more gravity, which means it pulls the moon into orbit around the Earth.

MATERIALS

Teacher

hole punch

Per student

parachute material (such as a handkerchief, 12" piece of cloth or paper towel sheet)

small paper cup

four 6"-8" pieces of string

(optional) small toy people or animals (from Lego or Playmobile kits for example)

SAFETY

- Always follow OCPS science safety guidelines.
- Students should be far enough apart so that they will not bump or hit each other when tossing their parachute in the air.
- Remind students to throw their parachutes straight up and not at others.

TEACHING TIPS

Punch a hole in each of the four corners of the parachute material and punch four holes around the rim of the paper cup before the students enter the classroom. Make sure that there is one parachute and one cup per student.

ENGAGE

Ask: *What happens when you throw items in the air?* Accept student responses. Discuss prior knowledge of parachutes, what they are, look like, and what they are used for. Tell students that they will be making a parachute and will experiment with it by tossing it up in the air many times to see where it goes. Ask: *What do you think will happen when we toss the parachutes up in the air?* Record student predictions.



EXPLORE

Provide students with the materials and ask them to tie one string on each of the corners through the holes. Students should then tie the opposite end of each of the four strings to one of the four holes in the cup. Allow students to test parachutes multiple times by throwing them straight up in the air. Discuss the results. The goal is for students to realize (on their own) that their parachutes will always fall to the ground, regardless of how high in the air it is tossed. The parachute will continue falling until another force or object stops it.

EXPLAIN

What happened when we threw the parachutes up in the air? Did your parachute ever not fall to the ground? Gravity pulls things towards the ground. What do you think would happen if we threw the parachute from a higher place? A lower place? Is there anywhere that you think we could throw the parachute from that it would not fall to the ground?

EXTEND AND APPLY:

Allow students to test different materials for the parachutes.

Allow students to test their own ideas if anyone thought there was a place that they could throw the parachute from that it would not fall to the ground.

ASSESSMENT

As you observe your students, look for these behaviors:

- Do they realize (on their own) that their parachutes will always fall to the ground regardless of how high in the air it is tossed?
- Are they actively involved in the discussion and activity?



PATTERN OF DAY AND NIGHT

BIG IDEA 5: EARTH IN SPACE AND TIME

BENCHMARKS AND TASK ANALYSES

SC.K.E.5.2 Recognize the repeating pattern of day and night.

The student:

- records observations of the sky during the day for at least one month using science notebooks or a class chart.
- records observations of the sky during the night for at least one month using science notebooks or a class chart (teacher can print Moon pictures from weather channel).
- expresses through the use of pictures, diagrams, or orally: understanding of the pattern of day and night, that the Sun can only be seen in the daytime, and that the Moon can be seen at night and sometimes during the day.

SC.K.N.1.5 Recognize that learning can come from careful observation.

The student:

- observes a variety of objects (living and nonliving).
- discusses observations of objects.
- states what was learned from observations.

KEY QUESTION

Do daytime and nighttime occur in a repeating pattern?

TEACHER BACKGROUND INFORMATION

The Earth makes a complete revolution on its own axis every 24 hours and rotates around the Sun in 365 days. Daytime occurs when a portion of Earth is facing toward the Sun during rotation. Nighttime occurs when the portion of the Earth is facing away from the Sun. To the young child, it seems that the Sun is moving when in fact, it is the Earth's movement that makes the Sun appear to move.

MATERIALS

Teacher

Noisy City Day, Anderson
newsprint
stapler

Per student

pair of sunglasses
Day and Night Journal

SAFETY

- Always follow OCPS science safety guidelines.
- Students should not look directly into the Sun.
- Students should not go outside their homes to make observations without adult supervision.

TEACHING TIPS

Make one journal for each child prior to the lesson. Use newsprint cut in half for a ten-page journal. Staple down the left hand side and write Day and Night Journal on the cover. On the first day of the lesson, send a note home with the journal, instructing parents to go outside with their child to observe the night sky, and then have the child draw what he/she saw on the back of a page each night. Be sure to tell parents in the note that the journal is to come back to school each day. The teacher should keep a



class journal also. If the *Noisy City Day* is not available, choose a book that can be used to illustrate daytime.

Save the teacher Day Night Journal to use in the next two lessons and to continue recording data for the next three weeks (to total one month of observations).

ENGAGE

What is day? What things can we see during the daytime? What is night? What things can we see at nighttime? Read and discuss *The Noisy City Day* by Anderson.

