Shoot for the Moon!

Developed by: Alexa Jones

Date:

Shoot for the Moon!

Table of Contents

UNIT OVERVIEW

Title of Unit: Shoot for the Moon!

Recommended Grade: 4th grade

Time Frame: 10 days of 45-minute lessons.

Unifying Theme:

- Scale- Know the basic characteristics and uses of telescopes.
- Patterns/phases- Identify major lunar phases.
- Patterns- Explain time (days, seasons) using solar system motions.

Integration Model:

- This can be integrated with technology by looking at telescopes and the uses of telescopes in observing objects in space. Students will also use Microsoft Excel when doing the one sun lab entering the length of the shadow measurements.
- This will be integrated into reading and writing as the students will be writing about their observations as well as reading many books that I will have placed throughout the room.
- This unit will integrate speech standards because at the conclusion of the study each student will be giving an oral report on their specific topic.
- The unit can be integrated into math lessons where the children will be able to answer problems based on the solar system.

Essential Questions:

- What is the evidence that the earth's systems change?
- What predictable patterns of change can be observed on and from earth?

Unit Questions:

- Why do the planets revolve around the sun?
- Why are there different phases of the moon?
- Why do we have night and day?

PA Academic Standards addressed in the Unit

Standard Category- 3.3 Earth and Space Sciences
Organizing Category- 3.3.B. - Origin and Evolution of the Universe
Strand- 3.3.4.B1- Composition and Structure
Standard Statement-

Identify planets in our solar system and their basic characteristics.

Describe the Earth's place in the solar system that includes the sun (a star), planets, and many moons.

Recognize that the universe contains many billions of galaxies and that each

galaxy contains many billions of stars.

Brief Description: Before beginning this unit on the universe and solar system, the students must have knowledge of the different planets in our system (i.e. Mercury, Venus, Earth, etc.). There will be three major components of the unit. The first will be the planets and how they move and change. The second will be the earth's moon and the different cycles it has and how it revolves around the Earth. The last will be the sun and how everything else in the universe revolves around the sun.

Day 1: Engage
I will read the students the book *The Magic School Bus: Lost in the Solar System*. I will pose a hypothetical case to the students that they are in Ms. Frizzle's class and have them discuss what they would want to learn about outer space on their adventure in the Magic School Bus. After finishing this, students will come back together and share their ideas with the class. I will be looking to see if the students mention the planets, moon, and sun.

Day 2: Explore
Students will be given different sized and colored Styrofoam balls representing the planets and sun. The students will have time to arrange, compare, and analyze the balls to determine what planet they represent. After doing so, the students will share their ideas with the class (lessonplans.com). **Explain** After coming together and discussing the students answers, we will debate whether their predictions were right and why or why not. This is where students will draw on earlier experience and prior knowledge. I will have the students then write their own description of each planet in their Student Resource Guide.

Day 3: Explore
Students will have time in class to discuss how the planets will revolve around the sun, and in what order and path they will take. After discussing it in their groups, the students will go outside or to the gym (which ever is available) where the lesson diagram will be waiting for them. The students will use a yellow punch balloon (bought at store) to represent the sun. There will be 9 other balloons of different colors and sized to be planets. I will guide their discussion on what planets will go in what order and students will be given string or chalk (depending on where they are) to draw or line the orbit of the planets. Once the order and orbits are agreed on, I will randomly pick students to come up and demonstrate the orbiting of the planets to the class. (lesson from www.totally3rdgrade.com) **Explain** In this section, I will ask the students to help me differentiate between rotation and revolution. Once they have correctly identified the two, they will write their answers in their Student Reference book. (this can be integrated with their Language Arts lessons on prefixes and suffixes). Then students will show both revolution and rotation in the demonstration. **Expand** This subject can be integrated with mathematics and the students can figure out how long it takes planets to circle the sun or how long each planets' day is.

Day 4: Engage
I will have the students watch a streaming video on the Earth's moon. After watching the video, I will have the students brainstorm characteristics of the moon. Then students will compare and contrast different moons in our solar system (i.e. Jupiter's moons, etc.) to our moon. Students

will be in groups discussing the moons. Students will also be asked to draw pictures of the moons. (videos from http://player.discoveryeducation.com/)

Day 5: Explore
Look at how the moon doesn't look the same every night. Brainstorm ideas why the moon doesn't look the same every night. Once the correct answer is reached, I will demonstrate the phases by using a tennis ball as the moon, beach ball as the earth, and flashlight as the moon. **Explain** Discuss why the phases change as a class. The answer is as the earth orbits the sun and the moon orbits the earth, the phases of the moon change. (lesson from Brainpop.com)

Day 6: Explore
Students today will use Oreo cookies to create and match the correct order of the phases of the moon. Each group will receive 8 cookies and eight squares of paper with the different moon cycles on it. They will arrange the papers in the correct sequence and then discuss as a class. After deciding the order, the students will take their cookies and make the phases of the moon in the icing, in the correct order. **Explain** We will discuss why this is the order. **Expand** I will ask students to start a Lunar Log the night of the next new moon. Each night the students will have to keep track of what the moon looked like. **Evaluate** I will look at their pictures as well as any journal entries. (lesson from brainpop.com)

Day 7: Engage
I will read the students an extremely descriptive paragraph about the sun. Students will then have some time to brainstorm what I was describing. **Explore** Students will be taking a trip outside on a sunny day to a level parking lot or sidewalk. Have students work in pairs and trace where they are standing as well as their shadow. Students will label their shadows with their names as well as the time they were drawn. Take a break. A couple hours later, return outside and stand in their own footprints and retrace their shadows. Make connections between the placement of the sun in the sky and the directions of their shadows. **Explain** Come back inside and discuss as well as demonstrate with a globe. Discuss what a shadow is. (FOSS lesson)

Day 8: Expansion
Discuss what the sun "is" and talk it over with the class. After they reach the correct answer, all them to play a connect the dots game. This will lead into the constellation expansion. Just as the sun rotates with the seasons, so do the stars. Students will simulate stars moving by using their heads. (FOSS lesson)

Day 9: Field Trip!
Students will take a field trip today to an IMAX theater to see *Outer space: Hubble Space Telescope 3D*. This presentation will show the fixing of the Hubble telescope, which allows us to see into galaxies that it is inconceivable that we will ever reach. It will give the students more knowledge on technology (imax.com).

Day 10: Evaluate
Culmination activity. Students will work on a group project together that will encompass everything they learned this unit- the connection between the earth, planets, sun, and moons.

