Planetary Science Unit Plan

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NASA Astronomy and Space Science

Adams State University

Planetary Science Unit Plan

Grade Level: 8th grade

Topic or Content Area: Planetary Science

Big Idea or Ideas:

1. Students will explore the known universe through research and investigations.
2. Students will be able to locate their place and other celestial bodies placement in the universe using a cosmic address.
3. Students to be able to conduct experiments and follow procedures with minimal assistance from the instructor.
4. Students will be able to identify important characteristics of our inner and outer planets.
5. Students will be able to understand that Earth is a system of systems which influences and is influenced by life on the planet.
6. Students will be able to appreciate that the solar system influences Earth and life on the planet.
7. Students will be able to determine the life cycle of a star based on mass.

<table>
<tr><th colspan="2">Stage 1 Desired Results</th></tr>
<tr><td rowspan="2">ESTABLISHED GOALS
NGSS Standards

Physical Sciences
MS-ESS1-1
MS-ESS1-2
MS-ESS1-3
MS-ESS1-4
MS-ESS2-2
MS-ESS2-4
MS-ESS3-1
MS-ESS3-2
MS-ESS3-3
MS-ESS3-4</td><td>Transfer</td></tr>
<tr><td>Students will be able to independently use their learning to…
● Explain the movement of Earth through space; Revolution and Rotation.
● Conduct investigations into the phases of the moon for one month.
● Create their own model of the Moon and Earth.
● Explore the new discoveries involving space (Parker Space Probe).
● Place the events in the creation of the solar system in order.
● List the planets in our solar system in order.
● Compare the temperature, atmosphere, rotation, revolution, and composition of the planets in our solar system.
● Explain the differences between the three space rocks in our solar system and describe certain characteristics they possess (asteroids, comets, and meteors).</td></tr>
<tr><td></td><td>Meaning</td></tr>
</table>

<table>
<tr>
<td rowspan="3">Engineering and Technology
MS-ETS1-1

Common Core
CCSS.ELA-LITERACY.SL.8.1
CCSS.ELA-LITERACY.W.8.1.B
CCSS.ELA-LITERACY.RST.6-8.1
CCSS.ELA-LITERACY.RST.6-8.9</td>
<td>UNDERSTANDINGS
Students will understand that…
Earth is a system composed of subsystems
The tilt of Earth’s axis and Earth’s revolution around the Sun results in seasons
The revolution of the Moon around the Earth and the rotation of Earth account for the phases of the Moon
The solar system formed during a sequence of events that started with a</td>
<td>ESSENTIAL QUESTIONS
Students will keep considering…
How does the Earth move through space?
What are the reasons for the seasons?
Why are the planets in the order that they are in?
How did the solar system form?
Where did the moon come from?
How are stars formed?
What kind of technology is available for space travel?
What celestial bodies exist outside of our solar system?</td>
</tr>
<tr>
<td colspan="2">Acquisition</td>
</tr>
<tr>
<td>Students will know…
Earth’s axis tilts at an angle of 23.5 degrees and points towards the North Star
Earth revolves around the sun in one year and rotates on its axis in one day.
The seasons on Earth are due to the revolution of Earth, Solar Angles, and the Earth’s tilt.
The life cycle of a star depends on its mass.</td>
<td>Students will be skilled at…
Calculating the ratios of objects and their representations
Conducting an activity in a collaborative setting given a procedure
Creating hypotheses about scientific phenomenon on Earth and in Space.</td>
</tr>
</table>

Stage 2 - Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
All Transfer Goals All Meaning Goals	● Accurate research ● Clear explanations ● Analysis and Conclusions for labs ● Use of laboratory equipment ● Calculated calories and energy ● Accurate observations ● Comparisons	PERFORMANCE TASK(S): *Students will show that they understand by evidence of…* 1. Task: create a model representation of the size and distances of the Moon and Earth. 2. Task: students will take their models from one task and calculate them to scale using ratios. 3. Lab: completing the moon lab. Recording the phases and observations of the moon every night for one month. 4. Task: Examining the features of planets and placing them in their locations in their solar system. Placement is based on temperature, resolution, and composition. 5. Debate: students will choose a theory on the end of the universe that they believe after researching these theories. Students will provide scientific evidence to back up their claims. 6. Essay: research and summary of the Parker Space Probe. 7. Task: taking notecards with images and explanations of events and placing them in order to show the formation of the solar system.
All Meaning Goals All Skill and Acquisition Goals Big Ideas	● Well crafted notes ● Examples ● Accurate research	OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* 1. Pretest: the pretest and the unit exam are the same test. It is used to measure student growth throughout the unit. 2. Projects: 3. Unit Exam: the pretest and the unit exam are the same test. It is used to measure student growth throughout the unit.

	• Self-assessment • Evidence based • Comparisons • Well spoken and written ideas • Participation • Vocabulary defined	4. Research: The James Webb Space Telescope vs. The Hubble Telescope. 5. Research: Evidence in the Big Bang Theory compared to other theories. Accompanied by an Essay Assignment. 6. Quiz: The order of the planets (also incorporates temperature, atmosphere, and identifying features of the different planets). 7. Quiz: I-checks (5 I-checks given in the unit) 8. Quiz: Review Earth Quiz for students. Some of the content was covered in 6th and 7th grade. *(All quizzes given as I-checks, which means students can correct answers marked wrong for half credit- self-assessment and chance to learn from mistakes).*

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

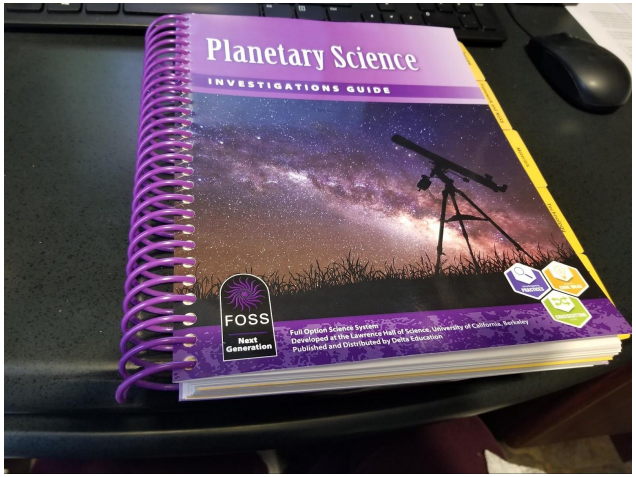
The key to the transfer, acquisition, and meaning goals for this unit is for students to be able to make observations and interpret data. Students need to understand the difference between a theory and a law. Research on the solar system and beyond will help in student understanding of the universe that they live in.

