

Saturday Science Teaching – Spring 2018

Lesson Plan

LESSON 1 and Planets

GRADE K-1

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET (minimum of 2/ lesson)

Objective:

(1)The students will be able to identify the planets based on their characteristics that they learn throughout the lesson.

(2)They will also be able to place the planets in the correct order.

B) STANDARDS (<https://www.nextgenscience.org/>)

- What science and engineering practices are you addressing in this lesson:

1-Developing and using models

2-Obtaining, evaluating, and communicating information

- What cross cutting concepts are you addressing in this lesson:

1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

3. Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

C) **TEACHER CONTENT KNOWLEDGE (As a teacher, describe what you need to know regarding the concepts you've identified for each bullet above)**

- The order and characteristics of the planets (size/shape)
- The distance of planets from the Sun

D) MATERIALS (**asterisk (*)** = any materials that may be a **safety concern**)

- Toilet Paper Rolls with Paper (8 rolls)
- Crayons
- Masking tape (one roll)
- Planets book
- paper plates (40)
- Planet cut out (blank circles)
- Printed Planets
- Planet Order Worksheet
- Large construction Paper
- Glue Sticks (20)
- Scissors (20)
- Lime (3)
- Apples (3)
- Watermelons (3)
- Cherry tomato (3)
- Pea (6)
- Grapefruit (3)
- Blueberries (6)

E) REFERENCES (list ALL references that you borrowed ideas from to develop this lesson – including any handouts you may distribute)

1. The solar system song
<https://www.youtube.com/watch?v=pUZ2tfr1bsU>
2. Solar system with toilet paper <https://www.pinterest.com/pin/329466528960468373/>
3. Planet sizes with fruits
<https://www.pinterest.com/pin/279223245627254145/>
4. McDonald, J. (2016). Hello, world! Solar system! NYC, NY: Doubleday.
5. Planet Order Worksheet <https://www.havefunteaching.com/product-tag/solar-system-worksheet/>
6. Solar System Planets Space 100 Interesting Facts <http://www.makemegenius.com/cool-facts/solar-system-planets-space-100-interesting-facts>

F) TENTATIVE TIMELINE (Keep brief)

9:00-9:15	Engage
9:15-10:00	Explore (activity 1)
10:00-10:20	Snack Break
10:20-10:40	Explore (activity 2)
10:40-11:00	Explore (activity 3)
11:00-11:10	Bathroom Break
11:10-11:35	Explain
11:35-12:00	Elaborate

G) DESCRIPTION OF YOUR LESSON:

Engage	<p>To introduce the topic of planets, we will start by figuring out what the students know about planets. We will ask questions such as, “Can anyone tell me the name of any planets?” “Does anyone know which is the biggest planet? Smallest? Hottest? Coldest?” This could lead to questions such as, “Is the sun a planet?” In doing so, we will introduce the concept that the sun is the center of our solar system that all planets rotate around.</p> <p>Focus Question: What do the characteristics of planets tell us about their order?</p>
Explore	<p>Activity 1- We will setup stations for each planet in the classroom. At each station, a teacher will have a factsheet and picture of the planet. The students will each be given a circle that is the approximate scale size of that planet and they will color it. The teacher will share the facts of the planet and they are given the opportunity to ask questions. Through these stations, the students will learn more about this planet without being told its position in the solar system. Once everyone finishes their drawing, we will come together as a class and each planet group will share facts that they learned. We will record this on the board (written and in pictures for those that cannot read). Then, we will introduce the sun by asking students about what they know. We will make it clear that the sun is the center of our solar system that all planets rotate around and is a star, not a planet.</p> <p>Activity 2- Once the students complete their stations, we will all go down to</p>

	<p>the atrium in their groups and find the tape that has a picture of their planet by it. Teachers will tape the starting and ending point of each planet to the ground in the hallways so that the students can easily see how far it is from the sun. We will not place the tape in the order of the planets. Instead, the students will figure out the order based on how far they find it is. Then, the students will measure the distance between their assigned planets using toilet paper. The students will count number of tiles that their toilet paper covers to measure the different distances each planet is from the sun.</p> <p>Activity 3-Based on what the students learn in the toilet paper activity, we will ask them which planet they think is farthest, 2nd farthest, 3rd farthest, etc. In doing so, the students will line up with their group in order from the distance they are from the sun. We will have one of the teachers pretend to be the sun and stand closest to Mercury. Then, we will then help them to act out how the planets rotate around the sun. We will play music while they are rotating to make it more fun for the students. We will make this into a game where when the music is paused, the students must freeze. We will do this several times so everyone gets a chance to participate.</p>
Explain	<p>A teacher will read a book, <i>Solar System</i>, to the students to further their knowledge of the planet order and some characteristics. This will also review what they learned throughout the lesson and connect terminology. Then, will have a final discussion about what we learned including the order of the planets, their characteristics, and the distance each of them are from the sun. In order to see what the students have learned, we will provide each student with a cutout worksheet shown below and a piece of construction paper. The students will cut out each planet and place them in the correct order on their piece of construction paper by gluing it down. This will show us how well the students were able to identify each planet and place them in the correct order.</p>
Elaborate	<p>We will provide students in groups of 6 with a variety of fruits that each represent a planet in the solar system. Students will compare the sizes of the different fruits to the planets that they have learned about in the lesson and work together in groups to place them in the correct order.</p>

- Mercury - 4 TP Squares
- Venus- 7 TP Squares
- Earth- 9 TP Squares
- Mars- 14 TP Squares
- Jupiter- 48 TP Squares
- Saturn- 89 TP Square
- Uranus- 179 TP Squares

H) What will you do to learn if your students met the objectives for this week?

(FORMATIVE ASSESSMENT - the 5th “E”)

In order to assess what the students have learned, we will provide each student with a cutout worksheet shown below and a piece of construction paper. The students will cut out each planet and place them in the correct order on their piece of construction paper by gluing it down. This will show us how well the students were able to identify each planet and place them in the correct order.

I) PEDAGOGICAL FOCUS:

We are anticipating what the students might know in the engage phase before starting the activities. We are using questions such as, “Does anyone know the name of a planet?” “What is the biggest planet? Smallest? Coldest?” Then, teachers will monitor student’s discussions throughout the lessons in the explore phases. In doing so, teachers will select and sequence student’s comments and questions in order to connect concepts. This will most likely occur when students are in their stations with an IU teacher. The teacher will connect the student responses to the students’ comments and their key ideas. This productive discussion will help the students further their knowledge to hear from other students and the teachers. We will also help make connections between the distances that they find in the toilet paper activity and the planets’ characteristics, such as their temperature.