Annotated Bibliography:

Spooner, S. "Bringing the Solar System to Life" *Totally Third Grade.* 23 March 2011
http://www.totally3rdgrade.com/lesson_plan_eight_planets.html
I liked this lesson a lot and it was a great addition to my unit. It is a fun way to get the students involved in learning.

Discovery Education Videos. Discovery Education. 23 March 2011
http://player.discoveryeducation.com/
This is a great website that has many useful and informational videos and movies for the students to watch.

Johnson-Jimenez, A. "Introducing the Most Heavenly Bodies in the Universe" *Hotchalk Lesson Plans.* 23 March 2011.
http://www.lessonplanspage.com/ScienceSSMars1IntroSolar56.htm
This is a site with many great lesson plans and it was extremely useful for me to look at this site to find a lesson on planets.

IMAX Theatre. 23 March 2011 http://www.imax.com/movies/
This site allows you to search the IMAX movies based on subject. That is how I found the movie that I would be taking my students to.

Storer, J. "Moon Phases" *Brain Pop Educators.* 23 March 2011
http://www.brainpop.com/educators/lp-moonphases/
This website contains many lesson plans and was useful in selecting one to fit into my unit.

FOSS lessons.
This is an amazing book series to look at. It was nationally based on the latest scientific findings on how children learn. It is a great source as well as teaching tool.

http://www.kidsastronomy.com/astroskymap/lunar.htm
This website is where I took my kid friendly descriptions of all the lunar phases that I included in my Resource Booklet.

http://www.moon.org/facts.html
This site was where I found the Fun Facts that I used in my Resource Booklet.

Teacher's Guide for Implementation of Task

Prior Knowledge Required of Student:

- Students will be required to know the basic names of the planets before we begin this unit. This is a requirement because the students will be looking at properties of the planets as well as the order, and will need to know the names in order to do this. They also need to have a prior knowledge of gravity.

Time Allotment:

- Most of the sciences lessons will be in the area of 45 minutes each day for 10 days. One Day 1 will take approximately 40 minutes in order to engage the students into the new unit. Day 2 will take about 40 minutes and Day 3 will take about 45 to 50 minutes. On Day 4 the lesson will take about 40 minutes to engage the students into learning about the moon and its phases. Day 5 will take approximately 40 minutes and Day 6 will take about 45 minutes. Day 7 will take about an hour total, but it will be split during the day due to the nature of the sun lesson. Day 8 will be approximately 45 minutes. Day 9 will be a class field trip to see an IMAX movie so it will take the entire day or at least half of the school day. Lastly, Day 10 will take about 45 minutes to an hour depending on the length of group presentations.

Student Groupings:

- For the most part, the students will be broken into cooperative groups of 3, with the chance of a couple groups of 4 (based on uneven distribution of class numbers). This gives the students small manageable groups in order to maximize learning and exploration of the concept and unit.

Materials/Resources Needed:

• **Day 1** • Book *The Magic School Bus: Lost in the Solar System* • Paper for the students	• **Day 2** • 10 different sized Styrofoam balls each representing a planet and the sun • Student Resource Guide • Student Data and Answer Book • Information for each station
• **Day3** • Gym • 1 yellow punch balloon • Chalk or string • 9 different colored balloons • Student Data and Answer Booklet	• **Day 4** • Discovery Streaming video *** • 4 copies of a picture of Earth's moon • 4 copies of Mar's moon *Phobos* • 4 copies of Jupiter's moon *Io* • 4 copies of Saturn's moon *Titan* • 4 copies of Earth's moon *Luna*

• **Day 5** • Flashlight • Beach Ball • Tennis ball or Softball • Student Resource Guide • Student Data and Answer Booklet	• **Day 6** • 8 Oreo cookies per group • 1 paper plate for each student • 1 plastic spoon for each student • Student Data and Answer Book • Earth and Sun cut out • Scissors • Student Resource Guide
• **Day 7** • Descriptive paragraph about the sun • Chalk • Flat blacktop the students can draw on • Sunny day • Globe • Meter stick • Overhead projector • Masking tape • Student Data and Answer book	• **Day 8** • Connect the dots examples • Transparency of Big Dipper • Transparency of Orion • Overhead projector • Paper • Student Data and Answer book
• **Day 9** • FIELD TRIP DAY! • IMAX tickets • Students' bright and smiling faces ☺	• **Day 10** • Culmination activity rubric

Teacher Preparation Prior to Unit:

- Prior to teaching the lesson, the teacher will need to test all the experiments and materials in order to be sure that the experiments will work properly. Students should be able to receive valuable results, as well as gain educational experience from the experiment. Also, the experiments should be able to be completed by the students on their own. The materials needed for each experiment should be readily accessible and organized prior to the teaching of the lesson. The teacher should also be aware at all times of how to use all the equipment, the location of the equipment, and safety procedures. Also, the teacher should be aware of the weather for certain days, because it is crucial to certain experiments and research for the students.

Implementation of Specific Activities:

- The teacher needs to be aware all safety procedures that will be required for every science lesson that will be taught. For example, in the lesson in the gym or outside, the

teacher needs to warn the students about spinning that they need to be careful and not spin into anyone when they are doing it.

Language Usage Icon:

	**Language Usage** Whenever you see this picture, it is important to make sure that what you have written is clear and complete and that you have used correct spelling, grammar, punctuation, and capitalization.

Websites for Teacher Background Information:

Discovery Education Videos. Discovery Education. 23 March 2011 http://player.discoveryeducation.com/index.cfm?guidAssetId=DF48EA8B-0872-4CB0-8C7E-F388D5E415B3&blnFromSearch=1&productcode=US

FOSS lessons.

IMAX Theatre. 23 March 2011 http://www.imax.com/movies/

Johnson-Jimenez, A. "Introducing the Most Heavenly Bodies in the Universe" *Hotchalk Lesson Plans.* 23 March 2011. http://www.lessonplanspage.com/ScienceSSMars1IntroSolar56.htm

Spooner, S. "Bringing the Solar System to Life" *Totally Third Grade.* 23 March 2011 http://www.totally3rdgrade.com/lesson_plan_eight_planets.html

Storer, J. "Moon Phases" *Brain Pop Educators.* 23 March 2011 http://www.brainpop.com/educators/lp-moonphases/

Literature Connection:

Cole, Joanna & Degen, Bruce. *Magic School Bus: Lost in the Solar System.* New York: Scholastic Inc., 1990. Print.