Lessons:	*Progress Monitoring*

1. Pre-assessment: Use pretests to assess prior knowledge and to allow students to self reflection on their own achievements in the unit. 2. Where do you live? (Activity): Students will be figuring out their cosmic address. This will open up the conversation on where the Earth is in the universe. Students will explore this thought using google maps on the chromebook. Students will draw an aerial view of the school then give it a cosmic address. 3. The Earth (Review): The class will review Earth science from last year. This will involve layers of the Earth, Atmosphere, land structures, water structures, rotation, revolution, and more. Students will take notes and answer questions. 4. Modeling the Earth, Moon, and Sun (Activity): The instructor will blow up a balloon and ask students to blow up there balloon to what they believe to be the size of the moon in comparison. The instructor will have a couple students come up who believe theirs is correct. The instructor will then show then using string how the moon is four times smaller than the circumference of the Earth. The instructor will then tell students to determine how far apart they should be in the model. This will again be shown using a string. 5. The Moon (Lecture): The instructor will go through notes on the moon and students will take notes. Videos of the moon landing and discussions on the space race will take place. 6. The Moon Theory: Students will create their own theory on how the moon came to be in our orbit. The class will discuss these theories and the instructor will go through the four most popular theories. The class will talk about the theory that is seen to be correct by the majority of scientists. 7. The Moon Lab (Take home lab): Students will study the moon for one cycle (one month). Students will record observations and draw it each night (time given for cloudy days). 8. The Sun (Lecture): The instructor will go through slides using PowerPoint on the Sun. This will include: how stars form, the life cycle of stars, the layers of the sun, and discussion on the energy the sun provides us. 9. Parker Space Probe (Research): Students will be given an article to read about the launch of the newest probe. This Probe is heading for the sun and will orbit around it collecting data on the corona. Students will discuss the mission and what they hope will be discovered. 10. Exploring other Planets (Lecture/Research): The class will learn about the other planets in the solar system. This will include the other planets: atmosphere, temperature, climate, structure, and location in the solar system. This will be done using powerpoints and videos. The class will also discuss planets in other solar systems and the location of some of these planets in the habitable zone. Students will watch videos, ask questions, discuss their own knowledge, and talk about what they believe visiting Mars would be like. 11. Technology in Space (Lecture/Videos): Students will watch videos provided by the International Space Station about what living in space is like. The class will discuss and research technology created for space. Students will also come up with ways that this technology could be used here on Earth.	● instructor observations ● System to scale activity ● I-checks ● Labs ● Type research reflections ● Questions and Answer ● Discussions ● Worksheets ● Online activities ● Study Island ● Pop quizzes *What are potential rough spots and student misunderstandings* ● The differences between a law and a theory

12. James Webb Space Telescope(Research): The instructor will show some videos on the James Webb and Hubble Telescope. The class will look at images from the Hubble Telescope and discuss. The instructor will also introduce the newest telescope set to launch in 2021. Students will research the Hubble space telescope and the James Webb Space Telescope. Students will then need to compare the two using a Venn Diagram. A worksheet will be provided to students to follow. 13. Quizzes: Quizzes called I-checks will be given throughout as evidence in stage 2. The I-check is a quiz in which students get it after the first round of grading to reflect on what they chose or explained. Students then have the chance to fix these answers and receive half credit. 14. Final Exam: Students will be tested on all transfer, acquisition, and meaning making goals in this unit through multiple choice, true/false, short answer, diagrams, tables, and essays. *Throughout the unit: Composition books: Keep notes, write vocabulary, and glue in lab sheets. Students will be in charge of organizing the information gathered throughout the unit into a book much like real life scientists use. (Scientific journal) The instructor will model and keep a composition book each unit with the students.* **Resources for Unit:** ● FOSS curriculum and Plan Book ● FOSS Planetary Science Textbook ● FOSS lab kits ● Google Classroom and Drive ● NASA lesson plans through Jet Propulsion Laboratories	● The formation of our solar system *How will students get the feedback they need* Students will be given feedback through informal assessments and I-checks. Oral feedback will also be provided from the instructor on a day to day basis. The instructor will also provide feedback on all written assignments.

Resources:



FOSS Learning Program for Middle School Students
FOSS. 2018. Delta Education. Received from: https://www.fossweb.com/

How to use:

Explore the teacher books provided to find lesson plans within units. Read through the teacher background pages, material list, and lesson instructions. Other materials can be found using the site, username, and password given by your school. This is a program that focuses on student learning through hands on activities and exploration. Students are given problems to solve in a group setting.

NASA Lesson Plans
NASA. 2018. Jet Propulsion Laboratory Lesson Plans. Received from: https://www.jpl.nasa.gov/edu/teach/

How to use:

Navigate the website by adding grade level, content area, topic, and type. Find lesson plans that match lessons and units already in progress. Add onto the learning environment in the classroom by engaging students in space exploration along with exploration of our own Earth systems.

Teacher Note:

Modifications to this unit plan are based around the specific IEPs or IEPs of each student.

Prior to beginning the unit students will take the pretest.

Objectives:

- SWBAT understand that location can be described in terms of a frame of reference.
- SWBAT use images to describe a location on Earth from many different points of view.
- SWBAT explain interactions between Earth's systems.
- SWBAT recall materials from the previous year involving the Earth and the atmosphere of the Earth.
- SWBAT explain plate tectonics and how the Earth's continents formed.
- SWBAT explain the location and movement of the Earth in the solar system.
- SWBAT understand that the moon phase depends on how much of the Moon's illuminated surface is visible to the Earth.
- SWBAT observe, record, and analyze the Moon's appearance and position in relation to the Sun over a four-week period.
- SWBAT explain the effects of the Sun on our planet and how the energy interacts with living organisms.
- SWBAT understand that craters of various sizes and types result when meteoroids of various sizes impact the surface of planets and satellites.
- SWBAT describe the solar system; this would include: The Sun, eight planets, satellites, dwarf planets, asteroids, comets, Kuiper Belt objects, and Oort Cloud matter.
- SWBAT explain the creation of the solar system through a sequence of events that started with a nebula of dust and gas.