-State the focus for the week (Productive discussions, Science for all etc)

Discussions

- The characteristics of the planets (size/shape)
- The distance of planets from the Sun

Science for all

-Explain how you are trying to incorporate this into your practice in this week’s lesson
Students will first explore the characteristics of the planets, think about why each planet possesses certain characteristics, and predict the distance of the planets to the Sun. In this way, students do not memorize the concepts; instead, they comprehend the concepts.

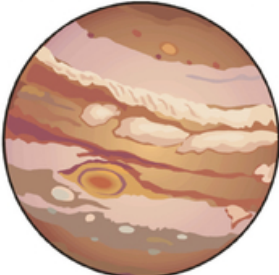
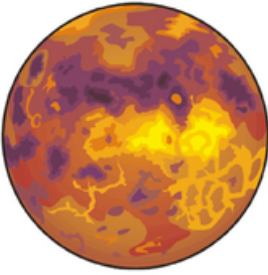
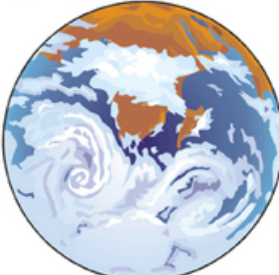

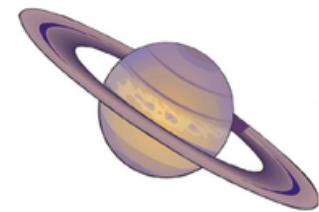
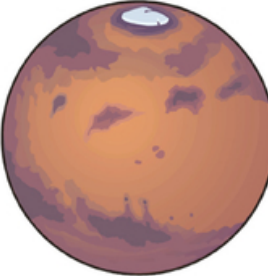
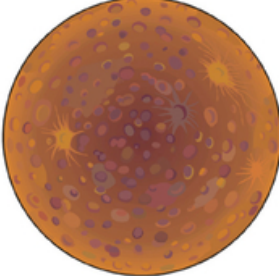
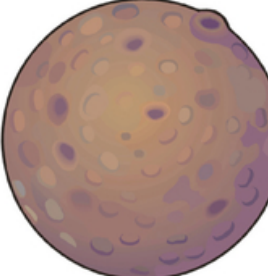
Science for all:

We will provide pictures of the planets along with the words. Each station will have a teacher presenting the information. Students do not have to know how to read and write to get involved in the activities. They are given the opportunities to present their knowledge through methods such as mapping. They can work in pairs to get support from their peers. Translation to ELLs’ native language about the planets is also possible.

Name: _____

The Planets

Directions: Place the planets in their correct order from the Sun.

	Jupiter		Venus
	Earth		Neptune
	Saturn		Mars
	Mercury		Uranus

LESSON 2

Day and Night

GRADE K-1

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET (minimum of 2/ lesson)

Students will be able to explain why we have days/nights.

Students will be able to identify the moon phases with the oreos phases and bingo activity.

B) STANDARDS (<https://www.nextgenscience.org/>)

- **What science and engineering practices are you addressing in this lesson:**
 - Developing and using models
 - Obtaining, evaluating, and communicating information
- **What cross cutting concepts are you addressing in this lesson:**

1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

C) TEACHER CONTENT KNOWLEDGE (As a teacher, describe what you need to know regarding the concepts you've identified for each bullet above)

As teachers, we will need to know why there are days and night (Earth rotating).

Teachers will need to know:

-One day on Earth is about 24 hours.

-One year on Earth is about 365 days.

-**For Sunrise:** Stand so that your left side is toward the flashlight. Hold your arms out all the way. Your left hand points toward the flashlight. This is sunrise.

-**Day:** Stay in the same spot. Keep your arms out from your sides, and turn to your left. Now the flashlight is in front of you. It is the middle of the day. It is noontime.

-**Sunset:** Keep turning until your right hand points toward the flashlight. You are turning away from the flashlight. It is sunset.

-**Night:** Keep turning until your back is toward the flashlight. It is night. But your back is in the daylight. Half of you is always light, and half is dark. It's the same with the Earth.

New Moon - The Moon's un-illuminated side is facing the Earth. The Moon is not visible (except during a solar eclipse).

Waxing Crescent - The Moon appears to be partly but less than one-half illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.

First Quarter - One-half of the Moon appears to be illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.

Waxing Gibbous - The Moon appears to be more than one-half but not fully illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is increasing.

Full Moon - The Moon's illuminated side is facing the Earth. The Moon appears to be completely illuminated by direct sunlight.

Waning Gibbous - The Moon appears to be more than one-half but not fully illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.

Last Quarter - One-half of the Moon appears to be illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.

Waning Crescent - The Moon appears to be partly but less than one-half illuminated by direct sunlight. The fraction of the Moon's disk that is illuminated is decreasing.

D) MATERIALS (asterisk (*) = any materials that may be a safety concern)

- Flashlights (8)
- Oreos (8 Packs)
- 100 math manipulative chips (for bingo)
- Two books (day/night and moons)
- 100 brass fasteners
- Chart papers (5)

E) REFERENCES (list ALL references that you borrowed ideas from to develop this lesson – including any handouts you may distribute)

Read Alouds:

Branley, F. M., Emberley, B., & Emberley, E. (2015). *The Moon Seems to Change*. New York: HarperCollins Childrens Books.

Branley, F. M., Emberley, B., & Emberley, E. (2015). *What Makes Day and Night*. New York: HarperCollins Childrens Books.

- <https://www.pinterest.com/pin/272397477445815143/>(Earth and Sun model)
- <https://www.universetoday.com/59707/what-causes-day-and-night/> (Informantion about content)
- <https://www.pinterest.com/pin/123075002286322341/> (Moon Phase Activity)
- https://www.pinterest.com/pin/AYxk3CtXaMrl99sZcQRdn4rTkFz1aymj2waY0-j_IOfZGOHIFQs6pY/ (Moon Phase Bingo)

F) TENTATIVE TIMELINE (Keep brief)

9:30-9:40	Engage 1- (Venn Diagram)
9:40-10:05	Explore 1-Day/Night Activity: Read book and model day and night
10:05-10:15	Explain 1-Day/Night Discussion
10:15-10:30	Snack Break/Bathroom
10:30-10:40	Engage 2- Moon Phases Discussion
10:40-11:00	Explore 1-Earth-Sun-Moon Model Activity
11:00-11:25	Explore 2- Oreo Moon Phases
11:25-11:45	Explain 2- Read Moon Phase book
11:45-12:00	Elaborate- Moon Phase Bingo

G) DESCRIPTION OF YOUR LESSON:

Engage	<p>In order to engage the class and get them to start thinking about day and night, together we will create a venn diagram on the board. We will do this by asking the students, “What are some things that you see during the day? Night? What about during both?” This venn diagram will be helpful for all learners. Additionally, we will draw pictures and write words within the diagram to help address all learners. We will emphasize how the moon is in the middle of the venn diagram so that they understand that moons can be seen during the day and night.</p> <p>Focus Question: How does the Earth’s rotation create night and day?</p>
Explore	<p>Day/Night Activity: For this activity, we will be reading a book about day and night. We will start by having the students listen to a story. On page 23 we will stop and complete the activity in the book.</p> <p>For Sunrise: Stand so that your left side is toward the flashlight. Hold your arms out all the way. Your left hand points toward the flashlight. This is sunrise.</p>

	<p>Day: Stay in the same spot. Keep your arms out from your sides, and turn to your left. Now the flashlight is in front of you. It is the middle of the day. It is noontime.</p> <p>Sunset: Keep turning until your right hand points toward the flashlight. You are turning away from the flashlight. It is sunset.</p> <p>Night: Keep turning until your back is toward the flashlight. It is night. But your back is in the daylight. Half of you is always light, and half is dark. It's the same with the Earth.</p>
Explain	<p>Day/Night: We will have a discussion with what they just learned about day and night and how the earth rotates. We will ask questions such as, "What is the difference between day and night?" "What way is the Earth facing during the day?" "What way is Earth facing during night?" We could have students come up to the board and draw the difference between day and night. We will ask students to paraphrase what other students said so that this is helpful for all learners.</p>
Engage	<p>We will refer back to the venn diagram when we transition into the moon phases. We will point out that the moon in the center of the venn diagram and ask questions such as, "What is something that we saw during the night time?" "Does the moon always look the same?" "How does it look different?" We will have students come up to the board and draw some examples of ways that they have seen the moon look. By doing this, students will begin think about why the moon looks different at different times.</p> <p>Focus Question: What are the phases of the moon?</p>
Explore	<p>Moon Activities: Activity 1- Earth-Sun-Moon Model In this activity, the students are creating a model of how the earth is moving around the sun. The students will first decorate/color an Earth, moon, and sun. Then, we will attach the three using connecting pieces of paper and brass fasteners. The students can then play with their model to have their own idea of how Earth is moving around the sun and the moon is moving around the Earth.</p> <p>Activity 2 - Oreo Moon Phases Students will get 6 oreos to make the moon phases using the cream inside the oreos. Students will get the help from teachers to make their phases. Teachers will display the moon phases for the students to make their phases out of oreos.</p>
Explain	<p>We will discuss as a class the moon phases and how they are shown with the sun reflecting to the moon. We will read "The Moon Seems to Change" to</p>

	further the students' knowledge about the moon phases and how they are seen on Earth and review what they learned in both of the explore activities. We will engage students throughout the reading by reading a page about a specific moon phase and have them guess which phase they think it is before showing them the pictures. The book will also connect the reason why there are different phases of the moon.
Elaborate	<p>For the day/night: We will have the students use the Sun-Earth-Moon models to show us when it would be day versus when it would be night.</p> <p>For moon phases: Students will play moon phase bingo to identify the phases of the moon. It will connect the student's picture of the phases with the names of the phases.</p>

H) What will you do to learn if your students met the objectives for this week?

(FORMATIVE ASSESSMENT - the 5th "E")

In order to assess what the students have learned, we will have students do an activity where they demonstrate how the Earth rotates makes day and night. We will also assess what the students learned from the moon phases with bingo.

I) PEDAGOGICAL FOCUS:

We will focus on science for all learners including students with special needs and students who are English language learners. We will do this by providing pictures with words to show the students the day/night and the moon phases. We will also work with diagrams to show compare/contrast with pictures. There will be visuals with gestures to help the ELLs. For bingo, there will be pictures and words to help the students find the correct moon phases. We will also have students work in groups to think, pair, share with their group mates during discussions. The teachers will facilitate discussions by having other students paraphrase the other students.

Focus for the week (Productive discussions, Science for all etc)

- Science for ALL (Students with special needs, ELLs)
- Continuing to use Productive Discussions

-Explain how you are trying to incorporate this into your practice in this week's lesson

We are trying to incorporate this into our practice this week by creating a lesson with engaging activities. We will be using a combination of visuals and hands on activities to reach all students. We will be using multiple methods for teaching the information to the students and...? (not really sure about this part, I just went with the focus we put on the matrix)

Handouts:

MOON BINGO



Oreo activity:

Phases of the Moon
with Oreo Cookies

The worksheet contains eight circular templates arranged in two rows of four. The top row is labeled with the following moon phases: new moon, waxing crescent, first quarter, and waxing gibbous. The bottom row is labeled with: full moon, waning gibbous, last quarter, and waning crescent. In the top left corner, there is a crescent moon illustration with stars. In the top right corner, there is an Oreo cookie logo.

new moon	waxing crescent	first quarter	waxing gibbous
full moon	waning gibbous	last quarter	waning crescent

LESSON 3

Seasons

GRADE K-1

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET (minimum of 2/ lesson)

- Students will be able to identify and describe the four seasons through sorting the pictures of each season and drawing their season plate.
- Students will be able to explain how the Earth rotating around the sun creates different seasons by using the styrofoam tilting toothpicks model.

B) STANDARDS (<https://www.nextgenscience.org/>)

- **What science and engineering practices are you addressing in this lesson:**
 - Developing and using models
 - Obtaining, evaluating, and communicating information
- **What cross cutting concepts are you addressing in this lesson:**
 1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

C) TEACHER CONTENT KNOWLEDGE (As a teacher, describe what you need to know regarding the concepts you've identified for each bullet above)

- Four seasons (summer, fall, winter, spring)
- It is cold in winter, hot in the summer, rainy/warm in the spring, and getting colder in the fall
- Seasons occur from Earth's elliptical orbit and tilt around the sun.
- When the northern hemisphere of Earth is tilted towards the sun, it is summer.
- When the northern hemisphere of Earth is tilted away from the sun, it is winter.
- Fall and Spring fall in between, with fall being the northern hemisphere is slightly tilted away and spring being the northern hemisphere is slightly tilted towards the sun.
- The Earth rotates around the sun, and tilts on its own axis.