Student Connection:

Bourgeois, Paulette & Slavin, Bill. *The Sun (Starting with Space).* New York: HarperCollins Children's Books, 1996. Print.

Furness, Tim. *The Solar System (Spinning Through Space).* London: Hodder Wayland, 2000. Print.

Jeffereis, David. *Earth (Exploring Our Solar System).* USA: Crabtree Publishing Company, 2008. Print.

Jeffereis, David. *Mars (Exploring Our Solar System).* USA: Crabtree Publishing Company, 2008. Print.

Jeffereis, David. *The Moon (Exploring Our Solar System).* USA: Crabtree Publishing Company, 2008. Print.

Jeffereis, David. *The Sun (Exploring Our Solar System).* USA: Crabtree Publishing Company, 2008. Print.

Rau, Dana Meachen. *Black Holes (Our Solar System series).* USA: Compass Point Books, 2005. Print.

Rogers, Kirsteen, Howell, Laura, & Smith, Alastair. *The Usborne Science Encyclopedia.* Washington: Usborne Books, 2009. Print.

Learning Cycle Lesson Plan: Planets in the Solar System

Name: Alexa Jones **Lesson Title:** Simply Spinning Solar System
Grade Level: 4th grade **Lesson Topic:** Planets in the Solar System

The main concept to be constructed during the lesson: The students should be able to decipher the correct order of the planets in our solar system as well as differentiate the meaning between "rotation" and "revolution".

Additional concepts that are important to Expansion: Students will be able to identify the planets in our solar system and their basic characteristics as well as describe our place in the solar system in relation to the other planets (3.3.4.B).

Materials needed:

- *The Magic School Bus Lost in the Solar System*
- Lined paper
- Station information about each planet
- 10 different Styrofoam balls of varying sizes to simulate the planets and the sun
    - Should each be a different color
- One yellow punch ball (sun)
- Nine balloons of different colors
- Chalk or string for orbits
- Gym or outside flat blacktop
- Student Data Booklets
- Student Resource Booklets
- Student worksheets

Safety Precautions and/or Special Procedures:
On Day 2, students will be reminded that the Styrofoam balls are to stay on their desks or tables and are not to be thrown around the room or at others in the class. On Day 3, students will need to be reminded that they must spin under control so as not to hurt any other children in the class. If anyone is not following directions, they will be removed from the activity and will have to sit and watch the lesson. Similarly, if we go outside for the lesson, I need to be aware of any allergies such as an allergy to pollen or grass. Students need to be safe first. Also I need to be aware of the temperature outside if we do go outside; it must be warm enough to stay outside for a while.

Phase 1: Engage

Students will gather around at the reading circle. I will read to them *The Magic School Bus Lost in the Solar System* to get them thinking about the new upcoming unit. After I have read the story to them I will pose a hypothetical story to them.

"Alright class, now suppose you are in Ms. Frizzle's class and are on the Magic School Bus when it gets lost in space. What do you want to see and explore when you are in space? What do you want to learn about when in the solar system?"

Students will have much time to write and discuss their upcoming adventures in outer space. I want them to think constructively about their work, so I must monitor to be sure all students are on task. When they are done, we will come back together as a class to discuss some of their ideas. I will be looking to hear the students mention learning about the planets, the moon, and the sun.

STOP END OF DAY 1

Day 2

Phase 2: Engagement

Process Skills:

- Observation- Students will be observing the Styrofoam balls and what they represent. Students will also be observing the descriptions of the different planets in each of the different stations.
- Classification- The object of the lesson is for the students to be able to place the balls in the correct order in the solar system.
- Communication- Students will be working in small cooperative groups and in order to accomplish the task, they need to communicate effectively (and not bossy or pushy) with others in the group.
- Prediction- Students will be predicting which Styrofoam ball represents which planet based on the descriptions they receive at the stations.

Exploration Activity:

- Students will be broken into collaborative groups of 3 or 4.
- Students will be given the 10 Styrofoam balls.
- I will give the students about 5 minutes to discuss in their groups what the balls represent. Reconvene then and discuss what they represent. Keep going until the decided upon answer is the planets.
- Once students have decided what they represent, challenge them to figure out the order of the planets and which ball represents what planet.
- Have different stations set up around the room with clues about each planet. Based on the clues, the students will have to discuss in their groups which Styrofoam ball they think is the correct planet. Once this is finished, bring the students together again to discuss the answers as a class.

Phase 3: Explanation

Key Questions

1. What are planets? *A body of mass that revolves around the sun (which is a star).*
2. What do the balls represent? *The 9 planets.*
3. What order did we place them in? *Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto.*

4. Why is earth the only planet that as of now can support life? *It has water and atmosphere for us to survive and thrive in.*
5. Is there any other planet that we might be able to live on in the future? *Mars*
6. What two planets are alike? *Uranus and Neptune*
7. What is so interesting about Pluto? *It is considered a dwarf planet, which is a large mass of matter but is not large enough to be considered a planet.*

Procedure and Concept Statement:

- When the class has discussed their answer, the students will have to draw a scientific drawing of the order of the planets from the sun in their Student Data and Answer Booklet.
- After completing this, each student will then get out their Resource Booklet and *in their own words*, describe each of the planets (looking for color, size, order in solar system, etc.).

STOP END OF DAY 2

Day 3

Phase 2: Exploration

Process Skills:

- Observations- Students will have to observe what happens when their classmates begin to "revolve" around the sun.
- Communication- The students will be working in their small cooperative groups as well as a whole class in order to answer the common problem. They need to communicate effectively to accomplish their goal.
- Estimation- Students will estimate the length of each planets' orbits around the sun. They will also have to estimate how far away from each other.
- Measurement- Students after making their estimations, will measure the time it takes the "planets" to revolve around the sun (through their observations).
- Inferences- Students will also be asked to think about what causes the change from day to night as well as the change in seasons.

Exploration Activity:

- I will ask students, what causes night and day. Cooperative groups will discuss this and then after about 5 minutes each group will select a reporter. The reporter will give their answer to the class (so there will be about 3-4 answers). Look for rotating around an axis.
- Then ask what causes the change in seasons? Again allow for discussion.
- Once students decide on revolving around the sun, create a Venn diagram about revolution and rotation.
- After discussing the diagram, have the students walk down to the gym or outside to a flat black top. The punch balloon and other balloons will be there already.
- Students will work in small collaborative groups to start, and diagram (in their Student Data and Answer Booklets) the paths they think the planets take around the sun.