Assessment: Students will be assessed on their growth throughout this unit. This will be measured in progress between the pretest and posttest.

Materials List: Pretest/Posttest

Standards: MS-ESS1-1, MS-ESS1-2, MS-ESS1-3, MS-ESS1-4, MS-ESS2-2, MS-ESS2-4, MS-ESS3-1, MS-ESS3-2, MS-ETS1-1**,** CCSS.ELA-LITERACY.SL.8.1, CCSS.ELA-LITERACY.W.8.1.B, CCSS.ELA-LITERACY.RST.6-8.1, CCSS.ELA-LITERACY.RST.6-8.9

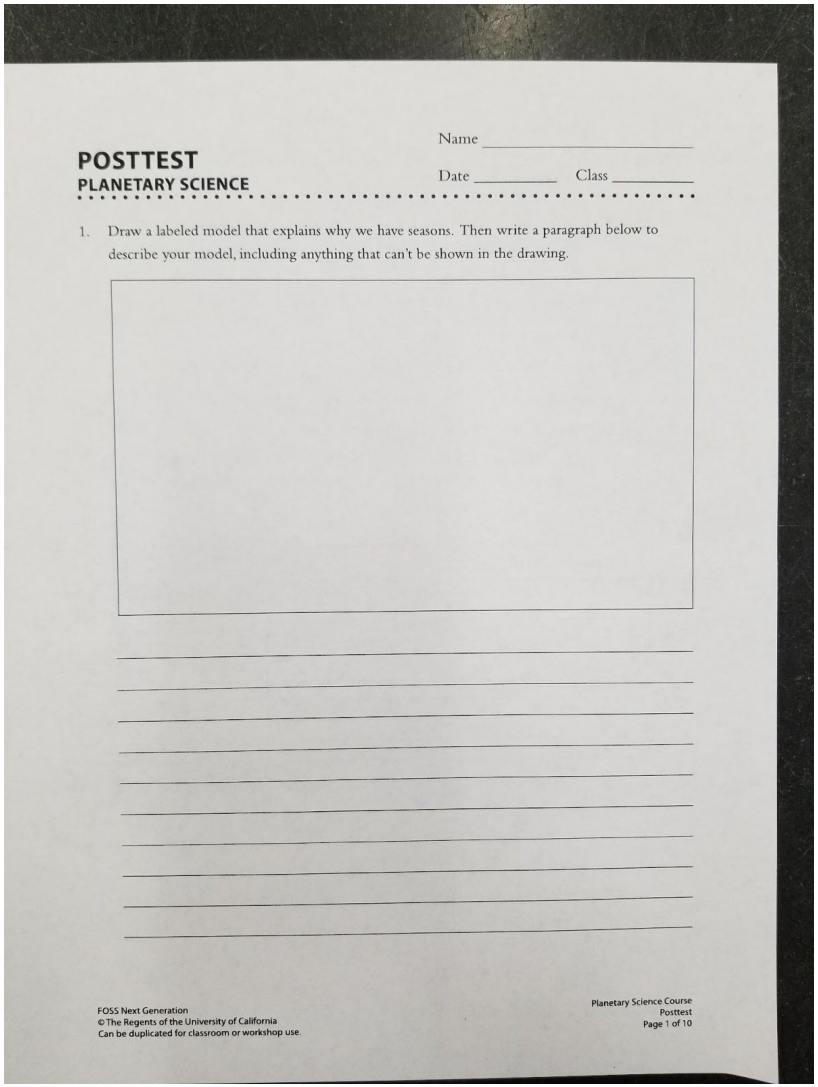
Procedure:

1. The instructor will introduce the new unit and explain the course that the unit will follow throughout the next couple months of school.
2. The class will go over directions and the instructor will pass out the pretest.
3. Once finished with the test students will turn it into the tray and work on something else quietly until everyone is done.

Modifications: *Students will be given extra time on the pretest if needed. The instructor will also be available to read the question allowed and assist in eliminating answers in the multiple choice section of the test.*

Unit Assessment

Pretest/ Posttest for Planetary Science Unit. Created and Owned by the FOSS Company



POSTTEST
PLANETARY SCIENCE

Name _____
Date _____ Class _____

1. Draw a labeled model that explains why we have seasons. Then write a paragraph below to describe your model, including anything that can't be shown in the drawing.

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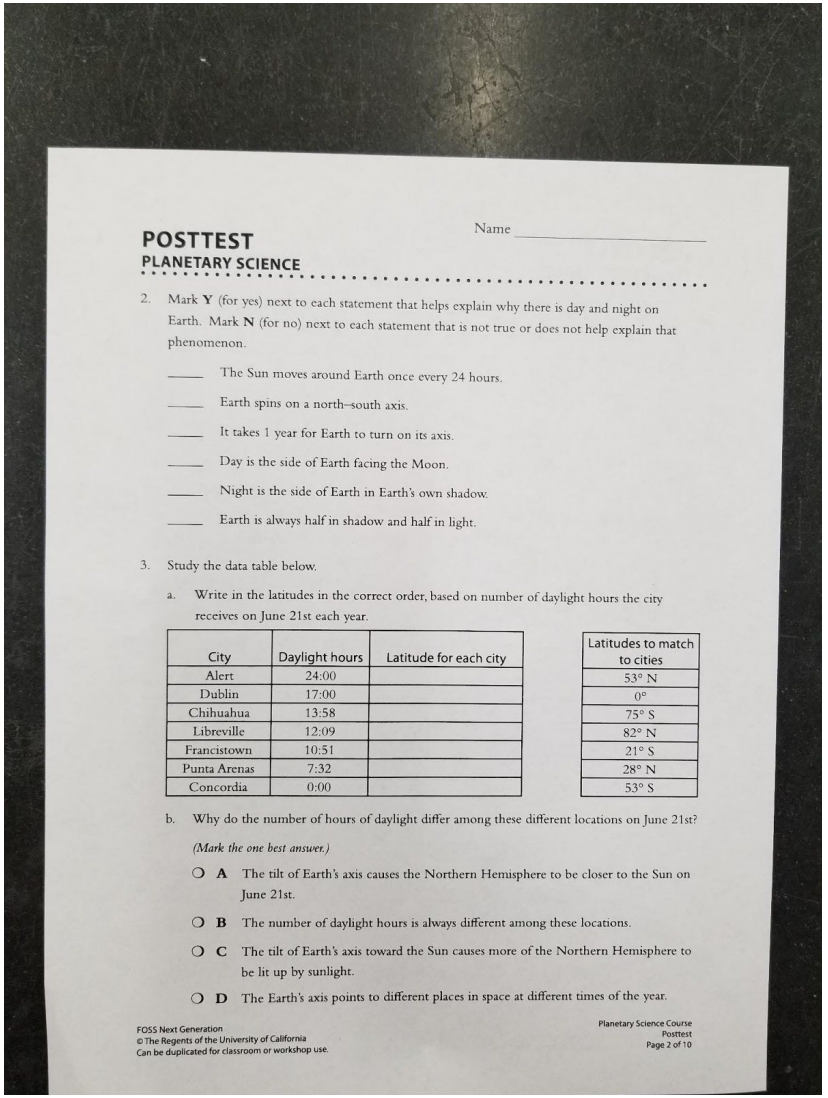
Planetary Science Course
Posttest
Page 1 of 10