D) MATERIALS (asterisk (*) = any materials that may be a safety concern)

- Styrofoam circular base (approximately 1 ft. in diameter) and four spheres (approximately 1 in.)
- Toothpicks

- Protractors (6)
- Craft light (5-6)
- Paper plates (40)
- Crayons
- 32 small styrofoam balls
- Scissors (6)
- 8 pieces of large chart paper
- Glue sticks
- *The Reasons For Seasons* by Gail Gibbons

E) REFERENCES (list ALL references that you borrowed ideas from to develop this lesson – including any handouts you may distribute)

- <https://www.youtube.com/watch?v=Jp21OUKsbgU> (0:30 - 2:30)
- <https://www.teacherspayteachers.com/Product/Reason-for-the-Seasons-Earths-Tilt-Activity-Craft-446991> **Reasons for Seasons Activity**
- <https://www.universetoday.com/59707/what-causes-day-and-night/> (Information about content)
- http://static.nsta.org/files/sc1004_68.pdf-- this is a more engaging example of a lesson on why we have seasons that we could use to incorporate inquiry
- *Reasons for Seasons* storybook

F) TENTATIVE TIMELINE (Keep brief)

9:30-9:40	Engage 1: (KWL Chart)
9:40-9:55	Explore 1: Seasons Sorting Activity
9:55-10:05	Explain 1: Paper Plate Seasons
10:10-10:25	Snack Break
10:25 - 10:35	Engage 2: (Discussion- KWL)
10:35-11:00	Explore 2: Activity 1 Styrofoam Tilting Toothpicks Model
10:50 - 11:05	Explore 2: Activity 2 Flashlight/Student Model
11:05 - 11:20	Explore 2: Activity 3 Re-evaluation of original Styrofoam Tilting Toothpicks Models

11:20-11:30	Bathroom Break
11:30-11:45	Explain - Bill nye clip/ Reasons for Seasons book
11:45-12:00	Elaborate - Position Earth around the sun on a paper plate

G) DESCRIPTION OF YOUR LESSON:

Engage 1	<p>In the engage phase, we will begin by asking the students what they know about the 4 seasons. We will prompt students with questions if needed. Some questions might include, “Can anyone name one of the 4 seasons?” “What is the weather like in ____ season?” “How are they different?” “What are some of your favorite things to do in these seasons?” “Why do you think we have different seasons?” By prompting students with these questions, we can get a better understanding of their knowledge on the topic and how they view the different seasons. Additionally, this will get them to begin to think about the key differences between all of the seasons and why these changes occur. We will make a class KWL chart to find out what the students know about seasons.</p> <p>Focus Question: What are the differences between the four seasons?</p>
Explore 1:	<p>Students will get pictures of the four seasons. As a group, the students will group the pictures of the same seasons together. This will allow the students to explain how they see the seasons and the characteristics of each.</p>
Explain 1:	<p>To practice what the students have discussed in the explore phase, they will decorate a plate that is divided into 4 parts. This will show us how they understand how each season is different and what characteristics they have observed in the different seasons. It will also show us what they learned through our discussions.</p>
Engage 2	<p>We will ask students to think back to what they observed in the earlier activity to connect with why we have seasons. The teacher will facilitate the discussion for the reason for the seasons. The teacher will see what the students current ideas are about why we have seasons.</p> <p>Focus Question: How does the Earth’s movement around the sun and its axis cause changes on Earth’s surface?</p>
Explore 2	<p>Activity 1- Styrofoam Tilting Toothpicks Model (Kiersten) We will provide students with a styrofoam circular base that will represent the Earth’s path around the sun. We will also give them four different small styrofoam balls that represent the four seasons. We will ask students to make a</p>

	<p>model of the seasons by using a small craft light, four Earth models made of Styrofoam, four toothpicks, and a protractor. We will not tell the student what represents the Earth's axis before the activity. We will draw an N and S on the balls to represent the North and South poles. We will also tell them that each Earth model should represent one season. We will mark Summer, Winter, Fall, and Spring on the flat styrofoam base. Once each group works together to make their model, we will have every table share their inferences. (Based on our research, students generally think that the seasons are caused by Earth's distance from the sun. We will let students share this information and then we will do the next activity to help them understand why these inferences are incorrect.)</p> <p>Activity 2- Flashlight/Student Model (Yiqi)</p> <p>In this activity, we will introduce the idea of earth's axis to all of the students. We will start by having the students make observations about the globe. We will walk around with the globe and write down observations that students have on the board. If someone mentions that it is sideways or not straight, we will emphasize this idea and tell them that this is called earth's tilt. We will talk about how the axis, what goes through the middle of earth is not up and down, but instead is tilted sideways. Next, we'll have all of the kids stand up behind their desks. We will tell them to pretend that there is an axis going through this body straight down through their heads. We will then say that their axis is tilted and have them show us what this might look like. After everyone shows what they think this might look like, we will have all of the student tilt so that they are leaning forward. Then, we will have them lean backwards. We will take a flashlight around and put it near their face when they lean towards it and away from it. This will model how the earth is tilted towards and away from the sun during different seasons. We will prompt students with questions such as, "Was it warmer/brighter when you were tilted towards or away from the flashlight/warm object?" This will lead into the student's understanding that when the earth is tilted toward the sun, it is warmer (summer) and colder when it is tilted away from the sun (winter).</p> <p>Activity 3- Re-evaluation of original Styrofoam Tilting Toothpicks Models</p> <p>After doing the flashlight/student model we will ask the students to go back to their Styrofoam Tilting Toothpicks Model. We will ask the students, "What do you think the toothpick represents?" "What modifications are you going to make to your model based on what you learned in the flashlight activity?" We will have the students make their corrections and explain this to the class.</p>
Explain 2	<p>-We will now read the book, <i>The Reasons for Seasons</i>. This will help to tie up the loose ends and reiterate the main points of the lesson. We will also show a clip of the Bill Nye Video (0:30 - 2:33) on the seasons and night/day so that it</p>

	<p>ties together both of our lessons. By doing this, the main ideas are reiterated to the students in a clear visualization.</p> <p>-Then, we will have a discussion about all of the things that they learned about including why we have seasons, the differences between seasons, Earth’s tilted axis, and why we have night/day.</p>
Elaborate 2	<p>For a final evaluation, each student will be given 4 small images of earth that they will be able to color. The students will pick a spot on their earth and mark it with a star in the same spot on all 4 pictures. They will also be given a circle that they can decorate for the sun. Then, the students will be given a paper plate that has 4 lines coming from the middle. The students will each glue their sun in the center of their plate and then glue their earths on the extension of each of the lines, indicating summer, spring, fall, and winter. They will tilt each of their pictures in different ways to show how the sun is hitting their location at different places throughout the year. They will label each pictures by writing the name of the season it corresponds with and decorating it with pictures that indicate that season.</p>

H) What will you do to learn if your students met the objectives for this week?