- Come back together as a class. Draw names at random and assign each student a balloon. As a class, the students have to decide what balloon represents the planets or sun and arrange the students holding the balloons in the correct order.
- Then using string (or chalk, again depending on where we are) the other classmates will draw the orbits of the planets.
- Then students holding the balloons will "orbit" the one student who is the sun. All the other classmates will be writing down their observations in their Student Data and Answer Booklet.

Phase 3: Explanation

Key Questions

1. What is the difference between rotation and revolution? *Rotation is spinning around on its own axis (earth spins on its own axis), while revolutions are spinning around another fixed object (earth revolving around the sun).*
2. What is an orbit? *The curved path of the planets that they follow around a star (the sun).*
3. Why do we orbit the sun? *The sun has much larger mass than the planets, and gravity is stronger.*
4. Why are the orbits more like ovals rather than circles? *The sun is not perfectly placed in the middle of the orbit, therefore it creates a more elliptical like orbit.*

Procedures and Concept Statement

- After going maybe 2 or 3 full revolutions each planet, have the students stop where they are. Discuss what the class wrote as observations.
- Then ask what was wrong with this picture (rotation of the planets around and axis).
- Then slowly, allow the students to "rotate around their axis" and revolve around the sun (for one revolution each). **SAFETY PROCEDURE**
- Once finished return inside and have students differentiate between rotation and revolution in their Student Resource Booklet.

Phase 4: Expansion

Process Skills:

- Identifying Variables- Students will have to identify the numbers (variables) that are given to them in the problem, and where to place them in the formulas they need to calculate the answers.
- Investigating- They will be investigating the differences between the lengths of years of the different planets.
- Communication- The students will be working on the problems in small groups in which they will have to compare their answers.

Exploration Activity:

- Read the activities in their Student Resource Booklet about elliptical orbits.
- Students have been working on multiplication and using formulas in math class. I will have the students calculate how long it takes certain planets to revolve around the sun (i.e. Earth takes 365 days or 366 on leap years). I will use Mars, Mercury, and Pluto. This will connect to their math skills then.

- **Science as Inquiry-** Students will be expanding their knowledge of the solar system to mathematical properties.
- **History and Nature of Science-** Since students will be learning more about how math relates to science (by completing math problems) they will be able to observe how science is an extension of math. They will also be learning more about the background of science on orbiting.

Phase 5: Evaluation

- Systematic Observation: I will be using student behavior checklists during all the activities to make sure the students are on task and accomplishing what I want them too.
- I will also be looking at their Data and Answer Booklet as well as Resource Booklet.
- Reflective Question: Differentiating between revolution and rotation will be a reflective question.
- Hands on Assessment: Students will be physically learning the difference between revolution and rotation as well as learning about orbiting the sun.

STOP END OF DAY 3

References and Internet Supplements:

Johnson-Jimenez, A. "Introducing the Most Heavenly Bodies in the Universe" *Hotchalk Lesson Plans.* 23 March 2011. http://www.lessonplanspage.com/ScienceSSMars1IntroSolar56.htm

Spooner, S. "Bringing the Solar System to Life" *Totally Third Grade.* 23 March 2011 http://www.totally3rdgrade.com/lesson_plan_eight_planets.html

Learning Cycle Lesson Plan: The Moon and Its Phases

Name: Alexa Jones **Lesson Title:** That Doesn't Phase Me
Grade Level: 4th grade **Lesson Topic:** Moon phases

The main concept to be constructed during the lesson: Students will learn about our moon, *Luna*, as well as all the phases that the moon goes through in a full cycle.

Additional concepts that are important to Expansion: Students will be able to describe the earth's place in the solar system in relation to the moon (3.3.4.B)

Materials needed:

- Link to video stream
  - http://player.discoveryeducation.com/index.cfm?guidAssetId=DF48EA8B-0872-4CB0-8C7E-F388D5E415B3&blnFromSearch=1&productcode=US
- 4 copies of Mar's moon *Phobos*
- 4 copies of Jupiter's moon *Io*
- 4 copies of Saturn's moon *Titan*
- 4 copies of Earth's moon *Luna*
- Flashlight
- Beach ball
- Tennis ball or softball
- Oreo cookies (8 per group)
- A paper plate for each student
- A plastic spoon for each student
- Moon phases cutouts
- Earth and sun cutout
- Scissors
- Student Resource Booklet
- Student Data and Answer Booklet

Safety Precautions and/or Special Procedures:
I need to be sure that there is no one in my class that is allergic to chocolate or Oreos or anything in them. Since the students will be working with Oreos, I need to be sure that no one will be harmed or get sick. Similarly, with each child receiving a plastic spoon, I need to be sure that they will use the spoon for what is intended for (scraping icing off the cookies) and not for eating, putting in their mouths, flinging things, etc. I also need to stress that none of the students are to eat the cookies. They will get their own untouched cookies after the experiment, as I do not want germs being spread around the classroom.

Phase 1: Engagement

Students will watch a streaming video from Discovery on our Earth's moon, *Luna*. This will take approximately 20 minutes and is titled *A Closer Look at Space: The Moon.* After watching

this movie, students will get out their Student Data and Answer Booklets and write down their observations about our moon. Anything like its physical characteristics, the atmosphere, craters, gravity, etc. should be written down in their booklets.

Groups will then discuss the ideas and thoughts they had about the moon and its characteristics. Each cooperative group will then receive a photograph of Earth's moon *Luna*, Jupiter's Moon *Io*, Mars's moon, *Phobos*, and Uranus's moon *Cordelia.* In their cooperative groups then, students will compare and contrast the different characteristics of each of the moons. In their Data and Answer Booklet they will record and draw their observations. Large Venn diagrams will be created as a class to compare these moons.

STOP END OF DAY 4

DAY 5

Phase 2: Exploration

Process Skills:

- Observation- They will be looking at what happens and the different relationships between the different balls and the flashlight. They will be keeping track of their observations
- Communication- They will be working in groups and having to communicate with each other in order to figure out the challenge that I gave them.
- Estimation- The students will estimate the distance between all the objects when recreating the scene.
- Classification- They will have to organize their observations of the different objects in order to figure out the problem. They will need to classify the flashlight as the sun, the tennis ball as the moon, and the beach ball as the earth.