POSTTEST
PLANETARY SCIENCE

Name _____

2. Mark **Y** (for yes) next to each statement that helps explain why there is day and night on Earth. Mark **N** (for no) next to each statement that is not true or does not help explain that phenomenon.

_____ The Sun moves around Earth once every 24 hours.
_____ Earth spins on a north–south axis.
_____ It takes 1 year for Earth to turn on its axis.
_____ Day is the side of Earth facing the Moon.
_____ Night is the side of Earth in Earth's own shadow.
_____ Earth is always half in shadow and half in light.

3. Study the data table below.

a. Write in the latitudes in the correct order, based on number of daylight hours the city receives on June 21st each year.

City	Daylight hours	Latitude for each city
Alert	24:00	
Dublin	17:00	
Chihuahua	13:58	
Libreville	12:09	
Francistown	10:51	
Punta Arenas	7:32	
Concordia	0:00	

Latitudes to match to cities
53° N
0°
75° S
82° N
21° S
28° N
53° S

b. Why do the number of hours of daylight differ among these different locations on June 21st?

(Mark the one best answer.)

❍ **A** The tilt of Earth's axis causes the Northern Hemisphere to be closer to the Sun on June 21st.
❍ **B** The number of daylight hours is always different among these locations.
❍ **C** The tilt of Earth's axis toward the Sun causes more of the Northern Hemisphere to be lit up by sunlight.
❍ **D** The Earth's axis points to different places in space at different times of the year.

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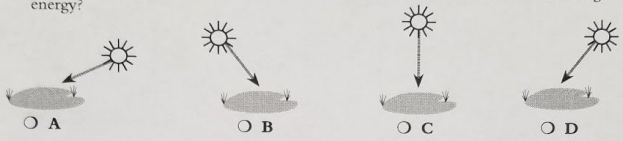
Posttest
Page 2 of 10

Name _____

POSTTEST
PLANETARY SCIENCE

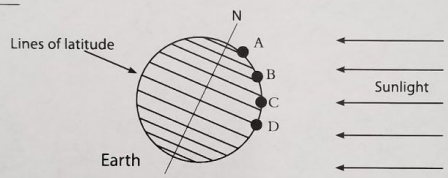
4. Study the images of the Sun shining on Earth.

   a. In which of the images below would the ground receive the least concentration of light energy?



   b. Which location on Earth would receive the least concentration of sunlight?

   _____



5. Planet Z is very similar to Earth, except that its axis is not tilted.

   Write **T** next to sentence(s) that would be true about Planet Z that is not tilted. Write **F** next to sentence(s) that are false.

   _____ There are no seasons on this planet.

   _____ The number of daylight hours in a given location changes predictably throughout the year (longer days in the summer; shorter days in the winter).

   _____ The concentration of sunlight changes throughout the day, but not from day to day, in a given location.

   _____ The concentration of sunlight at a given time of day in a given location is the same each day.

Name _____

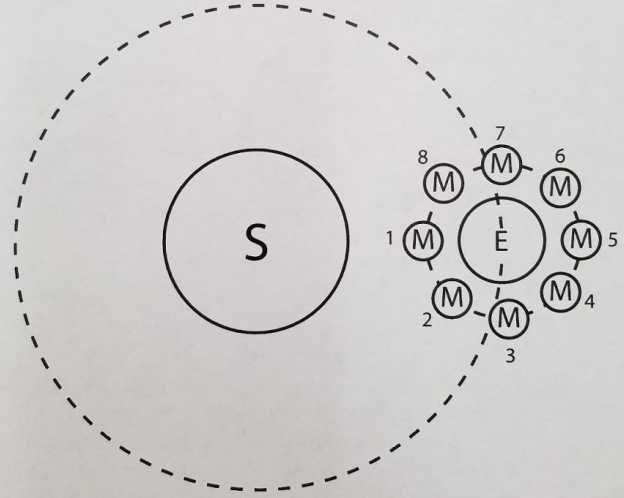
POSTTEST
PLANETARY SCIENCE

6. Look at this image of a crescent Moon. The image was taken from Earth.

   The model below (not to scale) shows a north-polar view of the Earth/Moon/Sun system.

   a. Which position of the Moon shown in the model is the position the Moon was in when the image was taken? _____

   b. Shade in the Moon you chose and Earth to show day and night on each.

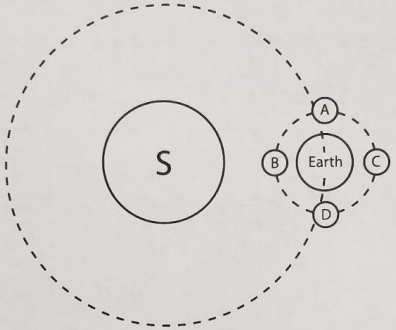


Name _____

POSTTEST

PLANETARY SCIENCE

7. Study the model of the Earth/Moon/Sun system shown here (north-polar view from space).



a. Which letter indicates the position of the Moon during a solar eclipse? _____

b. Which letter indicates the position of the Moon during a lunar eclipse? _____

8. Write **S** if the listed object is in the solar system. Write **G** if it is in our galaxy. Write **U** if it is in the universe. (You may write more than one letter in front of each object.)