(FORMATIVE ASSESSMENT - the 5th “E”)

In order to assess what the students have learned, we will have students do an activity where they demonstrate how the Earth being tilted causes seasons. They will cut out an Earth and position it in 4 different spots around a sun and label what season the specified country would be in. Then, we will have students draw pictures around each planet to indicate the characteristics of that season. This will show us that they understand both the differences between all of the seasons and how the tilt of Earth’s axis towards/away from the sun causes these differences.

I) PEDAGOGICAL FOCUS:

We are anticipating what the students might know about some of the seasons and be able to name them before starting the activities. We are using questions such as, “Can anyone name one of the 4 seasons?” “What is the weather like in ____ season?” “How are they different?” “What are some of your favorite things to do in these seasons?” “Why do you think we have different seasons?” Then, teachers will monitor student’s discussions throughout the lessons in the explore phases through our different activities. . In doing so, teachers will select and sequence student’s comments and questions in order to connect concepts. This will most likely occur during discussions facilitated by the teachers. The teacher will connect the student responses to the students’ comments and their key ideas. This productive discussion will help the students further their knowledge to hear from other students and the teachers. We will also help make connections between the activities and the content they should be learning.

-State the focus for the week (Productive discussions, Science for all etc)

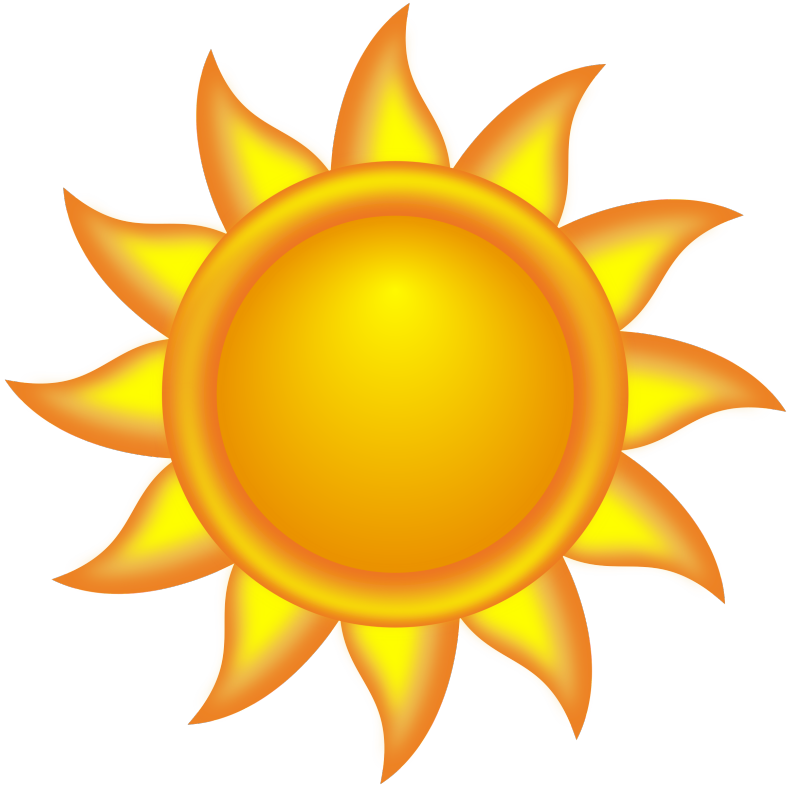
- NOS (This week's main focus)
- Continuing Science for ALL (Students with special needs, ELLs)
- Continuing to use Productive Discussions

-Explain how you are trying to incorporate this into your practice in this week's lesson

We are trying to incorporate this into our practice this week by creating a lesson with engaging activities. We will be using a combination of visuals and hands on activities to reach all students. We will be using multiple methods for teaching the information to the students like visually, audibly, and kinesthetically. We will incorporate observation and inference into the activity where the students are inferring the season based on the pictures shown in explore 1. The students will also use observation and inference when the students are exploring the styrofoam Earth model. Students will use empirical evidence to conclude how the earth rotating and is tilted effects the season on a specific part on earth. Students will use creativity when they come to the conclusion of where the earth is around the sun during each season and how the earth tilts.



















Lesson Plan

LESSON 4 Stars and Constellations

GRADE LEVELS K-1

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET (minimum of 2/ lesson)

Objective 1: Students will be able to identify constellations by observing photos of different constellations.

Objective 2: Students will learn that constellations are patterns in the sky by creating the dixie cup model, pretzel/marshmallow model and the glow-in-the-dark star model.

B) STANDARDS (<https://www.nextgenscience.org/>)

☐ What science and engineering practices are you addressing in this lesson?

Asking questions (for science) and defining problems (for engineering)

Developing and using models

Obtaining, evaluating, and communicating information

☐ What cross cutting concepts are you addressing in this lesson:

3. Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

4. Systems and system models. Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

6. Structure and function. The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

C) TEACHER CONTENT KNOWLEDGE (As a teacher, describe what you need to know regarding the concepts you've identified for each bullet above)

- What makes a constellation
- “In 1928, the International Astronomical Union (IAU) ratified and recognized 88 modern constellations, with contiguous boundaries defined by right ascension and declination. Therefore, any given point in a celestial coordinate system lies in one of the modern constellations. Some astronomical naming systems give the constellation where a given celestial object is found along with a designation in order to convey an approximate idea of its location in the sky.”
- The history behind the constellations
- “Origins for the earliest constellations likely goes back to prehistory, whose now unknown creators collectively used them to related important stories of either their beliefs, experiences, creation or mythology. As such, different cultures and countries often adopted their own set of constellations outlines, some that persisted into the early 20th Century. Adoption of numerous constellations have significantly changed throughout the centuries. Many have varied in size or shape, while some became popular then dropped into obscurity. Others were traditionally used only by various cultures or single nations.”
- Names of different constellations
- “Andromeda Antlia Apus Aquarius Aquila Ara Aries Auriga Boötes Caelum Camelopardalis Cancer Canes Venatici Canis Major Canis Minor Capricornus Carina Cassiopeia Centaurus Cepheus Cetus Chamaeleon Circinus Columba Coma Berenices Corona Austrina Corona Borealis Corvus Crater Crux Cygnus Delphinus Dorado Draco Equuleus Eridanus Fornax Gemini Grus Hercules Horologium Hydra Hydrus Indus Lacerta Leo Leo Minor Lepus Libra Lupus Lynx Lyra Mensa Microscopium Monoceros Musca Norma Octans Ophiuchus Orion Pavo Pegasus Perseus Phoenix Pictor Pisces Piscis Austrinus Puppis Pyxis Reticulum Sagitta Sagittarius Scorpius Sculptor Scutum Serpens Sextans Taurus Telescopium Triangulum Triangulum Australe Tucana Ursa Major Ursa Minor Vela Virgo Volans Vulpecula”
- Stars in the constellation create patterns
- There are 88 constellations
- There are sections in the sky that form constellations
- Hercules was perhaps the greatest hero in all mythology. He was the son of Jupiter and Alcmena, and was hounded all his life by Juno. (This is deliciously ironic, because in the original Greek myths, Juno is named Hera and Hercules is Heracles, which means "glory of Hera.") Juno was unhappy with Jupiter's infidelity, and saw Hercules as a living, breathing symbol of her shame. She delayed his birth, and when Hercules was a mere baby (but a big one!) sent two snakes into the crib he shared with his mortal half-twin Iphicles. Hercules killed them both with his bare hands, marking the beginning of his career as a monster-killer.