Exploration Activity:

- I will ask the students a broad overarching question, does the moon look the same every night? If not why not?
- Students as a class will generate and brainstorm ideas and answers to this question, which will be recorded in the front of the classroom. Keep going until the answer is reached.
- Students will then be split into their groups. Each group will receive a beach ball, tennis ball, and flashlight. I will pose a challenge to the students: I want them to use the materials given to them, to demonstrate the moon phases. Give students time to figure this problem out.
- If a group thinks they have reached the correct way, have them come up and demonstrate it to the rest of the class. Lead a group discussion on it. Observations should be written in their Data and Answer Booklet.

Phase 3: Explanation

Key Questions:

1. What did each object represent? *Flashlight = sun, tennis ball = moon, and beach ball = earth.*

2. What did we notice when we moved the tennis ball? *Different parts of the ball were illuminated by the "sun" (flashlight).*
3. When viewing the moon, which side do we look at as the view from earth? *The side facing the beach ball not the side toward the flashlight.*
4. Why is this important? *The side toward the earth is what we will see. So for a new moon, the other side of the moon will be illuminated but we won't see it, therefore creating a "no" moon effect.*

Procedure and Concept Statement:

- Students will use their Resource Booklets to distinguish each phase of the moon: New Moon, First quarter moon, Third Quarter Moon, Full Moon, Waxing, Waning, Crescent, Gibbous.
- They will only write them in their notebooks at this time. The next explore will go more in depth on their definitions.

Phase 2: Exploration

Process Skills:

- Communication- They will be working in cooperative groups and will need to communicate with each other to finish effectively and efficiently.
- Observation- They will be making observations during the entire lesson. They will need to observe the differences between the different phases.
- Measurement- The students will have to measure the amount of icing on the cookies that they will need to scrape off in order to make the different phases.
- Classification-Students will have to classify the different scrapings of the moon phases in order to learn the names.

Exploration Activity:

- Student groups will receive paper cutouts of the eight major moon phases as well as 8 slips of paper with the names of the phases on it.
- Each group will discuss as an entire group, and put the phases in order based on the day before's lesson on moon phases.
- Once they have agreed upon the order of the moon phases, they will get eight Oreo cookies per group. Each child will get a chance to use their plastic spoon to scrape the cookie icing off to create the moon phase.
- Once all the cookies are designed to represent the moon phases, the students as a group will have to put them in the correct order, and place the slips of the names underneath each.
- Students ***WILL NOT*** be allowed to eat any of the cookies that they will be working with. At the end of the experiment they will be allowed one or two cookies per child.
-

Phase 3: Explanation

Key Questions:

1. What does the icing represent? The cookie? *Icing is the part of the moon we see and the cookie is the part that is not reflected by the sun.*

2. Why does the moon have different phases? *It is revolving around the earth, therefore different parts of the moon are illuminated by the sun at different times.*
3. What is the difference between a waxing crescent and a waning crescent? *A waxing crescent looks like it is getting bigger, while a waning one looks like it is getting smaller.*
4. What is the difference between gibbous and crescent? *A crescent is shaped like a crescent roll, whereas the gibbous is larger and only one step from being a full moon.*

Procedure and Concept Statement:

- After all groups have reached a cohesive decision, bring the class back together to discuss their answers.
- After each group gives their answer, ask them to explain why they placed the label with the particular phase. Look for grammar and prefix/suffix connections.
- After all the students have discussed their orders and names (and I am satisfied with their reasoning and results) they will get out their Student Resource Booklets and define each phase and draw a picture.

Phase 4: Expansion

Process Skills:

- Observations- They will be observing the moon every night for a month to see what it looks like and what phase it is in.
- Prediction- Students will have to make a prediction on how long they think a moon cycle takes.
- Classification- Students will have to classify what phase the moon is each and every night.

Expansion Activity:

- I will ask the students to create a Lunar Log that they will keep track of for a month. I will try to start it as close to the next new moon as possible.
- The students will need to observe the moon every night and draw a picture of what it looks like.
- After drawing the pictures, I want the students to name what they think the phase is and why.
- The very last night, I want the students to reflect on what they learned about moon phases. I would like them to explain why the moon looks differently every night.
- At the end of the month, I will collect this log and use it as an evaluation of the students.
- **Science as Inquiry-** Students will be further exploring the properties of moon phases by exploring how long it takes the moon to complete a full phase cycle. They will be making a prediction and finding out if they were right.

Phase 5: Evaluation

- Reflective Questioning: I will be asking the students why questions such as "why does the moon look different every night?"
- Pictorial Assessment: Students will be using pictures to order the phases and learn about the order of the phases.

References and Internet Supplements:

Discovery Education Videos. Discovery Education. 23 March 2011 http://player.discoveryeducation.com/index.cfm?guidAssetId=DF48EA8B-0872-4CB0-8C7E-F388D5E415B3&blnFromSearch=1&productcode=US

Storer, J. "Moon Phases" *Brain Pop Educators.* 23 March 2011 http://www.brainpop.com/educators/lp-moonphases/

Learning Cycle Lesson Plan: Shadow Tracking

Name: Alexa Jones **Lesson Title:** Shadow Tracking Til the Sun Comes Up
Grade Level: 4th grade **Lesson Topic:** All about the Sun

The main concept to be constructed during the lesson: The main concept is to understand that the movement of the sun is due to the earth's rotation and revolution. I also want students to understand that shadows are created by this relationship between the earth and sun. I also want students to notice the relationship between the earth's rotation and the stars, as well as the sun is a star.

Additional concepts that are important to Expansion: Students will be able to know the earth's relationship to the sun in the solar system (3.3.4.B).

Materials Needed:

- 2 pieces of sidewalk chalk per group
- Globe
- Masking tape
- Scissors
- Overhead projector
- Meter stick
- Student Data and Answer Booklet
- Connect the dots papers
- Transparency of Big Dipper
- Transparency of Orion
- Tickets to the IMAX movie
- Rubrics for the culmination activity

Safety Precautions and/or Special Procedures:
Again, since we will be going outside, I will need to be sure that no students are allergic to anything outside, or if they are, that they have taken their medication or treatment in order to go outside. Similarly, I need to be sure that I am prepared for any unforeseen incidents such as bee stings, bug bites, scrapes, etc. It needs to be a sunny day so I should have sunscreen on hand for any children who burn easily. The students need to be informed that they should not run when holding the meter sticks.

Phase 1: Engagement

I will have the students gather around the reading circle as I read them an extremely descriptive paragraph about the sun. After I read it, they will have time to, in pairs, discuss what I am describing. We will brainstorm the idea as a whole then. I will make a list on the board with all

the different answers I receive from the students. After we come up with a couple ideas, the class will take a vote on the correct answer and then have to describe why.