EXPLORE

Take the students outside and have them put on their Sunglasses. Remind them that they are not to look directly into the Sun. Ask: *Is it day or night right now? How do we know? What do you observe (notice) that lets you know that it is daytime?* (Answers might include, light, Sunlight, ability to see easily, etc.) *What do you see in the daytime sky?* (Answers might include, clouds, birds flying, planes, the Sun.)

EXPLAIN

Return to the classroom and have the students discuss whether it was night or day and what observations led them to their conclusions. Record their answers on a class chart labeled “Things We See in the Daytime” and “Things We See in the Nighttime.” Ask: *Is it always daytime? How do you know? When will it be nighttime? How do we know when it’s nighttime?*

EXTEND AND APPLY

Day One: Using the class Day and Night Journal, draw a daytime picture on the first page. (This could be as simple as the Sun.) Explain to the children that they will be keeping their journals for four days. Have them write Day 1 and draw their observations on the first page. Instruct the children that they will go outside that evening after dinner to observe the sky and draw their observation on the back of the day page. (This could be as simple as a black sky or a black sky with stars.) Bring the journal back to school the next day so that the observations can be discussed. Continue the process for the next four days.

Day Two-Five: Repeat the process of day one. On day five, there will only be a day picture.

Day Five: Have students make their last observation and record it in their journal. Bring students together and have them start with day one of their journals and ask: *Does anyone notice anything about the day observations?* Does anyone notice anything about the night observations? If no one notices the pattern of day/night, day/night, ask questions to lead the students to the conclusion that day and night are a consistent pattern.

ASSESSMENT

As you observe your students, look for the following behaviors:

- Are they making realistic observations and recording them in their journals?
- Are they able to determine that day and night occur consistently in a pattern?



THE SUN IS SEEN ONLY IN THE DAYTIME

BIG IDEA 5: EARTH IN SPACE AND TIME

BENCHMARKS AND TASK ANALYSES

SC.K.E.5.3 Recognize that the Sun can only be seen in the daytime.

The student:

- records observations of the sky during the day for at least one month using science notebooks or a class chart.
- records observations of the sky during the night for at least one month using science notebooks or a class chart (teacher can print Moon pictures from weather channel).
- expresses through the use of pictures, diagrams, or orally: understanding of the pattern of day and night, that the Sun can only be seen in the daytime, and that the Moon can be seen at night and sometimes during the day.

SC.K.N.1.5 Recognize that learning can come from careful observation.

The student:

- observes a variety of objects (living and nonliving).
- discusses observations of objects.
- states what was learned from observations.

KEY QUESTION

Can the Sun be seen at nighttime or only in the daytime?

TEACHER BACKGROUND INFORMATION

The Earth makes a complete revolution on its own axis every 24 hours and rotates around the Sun in 365 days. Daytime occurs when a portion of Earth is facing toward the Sun during rotation. Nighttime occurs when the portion of the Earth is facing away from the Sun. The Sun cannot be seen at nighttime because that portion of the Earth is not facing the Sun. The Moon is visible during the daytime sometimes because the Moon orbits the Earth.

MATERIALS

Teacher

Goodnight, Moon by Brown

Day and Night teacher journal (from the first lesson)

Per student

Night journal

Per group

picture cards of things that
can be seen or done during the
daytime and the nighttime

SAFETY

- Always follow OCPS science safety guidelines.
- Students should not go outside their homes to make observations without adult supervision.

TEACHING TIPS

Make one journal for each child prior to the lesson with five pages of newsprint stapled on the left hand side and titled, "Night." Teacher may use the journal from the first lesson. Have a note for parents explaining that the Night journal will remain at home for four nights and be brought back to school on the fifth morning. Remind parents that they need to go outside with their child at night to help them observe and record in their journal what they saw at night.



ENGAGE

What is day? What things can we see during the daytime? What is night? What things can we see at nighttime? Read and discuss the book, *Goodnight, Moon* by Brown. Ask what they observed (noticed) in the book that let them know it was nighttime. Tell them to think about the observations that they made last week for the night. Ask what they remember seeing in the night sky. Ask if the journal entries for nighttime ever show the Sun. Record the answers.

EXPLORE

Show students the Day and Night teacher journal from the first lesson and focus on the night pages only. Point out what observations you recorded in your journal. Invite discussion. Allow students to sort pictures into four piles: daytime, nighttime, both, neither. Circulate the room allowing students to justify why each item belongs in the pile they chose.