- Draco represents the dragon who guarded the golden apples in the garden of the Hesperides. One of the labors of Hercules was to steal these apples (some sources state it was his eleventh labor, others it was his twelfth). This was, according to Bulfinch, the most difficult labor of all..., for Hercules did not know where to find them. These were the apples which Juno had received at her wedding from the goddess of the Earth, and which she had entrusted to the keeping of the daughters of Hesperus, assisted by a watchful dragon. After various adventures, Hercules arrived at Mount Atlas in Africa. Atlas was one of the Titans who had warred against the gods, and after they were subdued, Atlas was condemned to bear on his shoulders the weight of the heavens. He was the father of the Hesperides, and Hercules thought might, if any one could, find the apples and bring them to him (Bulfinch's Mythology, 136).
- The constellation Pegasus represents the white, winged horse of Greek mythology. This beautiful figure can be seen high in the sky starting near the end of summer and continuing through autumn if you live in the Northern Hemisphere. If you are below the Equator, look for Pegasus in late winter and through spring. When looking at the image, it is difficult to see the figure as a horse. That is because the constellation is actually upside-down! Imagine it flipped over, and you can see what could be the neck and head of a horse and two legs sticking out from the famous "Square of Pegasus".
- In mythology, Cancer is associated with the crab in the story of the Twelve Labours of Heracles (represented by the Hercules constellation). In the myth, Hera sends the crab to distract Hercules while the hero is fighting the Lernaean Hydra, the serpent-like beast with many heads and poisonous breath, represented by Hydra constellation. When the crab tries to kill Hercules, Hercules kicks it all the way to the stars.
- Arcas was the son of Callisto, who was transformed by Juno into a bear. When Arcas was fifteen, he was out hunting in the forest when he came across a bear. The bear behaved quite strangely, looking him in the eyes. He of course could not recognize his mother in her strange shape, and was preparing to shoot her when Jupiter prevented him. Arcas was transformed into a bear like his mother, and the two were taken up into the sky. Juno was annoyed that the pair should be given such honor, and took her revenge by convincing Poseidon to forbid them from bathing in the sea. It is for this reason that Ursa Major and Ursa Minor are both circumpolar constellations, never dipping beneath the horizon when viewed from northern latitudes.

D) MATERIALS (**asterisk (*)** = any materials that may be a **safety concern**)

- Pretzels (small pretzel sticks) 5 bags

- Small Marshmallows (5 bags)
- Glow in the dark stars
- Black construction paper (40 pieces of paper)
- Constellations printouts
- Dixie Cups (50)
- Crayons/Chalk (Yellow and white)
- Flashlights (30)

E) REFERENCES (list ALL references that you borrowed ideas from to develop this lesson – including any handouts you may distribute)

- <https://www.pinterest.com/pin/471541023475462500/> (edible constellations)
- http://www.comfychair.org/~cmbell/myth/ursa_minor.html
- http://www.astro.wisc.edu/~dolan/constellations/constellation_list.html
- <http://www.constellation-guide.com/constellation-list/cancer-constellation/>
- https://www.windows2universe.org/the_universe/Constellations/pegasus.html
- <https://www.pinterest.com/pin/542543086346545635/>
- <https://www.teacherspayteachers.com/Product/Sun-Moon-Stars-Next-Gen-Science-Aligned-Unit-2926947>
- <https://en.wikipedia.org/wiki/Constellation>

F) TENTATIVE TIMELINE (Keep brief)

9:30 - 9:55	Engage 1: Venn Diagram (Sun, Star & Moon)
10:00 - 10:20	Explore 1: 1) Dixie Cup Constellations 2) Pretzel & Marshmallow Constellations
10:25 - 10:40	Snack Break
10:45 - 11:00	Bathroom Break
11:00 - 11:25	Explain 1: Book reading <i>Our Stars</i>
11:30 - 12:00	Elaborate: Glow in the Dark constellation

G) DESCRIPTION OF YOUR LESSON:

ENGAGE	<p>We will start by doing a classwide Venn diagram of stars, moon, and the sun. The students will brainstorm the similarities and differences between the stars, moon, and the sun. The students will look at what makes a star a star.</p> <p>Focus Question: What is a constellation?</p>
EXPLORE:	<p>1: Identifying Constellations In the first explore activity, we will show students different pictures of constellations. Without telling them what the constellations are, we will have them make observations of the image. We will have them tell us what they see and see if the students recognize that there is a pattern in the sky. Then, we will tell them the story that goes along with each of the different images and show them the pattern within them. In doing so, the students will see that a constellation is a pattern of stars. The constellations that we are introducing in this phase is Hercules, Draco, Pegasus, Cancer, and Ursa Minor (Little Dipper).</p> <p>2:Dixie Cup Constellations Students will be given a Dixie cup and circle cut out with the pattern of a constellation on it. They will poke holes into the bottom of the cup to make the constellation they were given on their cut out. Students will use a flashlight with their Dixie cup to display their constellation on the wall.</p> <p>3: Making constellations with pretzels and marshmallows In this explore phase, the students will be given the scenario: “There is a huge empty gap in space that needs to be filled to make the 89th constellation. You must create a new constellation with 10 stars (marshmallows). Your challenge is to create a constellation that looks like your favorite animal.” We will have the students create a blueprint with pencil and paper before creating their design. The students will then be given marshmallows and pretzels to construct their constellation. We will have the students show their design to their peers to try and guess the animal they made. Additionally, they will come up with a story to explain the significance of their story.</p>
EXPLAIN	<p>We will read the book <i>Our Stars</i> to review more about stars and the ways that the constellations form in the sky.</p>
ELABORATE	<p>Students will take what they have learned about constellations and make their own or make one that already exists. The students will use the glow in the dark stars and poster board to make a constellation. The students will use what they know about constellations being a</p>

	group of stars to elaborate.
--	------------------------------

I) PEDAGOGICAL FOCUS:

-State the focus for the week

STE(A)M: Science, Technology, Engineering, Art, Mathematics

-Explain how you are trying to incorporate this into your practice in this week's lesson

This week we are focusing on STEM (STEAM) integration.