Phase 2: Exploration

Process Skills:

- Observation- Students will be observing what happens to their shadows over the course of the day. They also have to observe the relationships between the earth and sun.
- Measurement- They will be measuring how "tall" their shadows are after they trace them.
- Prediction- I will have students predict what direction their shadow will be facing at the later time as well as how "tall" it will be.
- Communication- They will be working in groups of 2 or 3 and have to communicate in order to finish the lesson successfully.

Exploration Activity:

Shadow Tracking:

- Have students describe in their groups what a shadow is. GUIDING QUESTIONS: Do you have a shadow all the time? What has shadows?
- This will be done in the morning around 10:30 (earlier than our normal science time). We will take a quick little field trip outside.
- Review the cardinal directions with the students (which way is north, south, east, west).
- Once outside, in pairs of 2 or 3, students will pick a spot on the blacktop and trace the outline of their partner's feet and shadow. MAKE SURE TO LABEL FEET OF THE STUDENTS.
- After tracing the shadow, they will then use the meter stick to measure how tall the shadow is and write it inside.
- Repeat with partner until everyone has had their shadow traced.
- Have students predict how tall they think the shadow will be when we go back outside and what way it will be pointing.
- Go back inside and continue the rest of the day.
- Now during our normal science time, have the students then create shadows on the overhead.
- Try making other shadows using pencils, notebooks, paper, etc.
- Now, go back outside. Distribute chalk and meter sticks to the groups.
- Have the students go back to their chalk outline and stand in their footprints and trace their shadow again.
- While waiting for all the students to finish, I will let the others play Simon Says with their shadows. (i.e. Simon says, make your shadow hand touch your head).

Phase 3: Explanation

Key Questions:

1. What did the projector represent? *The sun*
2. What did our shadows do? Why? *The moved and changed direction, because the sun is moving in the sky and the earth is rotating on its axis.*

3. What direction did they point? Why? *They pointed the opposite direction of the sun because the side of us facing the sun is lit up, and then the side not facing the sun is dark.*
4. What do you notice about the projector and the globe? *The side of globe toward the projector is brightly lit, the other side is dark.*
5. What changes to the shadow of the masking tape happen as I rotate the globe? *The closer it was to the sun the smaller the shadow was and the shadow was always going the opposite direction of the sun.*

Procedure and Concept Statement:

- When we finish our exploration, we will find a spot on the playground and discuss our observations.
- I will ask the students to tell me what the projector represented in our earlier demonstration.
- What did our shadows do? Why do you think they changed?
- See if the students make the connection that our shadows point the direction opposite of the sun.
- When a student answers because of the sun, I will demonstrate this relationship to the class. We need to go back inside first.
- I will set up the projector and a globe, and then turn out the lights.
- What do students notice?
- Place a piece of masking take in a little bunch on the globe. Observe how the shadow of the tape changes as the earth rotates.

STOP END OF DAY 7

DAY 8

Phase 4: Expansion

Process Skills:

- Observation- They will be observing how stars "move" across the sky as well as what they see in the different connect the dots worksheets.
- Communication- They will be discussing and telling each other their stories as well as working with each other.
- Classification- They will have to classify what stars are and be able to use their knowledge to create their own stories.

Expansion Activity:

- What is the sun? *will accept variety of answers but looking for a star*
- What is a star?
- When we look at the sky at night, we see tons of stars but they are not evenly spaced. Some are in groups. What are these groups called?
- I will then show the students a transparency of the Big Dipper or Ursa Major.

- I will read the students the story of Ursa Major (the great bear). I will explain that a long time ago, people created stories about the groups of stars.
- Students in groups of 3 or 4 will create their own constellations and write a story about them. But first, they will practice using connect the dots papers.
- Stories will be hung around the classroom.
- The stars are the same and don't move, but then how do they move across the sky?
- Let students discuss and talk this over.
- Earth is moving. Earth spins completely once every day, as well as a full revolution over a year.
- Put up the transparency of Orion.
- Have students stand at desk and face the right wall. Students will then put hands to side of eyes and slowly rotate counter clockwise just as the earth does.
- Have them describe what happens.
- The rest of the time will be dedicated to writing their stories, which will be hung around the room. Make sure they know this will be graded so they need to use their best 4th grade writing.
- **Science as Inquiry-** Students will be inquiring about how constellations come about and were "made". They will get their own chance to do so as well.
- **Science and Technology-** Students will have a chance to see an IMAX movie about a space telescope that will enhance their knowledge about space as well as the technology we now have to learn more about the universe.
- **History and Nature of Science-** The students will be writing their own stories about constellations after they learn that constellations were formed from stories. They will be learning the history of constellations and creating their own addition.

STOP END OF DAY 8

DAY 9

Phase 4: Expansion
FIELD TRIP DAY!

Students will be taking a trip to the Benjamin Franklin Museum in Philadelphia, where they will see the IMAX movie on the Hubble space telescope. This will be a day-long trip so there will be no true science lesson but the IMAX movie certainly adds to our knowledge about the relationship between the earth, moon, sun, stars. Also, the students will be given chances to learn on their own and allow their creativity to take over.

STOP END OF DAY 9

DAY 10

Phase 5: Evaluation

Project: Students will each receive a planet, sun, constellation, or moon that they will become an expert on. They will be required to find certain "fun facts" about their object. Such facts can be

size, distance from sun, length of year, background story, etc. Once finding these facts, they will have to create a paper listing the facts. Also, the students will have to create an artwork of their object, because this will be our next bulletin board. I will create a bulletin board will all the facts they found and their beautiful artwork.

Oral Presentation: The same project will also need to be presented to the class during the science period. It will be their time to shine and show off their expertise of the object to the rest of the class. I will be looking for clear speaking, good knowledge of facts, and eye contact.

This will be a culmination activity for the entire unit!

References and Internet Supplements:

FOSS lesson plans

Shoot for the Moon!

Student
Data and Answer Booklet

Name: _____

Date: _____

Shoot for the Moon!: That Doesn't Phase Me

Engagement:

Take the beach ball, flashlight, and tennis ball. Based on yesterday's lesson, figure out what each one stands for and represents. Draw your picture and label it here:

Does the moon look the same every night? Why or why not?