EXPLAIN

Ask: Is it always daytime? How do you know? When will it be nighttime? How do we know when it's nighttime? Is it always nighttime? What are some differences between day and night time? How do we know when it's going to be day or night? What sorts of things can we do during the day that we can't do at night? What do we usually do at night that we don't do much in the daytime?

EXTEND AND APPLY

Instruct the students in the use of their Night journal. Remind them to only go outside at night with a parent and to record everything they observe in the nighttime sky. Remind them that they are to do this every night for four nights and to bring their journal back on the fifth day.

Day Five: Have students look at their Night journals. Ask them what conclusions they can make from their observations (May include such answers as: It was dark, I saw the Moon, I saw stars, etc.) Record the answers on a class chart. *Ask: Is there anything that you were not able to see in the nighttime?* (the Sun.)

ASSESSMENT

As you observe your students, look for the following behaviors:

- Are they making realistic observations and recording them in their journals?
- Are they able to determine that the Sun is not visible at night?



THE MOON IS SOMETIMES VISIBLE DURING THE DAY

BIG IDEA 5: EARTH IN SPACE AND TIME

BENCHMARKS AND TASK ANALYSES

SC.K.E.5.4 Observe that sometimes the Moon can be seen at night and sometimes during the day.

The student:

- records observations of the sky during the day for at least one month using science notebooks or a class chart.
- records observations of the sky during the night for at least one month using science notebooks or a class chart (teacher can print Moon pictures from weather channel).
- expresses through the use of pictures, diagrams, or orally: understanding of the pattern of day and night, that the Sun can only be seen in the daytime, and that the Moon can be seen at night and sometimes during the day.

SC.K.N.1.5 Recognize that learning can come from careful observation.

The student:

- observes a variety of objects (living and non-living).
- discusses observations of objects.
- states what was learned from observations.

KEY QUESTION

Can the Moon be seen in the daytime or only at nighttime?

TEACHER BACKGROUND INFORMATION

Daytime occurs when a portion of Earth is facing toward the Sun during rotation. Nighttime occurs when the portion of the Earth is facing away from the Sun. The Moon is visible during the daytime sometimes because the Moon orbits the Earth.

MATERIALS

Teacher

When You Look Up at the Moon (Rookie Read-About Science) by Allan Fowler

<http://planetariumweb.madison.k12.wi.us/Mooncal/dayMoon>

Per student

one pair of sunglasses

SAFETY

- Always follow OCPS science safety guidelines.
- Students should not look directly into the Sun.

TEACHING TIPS

If the book, *When You Look Up at the Moon*, is not available, choose a non-fiction book about the Moon that is available. The Moon is best visible during the day in the early morning. Before engaging the children in this lab, access the website listed in teacher materials to determine which days the Moon will be visible during the day.

ENGAGE

Ask the students to tell you what they know about the Moon and record the answers on a class chart.



Read and discuss the book *When You Look Up at the Moon* by Allan Fowler. Ask if they have any new facts about the Moon that they learned from the book and add responses to the chart. Ask: *Do you think that we can see the Moon during the daytime?*

EXPLORE

Take the students outside and have them put on their Sunglasses. Remind them not to look directly into the Sun. Instruct the students to observe the morning sky. If no one notices the Moon, direct the students to look in the general direction of the morning sky where the Moon can be seen.

EXPLAIN

Return to class and discuss their observations. Ask: *Did you observe something that you did not expect to see? (the Moon.) Why do you think we could see the Moon in the daytime? Can you see the Sun in the nighttime?*

EXTEND AND APPLY

Make a large class chart with columns for Monday, Tuesday, Wednesday, Thursday, and Friday and enough space for two weeks of observations. Draw a Moon and Sun in that day's square. For the next nine school days, take students outside each morning to observe whether the Moon and Sun are visible and draw them in the correct squares for each day. The Moon will eventually no longer be visible during the day, but the Sun will. At the end of the two weeks, ask the children what they can determine from the daily record of their observations (The Sun is always visible in the daytime, but the Moon is not.) Make a T-chart labeled "Daytime Sky" and the "Nighttime Sky." Ask: *What do you know about the daytime sky? What do you know about the nighttime sky?* Record their answers on the chart.

ASSESSMENT

As you observe your students, look for the following behaviors:

- Are they making realistic observations?
- Are they able to determine from the daily observations chart that the Moon is not always visible during the daytime?
- Are the students able to describe characteristics of daytime and nighttime skies?