Science- Students will learn about stars and the patterns they form in the sky: constellations. Students will observe images of the constellations. Without telling them what the pattern is, they will guess what the constellations are and we hope that they will see the pattern within the constellations.

Engineering- "There is a huge empty gap in space that needs to be filled to make the 89th constellation. You must create a new constellation with 10 stars (marshmallows). Your challenge is to create a constellation that looks like your favorite animal. After designing their own constellation, students will be given marshmallows and pretzels to construct their constellation." In this task, students have to think of a way to use a specific number of marshmallows to create their own constellation that represents a pattern of an animal.

Art- Students will create a their favorite animal and they will use marshmallows and pretzels to create their own constellations. Students are designing their constellation and artistically creating an animal with what they have.

Technology - Students will draw out their constellations as a blueprint to prepare to make a constellation. They are using paper and pencil, as well as marshmallows and pretzels to design their constellations.

Math - Students will be asked to count out 10 marshmallows to make a constellation. Students will use geometry to make the shapes of the constellations like squares and rectangles. They will also need to angle and make the constellations look right.

Q405/E548 Saturday Science Teaching – Spring 2018

Lesson Plan

LESSON 5 Exploring Space

GRADE K-1

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET (minimum of 2/ lesson)

- Students will be able to describe how scientists use telescopes to learn about space by creating their own telescope and model of what they might see when they look through it.
- Students will be able to identify different elements of the season, by making observations of what we see throughout our campus walk.

B) STANDARDS (<https://www.nextgenscience.org/>)

- What science and engineering practices are you addressing in this lesson:
 1. Asking questions (for science) and defining problems (for engineering)
 2. Obtaining, evaluating, and communicating information
- What cross cutting concepts are you addressing in this lesson:
 - Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
 - Systems and system models. Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

C) TEACHER CONTENT KNOWLEDGE (As a teacher, describe what you need to know regarding the concepts you've identified for each bullet above)

1. What is a telescope?

A telescope is an optical instrument that aids in the observation of remote objects by collecting electromagnetic radiation (such as visible light).

2. How can we study objects in space?

One of the earliest tools for space exploration was the telescope. Using lenses and mirrors to see beyond Earth's borders, telescopes gave scientists their first glimpses of what exists beyond Earth's atmosphere.

What scientists were able to learn with telescopes paved the way for manned space exploration. From trips to the Moon to dozens of manned space shuttle flights, teams of humans were able to travel in space and conduct research on a variety of scientific subjects.

Scientists have always been curious. The more we learn about outer space, the more we realize how much more there is to explore. This has led scientists to develop even more powerful tools to help them explore way beyond the places we can go as humans.

For example, the telescope is no longer an Earth-bound instrument. In 1990, the Hubble Space Telescope was launched into outer space. In the last 20 years, it has brought us images of our universe that couldn't have been captured in any other way.

It's a miraculous piece of technology that's powered by sunlight. With many different cameras and types of scientific instruments, the Hubble Space Telescope has provided scientists with invaluable data. In fact, NASA estimates that data from the Hubble Space Telescope has been used as the basis of over 10,000 scientific papers in the past two decades!

Since late 2000, scientists have also been able to conduct hundreds of experiments in low-Earth orbit thanks to the International Space Station (ISS). The ISS is humankind's first orbital space station meant to be used for long-term visits from astronauts from a variety of countries. What scientists learn from the ISS will likely be a stepping stone to sending humans on manned missions to Mars and beyond.

In the meantime, scientists have pushed forward with a wide variety of unmanned machines built to explore the deepest corners of our solar system. Unmanned probes, such as NASA's Cassini probe, have been sent to explore other planets. If you've seen a spectacular picture of Saturn recently, you can thank the Cassini probe.

Astronomers have always been fascinated by Mars, and we know more than ever about Mars today thanks to the Mars Reconnaissance Orbiter and the Mars rovers, Spirit, Opportunity, and Curiosity. The rovers are powerful robots that have helped scientists learn a tremendous amount about the geology of Mars.

As time marches on, scientists will continue to learn more and more about our universe using advanced scientific technology to create tools to explore the depths of space. For example, thanks to the Kepler telescope, launched in 2009, scientists now know that there are possibly over 3,000 planets orbiting over 2,000 stars in the Milky Way galaxy, none of which were known about until the last couple of years!

3. What do we see through a telescope?

There are 3 telescope categories.

I. 60mm (2.3in) to 70mm (2.8in) aperture or equivalent

With telescopes of this aperture size, you'll be able to see

- a) **Within the Solar System:** - structure in sunspots (with an appropriate solar filter)
- the phases of Mercury
 - lunar rilles, or the depressions in the Moon's surface
 - lunar craters less than 5 km in diameter
 - Martian polar caps and major dark surface features when Mars rotates (oppositions)
 - several additional cloud belts on Jupiter, and in better detail than the 60mm – 70mm aperture range
 - the shadows of Jupiter's moons as they revolve around her
 - Cassini's division in Saturn's rings on a regular basis, plus four or five of its moons
 - Uranus and Neptune are also visible as very small discs

b) **Stars:** double stars separated by 1.5 arcseconds or more in good seeing, and some faint stars down to magnitude 12

c) **Deep Sky Objects:** dozens of globular clusters, emission nebula, planetary nebulas, and galaxies. Also, all of the Messier objects, although most galaxies will remain relatively featureless hazy patches.

II. 130mm (5in) to 200mm (8in) or equivalent

With telescopes of this aperture size, you'll be able to see

- a) **Within the Solar System:** - lunar domes, rilles, and other lunar features less than 3 km across
- many more dark surface features on Mars, even during less-than-favorable oppositions
 - festoons, streamers, and much more detail in Jupiter's cloud belts with good seeing
 - subtle cloud belts on Saturn's disk
 - many faint comets and brighter asteroids

b) **Stars:** double stars separated by about 1 arc second in good seeing, and some faint stars down to magnitude 13 or better.

c) **Deep Sky Objects:** hundreds of star clusters, nebulae, and galaxies (with hints of spiral structure visible in some galaxies). You will also see considerable detail in nebulae and star clusters.