_____ Earth

_____ Milky Way

_____ M31 Andromeda Galaxy

_____ Halley's Comet

_____ Io (moon of Jupiter)

_____ Ceres (an asteroid)

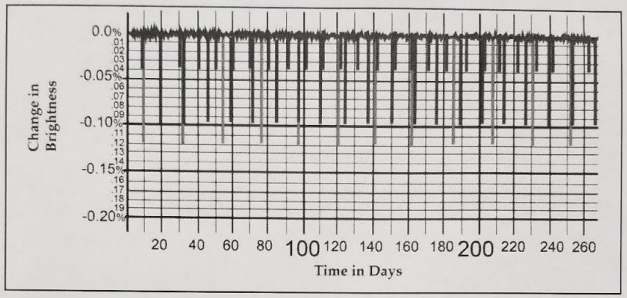
_____ M104 Sombrero Galaxy

Name _____

POSTTEST

PLANETARY SCIENCE

9. Analyze the data in this graph.



a. How many planets do you think are orbiting this star? _____

b. Write **T** (true) if the evidence from this graph supports the statement. Write **F** (false) if the data from the graph does not support the statement.

_____ The smallest planet has the shortest orbital period.

_____ The largest planet has the longest orbital period.

_____ The smallest planet is about one-half the size of the largest planet.

_____ The medium-sized planet has a period of about 12 days.

Name _____

POSTTEST
PLANETARY SCIENCE

10. Study the table shown here.

Planet name	Orbital period (days)	Planet size (Earth=1)	Planet average temp (°C)	Light at planet's surface (Earth=1)	Star temp (K)	Star diameter (Sun=1)
Kepler-395c	34.99	1.14	19	1.71	3765	0.521
Kepler-106b	6.16	0.79	747	256	5854	1.01
Kepler-452b	385	1.09	–53	0.56	5579	0.8
Kepler-90h	331.60	10.89	21	1.76	5970	1.2

Which planet in the table above is most likely to support life? _____

Explain why you chose that planet and not one of the others.

_____

_____

_____

_____

_____

11. Column A lists the stages of solar system formation. In column B, write G next to the stages in which gravitational attraction played a role in that stage; write NG next to those that did not require gravitational attraction.

Column A	Column B
Nebula	
Contracting	
Heating	
Disk forms	
Sun turns on	
Condensing	
Accreting	
Gas giant planets	
Rocky planets	
Flinging	

Name _____

POSTTEST
PLANETARY SCIENCE

12. The data table below shows information about a star and its planets and moons. Use the data table to answer the three items that follow (a–c).

Star, Planets, and Moons in a Mystery Planetary System

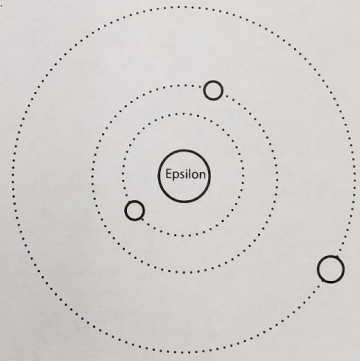
Name Name of star, planet, or satellite
Orbit Star or planet it orbits
Orbital radius Orbit radius of the planet to the star (in 1,000 km)
Object radius Radius of object (in km)
Temperature range Degrees Celsius
Orbital period Orbital period (in Earth days)
Rotational period Rotational period (in Earth days)

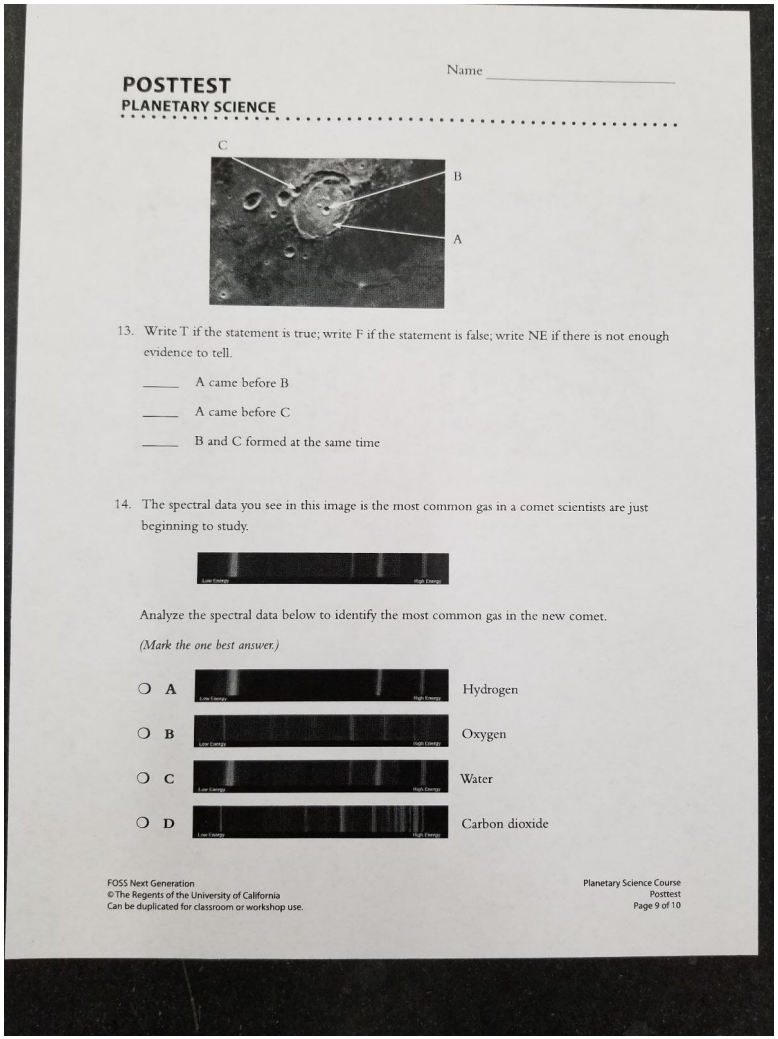
Name	Orbit	Distance	Radius	Temperature range	Orbital period	Rotational period
Alpha	Epsilon	108,200	6,052	445°C to 480°C	225.0	243.0
Beta	Delta	1,222	2,526	–200°C to -50°C	16.0	16.0
Chi	Gamma	527	765	–120°C to 390°C	4.5	4.5
Delta	Epsilon	1,429,400	60,268	–140°C to 190°C	10,760.0	0.4
Epsilon			695,000	>6000°C		25–36
Gamma	Epsilon	57,910	2,440	–180°C to 425°C	88.0	59.0

a. Use the data table to label the planets with their names in the diagram below. The diagram is not to scale.

b. Draw the moons and their orbits in the correct locations. Label each moon.

c. Shade in the planets in the diagram to indicate day and night.