Exploration:

- First, split into groups of 3 or 4.
- Once in your groups, here are the jobs you will be doing:
    - **Principal Investigator:** is in charge of all operations associated with the group activity. The "PI" checks the assignment, communicates the directions of the teacher, provides assistance to other group members, and conducts group discussions about results.
    - **Materials Manager:** the "MM" obtains and dispenses materials and equipment for activity. The "MM" also sets up and operates the activity equipment in cooperation with the "PI".
    - **Recorder & Reporter:** The "R&R" is in charge of collecting and recording information on the group worksheets. Also the "R&R" reports results to the class.
- Materials needed:
    - Student Resource Booklet
    - Moon phase cutouts
    - Earth and Sun cutouts
    - Scissors (2 per group)
    - A paper plate per student
    - A plastic spoon per student
    - Paper towels

Procedure:

My challenge to you: Place the cutouts in the correct order based on what you observed earlier. Draw each phase in order here:

1.	2.
3.	4.
5.	6.
7.	8.

Explain why you think this is the right order?

- Once you reach an answer as a group, raise your hand and I will bring your group 8 Oreos. ***DO NOT EAT THE OREOS!!***
- Directions:
    - Each student will get a chance to use your plastic spoon to scrape off icing in the shape of the moon phases.
    - After finishing this, label each phase with its correct name. *For hints*, don't forget about your Student Resource Booklet!
- Draw and label pictures here!

Explanation:

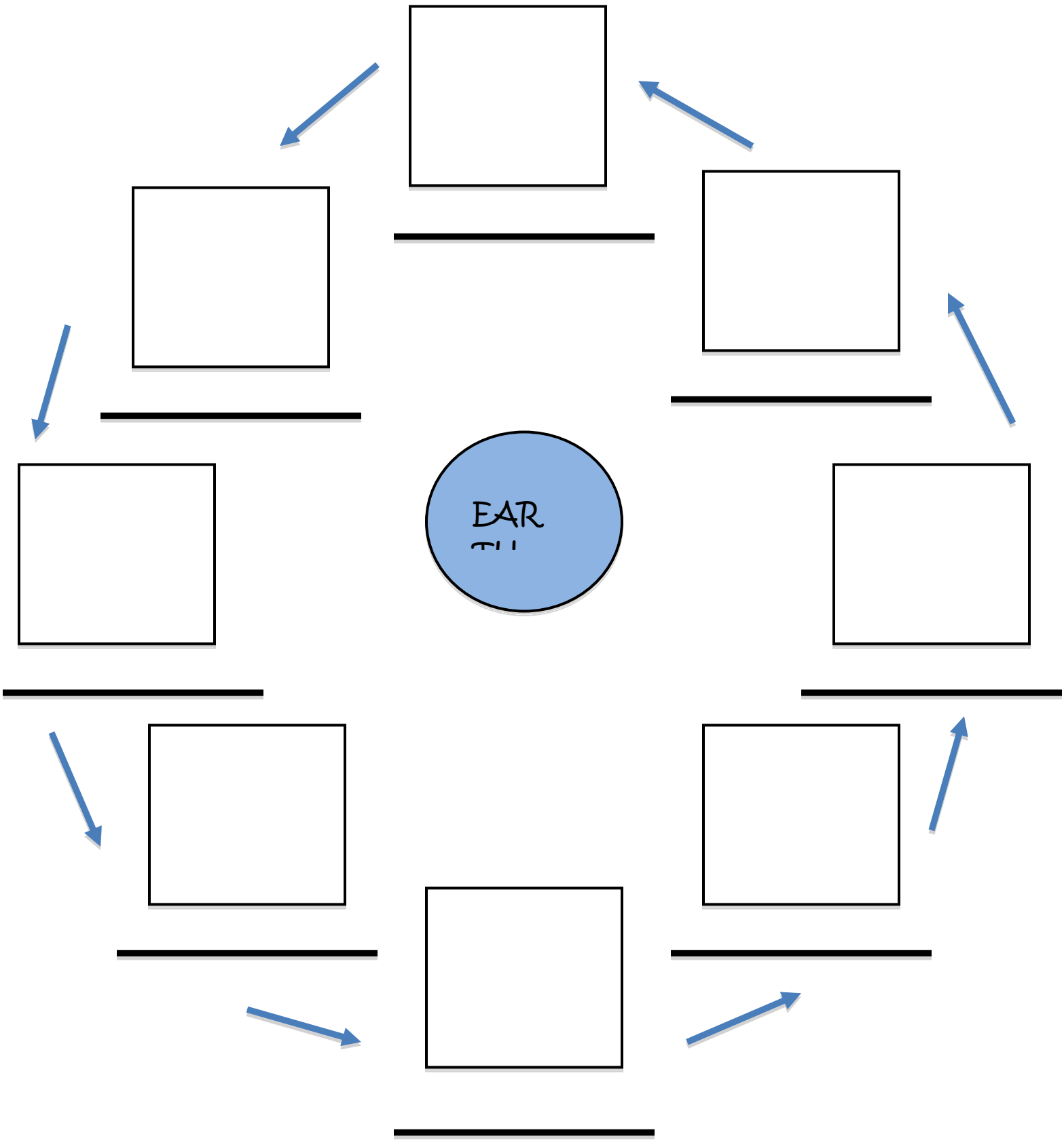
Why does the moon have different phases? How?

What is the difference between a waxing moon and a waning moon?

What is the difference between gibbous and crescent?

In the engagement activity, when viewing the moon, which side do we look at as the view from earth? Why is this important?

Fill in the diagram in with the correct moon phase in relation to the earth.



Expansion: Lunar Log

How long do you think it takes the moon to complete a full cycle and why? Let's predict.

For the month of May, I want you to observe the moon everynight, and draw a picture and label it. At the end of May, we will compare our pictures and answers as a class.

** Don't forget to record the date and day of the week!!**

Shoot for the Moon!

Student Resource
Booklet

Name: _____

REMINDERS!

SAFTEY PRECAUTIONS

- DO NOT EAT ANY OF THE OREOS GIVEN TO YOU. You will all be touching and handling these Oreos and we do not want the spread of germs!
- Be careful when using the plastic spoons to scrape the icing off the cookies. I know they are just spoons but you can still give yourselves scrapes and cuts on your skin.
- NO SHINING FLASHLIGHTS INTO YOUR GROUP'S EYES! Yes, this does hurt, do not try it.
- NO THROWING BASEBALLS OR TENNIS BALLS! I do not want to see any baseballs or tennis balls being thrown around the room, even if it is to a partner. It is not that hard to walk the ball over to your partner and hand it to them.
- Similarly, NO TOSSING OR "SPIKING" THE BEACH BALLS ACROSS THE ROOM! Yes it is tempting but again, don't do it! We do not want someone to get hurt.