III. 8in (203mm) to 14in (355mm) or equivalent

With telescopes of this aperture size, you'll be able to see

- a) **Within the Solar System:** - under excellent seeing conditions, all lunar features – even those less than 2km across

- small clouds and significant surface detail on Mars, with moons Deimos and Phobos a rare possibility
- a wealth of detail in Jupiter's clouds and belts
- Enke's division (a gap) in Saturn's rings often visible
- Neptune's moon Triton visible
- Pluto visible as faint star-like point

b) **Stars:** double stars separated by as little as 0.5 arcseconds in excellent seeing conditions, and faint stars down to magnitude 14.5 and below.

c) **Deep Sky Objects:** thousands of globular clusters, nebulae, and galaxies, with many showing details that were invisible in smaller telescopes. Also, faint color is now visible in some of the brighter nebulae from a dark sky site, as these telescopes excel in viewing these faint objects at low to medium powers.

4. Real distances vs. model distances

REAL DISTANCES		PLANETS	MODEL DISTANCES	
Diameter	Orbit Radius		Diameter	Orbit Radius
average	average		average	average
km	km		cm	m
1,392,000		Sun	38.14	
4,879	57,910,000	Mercury	0.1337	15.87
12,100	108,200,000	Venus	0.3315	29.64
12,740	149,600,000	Earth	0.3490	40.99
6,779	227,900,000	Mars	0.1857	62.44
950.0	413,800,000	Ceres Asteroid Belt	0.02603	113.4
139,800	778,600,000	Jupiter	3.830	213.3
116,500	1,433,000,000	Saturn	3.192	392.6
50,720	2,877,000,000	Uranus	1.390	788.2
49,250	4,503,000,000	Neptune	1.349	1,234
2,372	5,874,000,000	Pluto Kuiper Belt	0.06499	1,609

D) MATERIALS (asterisk (*)) = any materials that may be a **safety concern**)

- Toilet paper rolls/paper towel rolls (60)
- Long rope (for students to hold and walk)
- Foil
- Packing peanuts
- Dixie cups
- Modeling clay
- Pipe cleaners
- Tape
- Glue
- Scissors
- Stickers
- Plastic
- Styrofoam
- Egg cartons
- Crayons
- Cut outs

E) REFERENCES (list ALL references that you borrowed ideas from to develop this lesson – including any handouts you may distribute)

<https://en.wikipedia.org/wiki/Telescope>

<https://wonderopolis.org/wonder/how-do-scientists-explore-the-solar-system>

<http://www.ozscopes.com.au/what-can-you-expect-to-see-with-a-telescope.html>

<http://www.deepskywatch.com/Articles/what-can-i-see-through-telescope.html>

F) TENTATIVE TIMELINE (Keep brief)

9:30-9:45	Engage
9:45-10:15	Explore 1: Planet Walk
10:15-10:45	Explore 2: Kirkwood Observatory
10:45-11:15	Explore 3: Observation Walk
11:15-11:30	Snack/Bathroom Break
11:25-11:40	Explain: Read Aloud
11:40-12:00	Elaborate: Create Telescopes & What You See

G) DESCRIPTION OF YOUR LESSON:

<p>Engage</p>	<p>Teachers will facilitate a discussion around how we study space and the tools we need to see space. We will brainstorm ideas as a class around how a telescope helps us see objects/planets in space. Teachers will make a chart of the objects the students can see in space.</p> <p>Focus Question: How do scientists study objects in space?</p>
<p>Explore</p>	<p>Explore 1: Planet Walk For the explore phase of our experiment, we will be walking to the Kirkwood Observatory to see and learn about telescopes. While walking, we are going to pretend like we are traveling through space, from the Sun to Pluto. We have mapped out the scaled distance that each planet would be from the sun (Education Building) and we will stop along the way at each spot to ask the students what planet we would be at. We will have pictures of each planet to show the students if they can't remember the names so that they are able to identify the planets in a different way. We will also ask the students what they remember about each of the planets so that we can assess what the students have learned from previous lessons.</p> <p>Explore 2: Kirkwood Observatory The students will learn more about how scientists use telescopes to learn about space. They will get the opportunity to see the large telescope that they have here and listen to a speaker.</p> <p>Explore 3: Observational Walk When walking back to the Education Building, we are going to ask the students to make observations about what they can see in the sky and around them. We will ask students to look for the moon as well, because this could tell them what moon phase we might be in if we can see it in the day. Additionally, we will encourage them to make observations about what they see that indicates what season we are in and the changes we are beginning to see. This will connect to our seasons lesson from week 3.</p>
<p>Explain</p>	<p>We will read the book "There's No Place like Space" while the students are eating snack. This will help review all of the things that we have talked about throughout the semester so that they can use this to help them in the elaborate phase.</p>
<p>Elaborate</p>	<p>Students will use what they learned about the telescope at the Observatory to construct their own. Students will be given materials to make a telescope that would represent what a telescope looks like and would be used for.</p>

	Additionally, we will have the students create what they see through the microscope such as a constellation, moon, planet, etc. The students will be provided with a variety of materials that they have used throughout the semester.
--	--

**H) What will you do to learn if your students met the objectives for this week?
(FORMATIVE ASSESSMENT - the 5th “E”)**

We will assess the students on their engagement in the discussion and their contribution to the discussion. We will also assess students on if they can tell us how we study space and what a telescope is used for.

I) PEDAGOGICAL FOCUS:

-State the focus for the week (Productive discussions, Science for all etc)

Assessing for Learning

-Explain how you are trying to incorporate this into your practice in this week’s lesson

We will incorporate equity of assessment into our lesson by having the students choose what they see through their microscope. They are able to express their learning by choosing what they want to create and how they choose to create it. This also gives students the opportunity to think creatively about what they learned and we are not giving them an assessment that has one correct answer. If some of their designs are inaccurate such as the order of planets that they make, we can ask them, “How can we improve this model to make it more accurate?” Another way is by encouraging them to add more to their model to make it more accurate such as drawing stars around the planets that they are looking at through the microscope. This avoids making the students feel like they failed, while also pushing them to learn more and gain a better understanding on the topic.

“Draw Talk” Interviews: On our way back from the Observatory, we will talk about the things we learned in the Saturday Science School with our students. We will encourage them to make observations of the planets and stars in the sky. They will also observe and discuss with us the what they see that indicates what season we are in and the changes we are beginning to see. In addition, the students will also show “draw talk” by creating their own telescope. Before creating the telescope they will draw their ideas down and explain why they decided to create it a certain way.

We will assess students’ ideas based on the 3Cs in the reading:

-Clarity: Students express their own ideas clearly and the ideas make sense to the teachers and other students.

-Coherence: Students’ ideas develop based on the things that they already know.

-Causality: Students' ideas create a link between a cause and its effects.