BIG, SMALL, NEAR, AND FAR

BIG IDEA 5: EARTH IN SPACE AND TIME

BENCHMARKS AND TASK ANALYSES

SC.K.E.5.5 Observe that things can be big and things can be small as seen from Earth.

The student:

- identifies that some things seen from Earth are big and some things seen from Earth are small (for example: a building is big and a student is small).

SC.K.E.5.6 Observe that some objects are far away and some are nearby as seen from Earth.

The student:

- identifies that some things seen from Earth are nearby and some things seen from Earth are far away (for example: standing next to the board, it is close and standing across the room, the board is far away).

KEY QUESTION

Do objects change size when they are near or far?

TEACHER BACKGROUND INFORMATION

Objects on earth remain constant in size, shape and mass unless acted on by outside forces. When they are viewed from far away, they seem to become smaller. When viewed from close by, they appear to become larger again.

MATERIALS

Teacher

Near and Far at the Beach: Learning Spatial Awareness by Amanda Boyd

assortment of different sized balls

large utility ball or kickball

tennis ball

Unifix cubes

Per student

Unifix cubes

SAFETY

- Always follow OCPS science safety guidelines.
- Remind students not to put the Unifix cubes into their mouths or to throw them.

TEACHING TIPS

This lab can be done whole group. Pay particular attention to vocabulary used with students. For example, do the objects really change size or do they just appear to change size?

ENGAGE

Read and discuss the book *Near and Far at the Beach* with the class. Hold up the large utility ball and the tennis ball. Ask the students to identify which ball is large and which one is small.

Ask one student to take the utility ball across the room to the other side. Ask which ball looks larger – the utility ball or the tennis ball. Ask which ball is nearer the children and which one is farther away. Did the size of the ball actually change?

EXPLORE



Day One: Take the children, utility ball, tennis ball, and Unifix cubes outside to the playground. Hold up the utility ball and ask if it looks large or small. Ask one child to take the ball across the playground to the other side. Ask the remaining students if the ball looks the same (the expected answer is that it looks smaller). Have the child return. Measure the diameter of the utility ball with the Unifix cubes. Have the students put together the same number of Unifix cubes. Give the students the opportunity to use their line of Unifix cubes to measure against the utility ball. Have a student take the utility ball and his/her Unifix cubes across the playground. Have the remaining students look at the utility ball and ask: Does the ball look large or small? Have them hold up their Unifix cubes in their line of sight and ask if it is still the same length. Have the student with the utility ball show his/her Unifix cubes to measure the ball again (it should be the same). Return with the ball and repeat the measurement task to show that the ball did not really change size. Repeat the activity with the tennis ball.

Day Two: Take the students outside. Have two boys and two girls stand in front of the children. Have them go to the other side of the playground. Ask: *Do the boys and girls look bigger or smaller?* Have the students return. Ask: *Did the boys and girls get smaller or stay the same size?* Let the children take turns throwing an assortment of different sized balls as high into the air as they can. Tell them to watch the balls as they go up high and ask: *Do the balls look bigger or smaller when you throw them high into the air? (They appear smaller because of how far away they are.) Why are they the same size when you catch them as they were before you threw them?*

EXPLAIN

Ask students if any of them have flown in an airplane. Ask the ones who respond to think about when they looked out the window of the plane. Ask them to describe the size of the houses and buildings that they saw on the ground while they were in the airplane.

Did the balls look smaller far away?

Did the balls really change size?

Does the size of objects seem to change when objects are near and far?

Tell them that objects and people remain the same size, but look larger close to us and smaller when they are far away.

EXTEND AND APPLY

Take students on a walk around the school and campus. Point out signs, pictures or objects at the far end of the halls across the campus and ask if they appear to be small or large. When the children walk closer to the sign, pictures or objects, ask if they then look the same or larger. Ask if the sizes really changed or the children's location has changed. After returning to the classroom, instruct the children to draw a picture of themselves. Then have them draw a person near to them (should be approximately the same size) and to draw a person far away from them (should be smaller). Show the children pictures taken out of airplanes that show buildings or houses as very small and of the airport with the plane on the ground with the buildings appearing normal size. Show the children pictures of airplanes, hot air balloons, kites, etc. that are high in the sky and appear to be small and pictures of them closer to the ground and appearing normal size. Have the children discuss why the objects in the sky look smaller and larger when on the ground.

ASSESSMENT

As you observe your students, look for the following behaviors:

- Are they making realistic observations about objects appearing larger and smaller depending upon whether they are near or far?
- Distinguish when objects appear to change size as opposed to actually changing size?