	**Language Usage** Whenever you see this picture, it is important to make sure that what you have written is clear and complete and that you have used correct spelling, grammar, punctuation, and capitalization.

New Moon- The side of the moon facing the Earth is not illuminated. Additionally, the moon is up through out the day, and down through out the night. For these reasons we cannot see the moon during this phase.

Waxing Crescent- During this phase, part of the Moon is beginning to show. This lunar sliver can be seen each evening for a few minutes just after sunset. We say that the Moon is "waxing" because each night a little bit more is visible for a little bit longer.

First Quarter- During first quarter, 1/2 of the moon is visible for the first half of the evening, and then goes down, leaving the sky very dark.

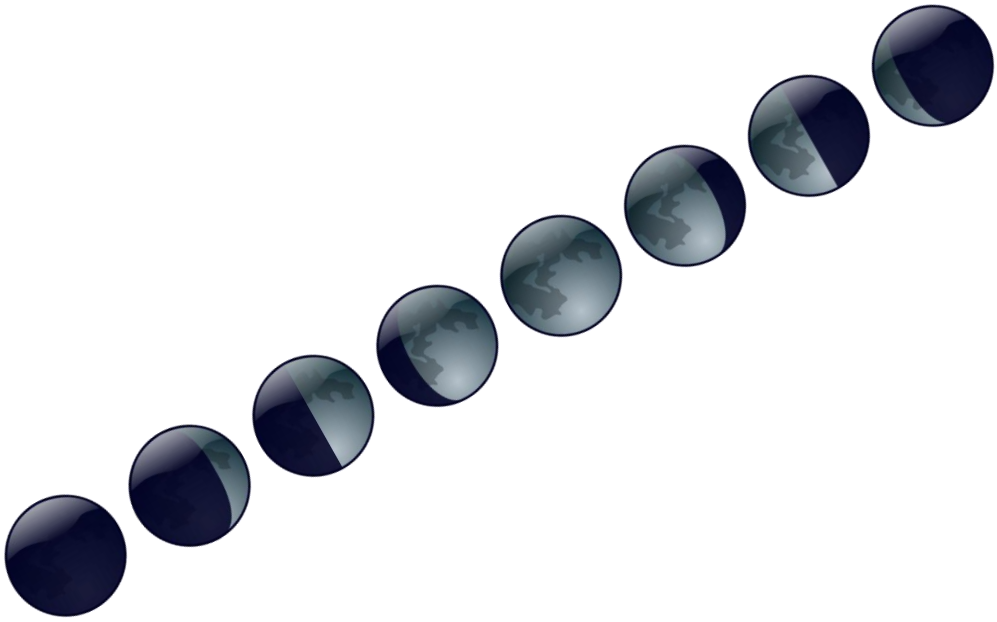
Waxing Gibbous- When most of the Moon is visible we say it is a Gibbous Moon. Observers can see all but a little sliver of the moon. During this phase, the Moon remains in the sky most of the night.

Full Moon- When we can observe the entire face of the moon, we call it a Full Moon. A full moon will rise just as the evening begins, and will set about the time morning is ushered in.

Waning Gibbous- Like the Waxing Gibbous Moon, during this phase, we can see all but a sliver of the Moon. The difference is that instead of seeing more of the Moon each night, we begin to see less and less of the Moon each night. This is what the word "waning" means.

Third Quarter- During a Last Quarter Moon we can see exactly 1/2 of the Moon's lighted surface.

Waning Crescent- Finally, during a Waning Crescent Moon, observers on Earth can only see a small sliver of the Moon, and only just before morning. Each night less of the Moon is visible for less time.



Fun Facts about the Moon!

- The Moon is Earth's only natural satellite.
- Distance from Earth to its Moon is 384,403 km (centre-to-centre).
- It was not discovered until 1665 that other planets had natural satellites as well, at which point "moon" started to be dropped and instead referred to as "The Moon".
- There is no "Dark Side of the Moon" - the Moon rotates around the Earth and so all sides of the Moon are hit by the Sun at some point. However there is a "Far Side of the Moon" which is the side facing away from Earth.
- Temperatures on the Moon can drop to 250 degrees below zero.
- Neil Armstrong and Buzz Aldrin were the first to walk on the moon's surface by landing the lunar module Eagle on the "Sea of Tranquility".
- A full moon is about 5 times brighter than a half-moon.
- The moon rotates counterclockwise around the earth.
- Our moon is called *Luna.*

What's your favorite thing you learned?

ASSESSMENT AND EVALUAION TOOLS

Shoot for the Moon!

Name	Communication	Classification	Observation	Prediction
Vashanna				
Amy				
Caitlin				
Hailey				
Alee				
Nikki				
Amanda				
Roxy				
Janet				
Casey				
Shawna				
Emily				
Ali				

4 = On task at all times and completing the work given to them in an efficient and effective manner. No arguments or discussing of topics other than science.

3 = On task most of the time. Still getting the main concept of the lesson but with couple disagreements amongst themselves.

2 = Slightly off task at times. I have to remind them 2 or so times to discuss our lesson not other subjects.

1 = Not on task at all. Reprimanded for not following directions as well as major disagreements and arguments within the group.

Grading of pictures and data booklet:

- Are pictures in the correct order? (8 points)

- Are they drawn neatly? Scientifically? (8 points)
- Did they write and label the phases clearly, neatly, and correctly? (8 points)
- Are answers well thought out and descriptive? (6 points)
- Were all questions answered? (5 points)

35-32 = A
31-28 = B
27-25 = C
24 and below = D

Answer Key to Data Booklet Explanation

Explanation:

Why does the moon have different phases? How?

The moon is constantly revolving around the earth. Since the earth is revolving around the sun, certain parts of the moon are shadowed and covered by the earth. The remaining part is what is reflecting sunlight.

What is the difference between a waxing moon and a waning moon?

A waxing moon is one that is looking to become larger each night while a waning moon looks to be becoming increasingly smaller with each night.

What is the difference between gibbous and crescent?

Gibbous is closer to a full moon while crescent is shaped like a crescent roll.

In the engagement activity, when viewing the moon, which side do we look at as the view from earth? Why is this important?

The side facing the earth because this is what we'll see at night, not the side facing the sun.

Fill in the diagram in with the correct moon phase in relation to the earth.