Name _____

POSTTEST
PLANETARY SCIENCE

C

B

A

13. Write T if the statement is true; write F if the statement is false; write NE if there is not enough evidence to tell.

_____ A came before B

_____ A came before C

_____ B and C formed at the same time

14. The spectral data you see in this image is the most common gas in a comet scientists are just beginning to study.

Analyze the spectral data below to identify the most common gas in the new comet.

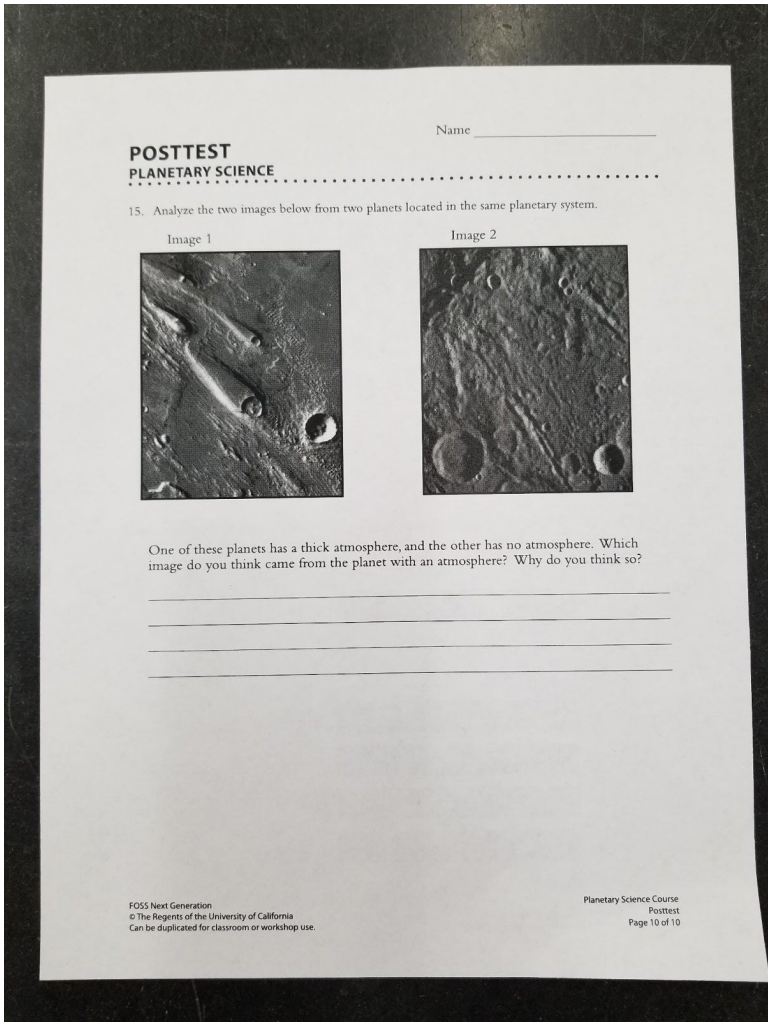
(Mark the one best answer.)

❍ **A** Hydrogen

❍ **B** Oxygen

❍ **C** Water

❍ **D** Carbon dioxide



Name _____

POSTTEST
PLANETARY SCIENCE

15. Analyze the two images below from two planets located in the same planetary system.

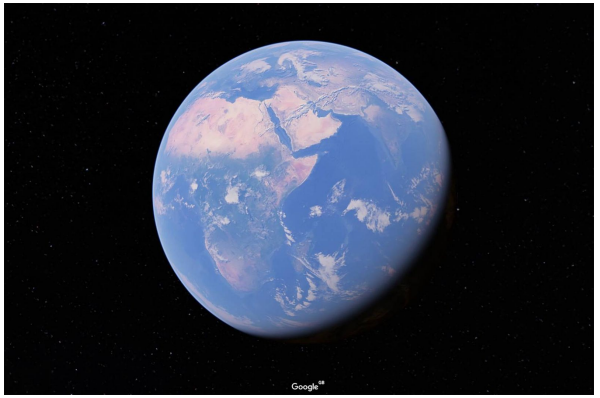
Image 1

Image 2

One of these planets has a thick atmosphere, and the other has no atmosphere. Which image do you think came from the planet with an atmosphere? Why do you think so?

Teacher note: The pretest and posttest will be stapled together at the end of the unit and shown to students. This way students can see their own growth in the content area.

1. Where do you live?



Overview:

Students use web-based images centered on their school to observe and describe where they are as their point of view moves away from Earth's surface in powers of ten. When students retreat to a distance of 10,000km above their school, they can see that they are on Earth, a planet surrounded by the darkness of space. The ideas of *frame of reference* and *point of view* are incorporated into their description of where they are.

Students will then begin to configure their cosmic address. Our own galaxy, the Milky Way, is home to hundreds of billions of stars. These stars have celestial bodies orbiting them. Some even have planets! We live on one of these planets orbiting a star in a galaxy. This unit will begin with students beginning to grasp what it beyond their field of view.

Class size: 4 sections of ~ 25 students each
# of class periods to complete: 1

Objectives:

- SWBAT understand that location can be described in terms of a frame of reference.
- SWBAT use images to describe a location on Earth from many different points of view.
- SWBAT explain interactions between Earth's systems.

Assessments:

- Students will be assessed on their ability to use terms and phrases from the lesson, such as, "frame of reference", "point of view", elevation, and altitude.
- Students will be assessed on their ability to describe their point of view using Google Earth with the school as a frame of reference.
- Students will be assessed on their ability to record observations using chromebooks and data sheets.

Standards:

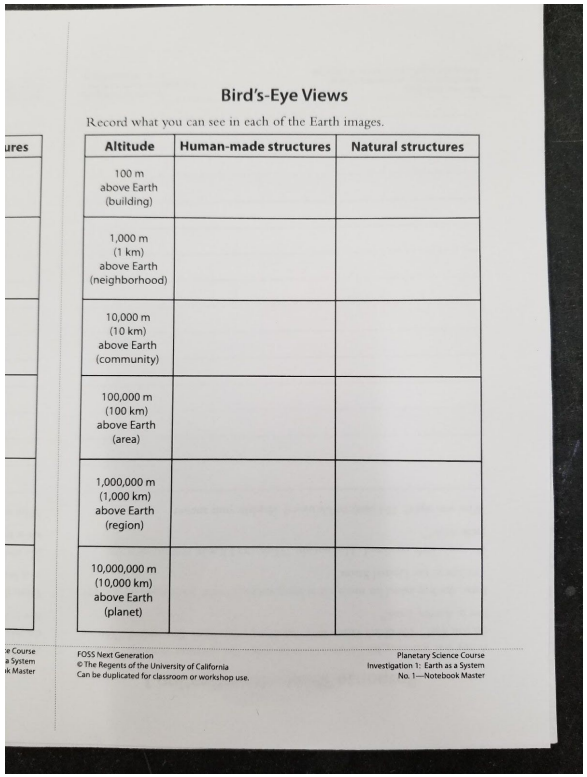
ESS1. ESS1.A, ESS3, ESS3.C, CCSS.ELA-LITERACY.RST.6-8.1

Materials List:

- PowerPoint, FOSS notebook sheet, Chromebooks, Student Composition books

Procedure:

1. The class will begin with the instructor introducing the unit with the Earth. The class will conduct a KWL (know, want to know, learn) to determine what prior knowledge students are bringing into the unit.
2. The instructor will introduce the phrase, frame of reference.
3. Students will copy down and answer the focus question of the day, "Where are you in science class?"
4. Students will then share some of their answers with the class.
5. The instructor will introduce the school aerial view. This is a Google Earth image of the school. The instructor will ask students to describe what they see as the instructor zooms out.
6. The instructor will then take this opportunity to introduce, point of view. This is the term used to describe the position from which an observation is made.
7. As the instructor zooms out he/she will also use words like altitude and elevation. Students are asked to draw an image explaining the difference between elevation and altitude.
8. Students will then get chromebooks for themselves to use Google earth to look at the school and continue to zoom out until they are unable to see the school anymore.
9. Students will make observations using a sheet given in class.
10. Students will continue to zoom out until they can see the whole Earth. This would be part of their cosmic address.
11. By the end of class students will share their cosmic address in relation to the school.



Bird's-Eye Views

Record what you can see in each of the Earth images.

Altitude	Human-made structures	Natural structures
100 m above Earth (building)		
1,000 m (1 km) above Earth (neighborhood)		
10,000 m (10 km) above Earth (community)		
100,000 m (100 km) above Earth (area)		
1,000,000 m (1,000 km) above Earth (region)		
10,000,000 m (10,000 km) above Earth (planet)		

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Planetary Science Course
Investigation 1: Earth as a System
No. 1—Notebook Master

Closure: Question: Where do you live? Students will write their full address on an index card as an exit slip.

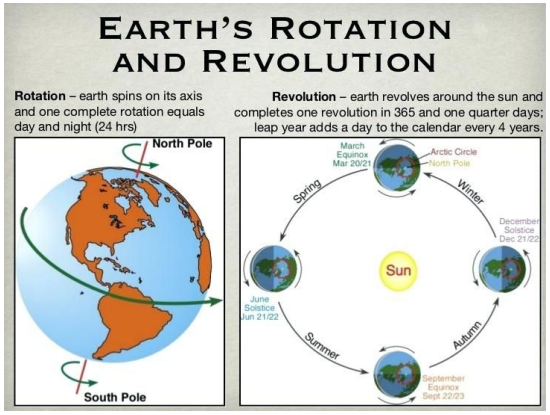
Modifications: *The instructor will provide written and oral instructions to the activity. Students will also have the opportunity to work in pairs if they want too. This is of course optional and students may choose to work individually.*

2. The Earth (Review)

Overview:

In the 7th grade curriculum students talk about the layers of the Earth, the atmosphere, land structures, water structures, and the position of the Earth in the solar system. For this section of the unit we will be reviewing these concepts. The main focus will be on our position and movement in our solar system. We will start with a review on the layers of the Earth and the layers of the atmosphere. We will also discuss (briefly) plate tectonics and the history of Earth. From here the class will focus on concepts, such as, rotation, revolution, and the Earth's axis. This will take roughly 2 class periods to complete. This will lead us into discussing the seasons and the relationship between the Moon, Sun, and Earth.

Class size: 4 sections of ~ 25 students each
# of class periods to complete: 2



Objectives:
SWBAT explain interactions between Earth's systems.
SWBAT recall materials from the previous year involving the Earth and the atmosphere of the Earth.
SWBAT list the layers of the Earth and the layers of the atmosphere.
SWBAT describe the layers of the atmosphere.
SWBAT explain plate tectonics and how the Earth's continents formed.
SWBAT explain the location and movement of the Earth in the solar system.

Assessments: Students will be assessed using a review PowerPoint in which the instructor asks students questions as they go through to assess what they remember from the previous year. Students will be assessed on their knowledge on the Earth and atmospheric layers. Students will also be assessed on their definitions of rotation and revolution of the Earth.

Standards: ESS1. ESS1.A, ESS2, ESS3, CCSS.ELA-LITERACY.RST.6-8.1

Material List:

- PowerPoint, Composition books

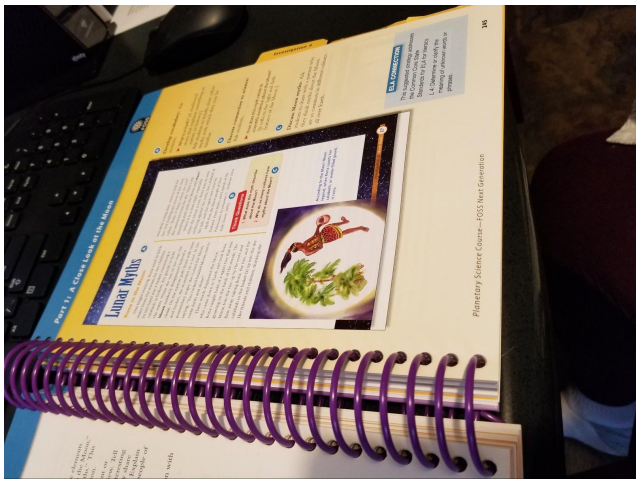
Procedure:

1. Students will enter the classroom with a focus question on the board, “What are the layers of the Earth?”. Students will have two minutes after the late bell to write down and answer the question in their composition book.
2. The instructor will begin the PowerPoint presentation on the Earth as a review. The instructor will pose questions to assess student recollection of the previously learned concepts from 7th grade. The instructor will pause on a topic if more time is needed for students.
3. Students will be asked about the layers of the Earth, land structures, water structures, layers of the atmosphere, composition of the atmosphere, plate tectonics, and the movement of the Earth in the solar system.
4. The class will spend the majority of the time on the Earth’s rotation, revolution, and axis.
5. Students will record vocabulary and notes from the PowerPoint slides.

Closure: Discussion: Was it easy to remember this information from last year? What techniques could help retain memory over the years?

Modifications: *Students will be given guided notes for the lecture part of this lesson if that is recommended in their IEP. Students will also be challenged by the instructor to recall information from previous years. This will allow GIEP students or more advanced students to showcase their skills in memory and teach the class information that they remember from last year.*

3. Modeling the Earth, Moon, and Sun



Overview:

Where did the Moon come from and why is it there? In this investigation in the unit students will be exploring the different theories on the moon, looking at the features, calculating ratios by scale, and talking about the Moon landing. Students will also conduct a lab for a month where they record observations from the moon at night.

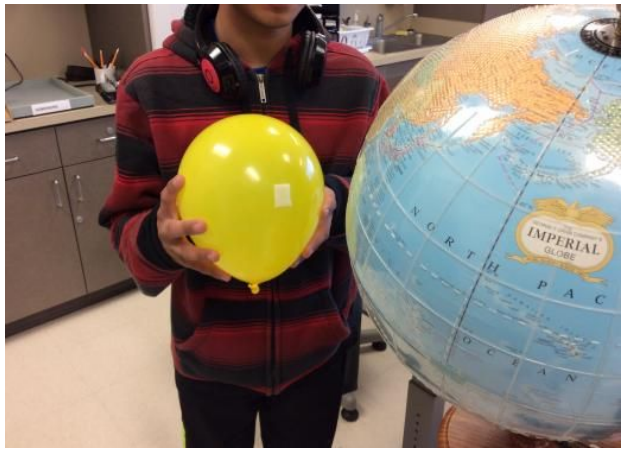
Students focus on the Moon’s surface features. They study an image of the moon to observe and catalog the main features. They also read a Maori myth that explains the appearance of the Moon. Students explore the Earth/Moon relationship by creating a scale model of the system. Using a blown up balloon from the instructor to represent the Earth students will blow up their own balloon to scale in comparison. Then, the class will position it at the right distance to represent the Moon’s orbital distance. ***(The idea for this lesson was provided by Brandon Rodriguez from the Astronomy and Space Science Course during a live session).***

Objectives:

SWBAT describe the features of the moon: craters, maria, and highlands.

SWBAT understand that the Moon is a satellite and is one-fourth Earth's diameter.
SWBAT explain scale as the size relationship between a representation of an object and the object.
SWBAT observe images of the Moon to identify and classify some major features.
SWBAT construct a scale model of the Earth/Moon System.

Assessments: Students will be assessed on their ability to create a scale model of the Earth and Moon. Students will also be assessed on their ability to identify features on the moon using images provided. Students will be assessed on an upcoming I-check involving the Moon. There is also the Moon Lab for students to be assessed on their abilities to record observational data.



Standards: ESS1. MS-ESS1-1, MS-ESS1-3, CCSS.ELA-LITERACY.RST.6-8.2, CCSS.ELA-LITERACY.RST.6-8.1

Material List:

- PowerPoint
- Composition books
- Science Resource book
- Balloons
- String
- FOSS Notebook sheets

Part 1

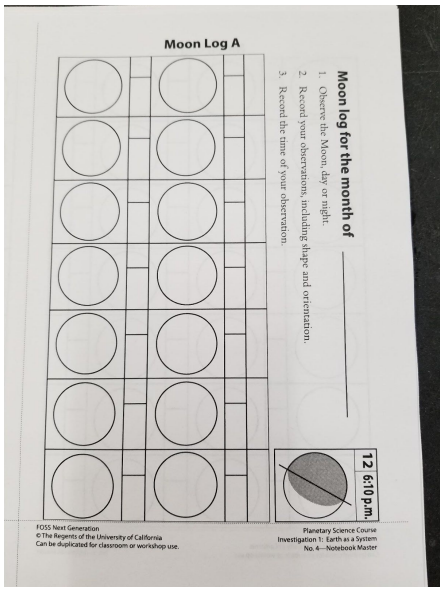
Procedure:

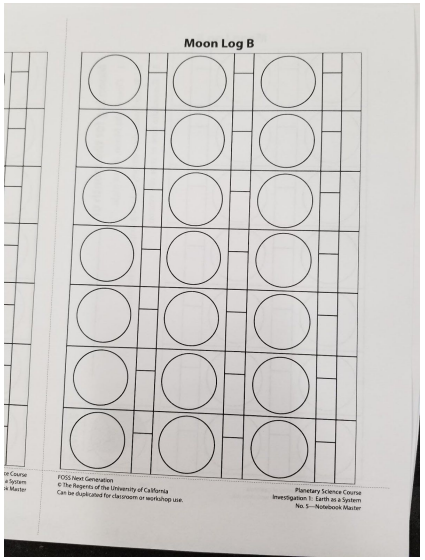
1. The class will begin with students writing down and answering the focus question on the board, "What is visible on the Moon?".
2. Students will write down information and share it with the class on information/details on the Moon that they already know.
3. The instructor will introduce the Moon log. This is an experiment to be taken home on making observation on the Moon for one month. Students will draw and write down observations on what they see at night. (extra days will be added to account for cloudy/rainy/snowy weather.
4. The instructor will show images and discuss the major features of the Moon using a Powerpoint as students take notes.
5. Students will record vocabulary in their glossaries: Highlands, Maria, Rays, and Rilles.
6. The class will spend the second half of class reading through, "Lunar Myths", in the science resource book. Students will discuss the myth and its relevance to the Moon.

Part 2

Procedure:

1. Students will enter the classroom and pick up the notebook sheet provided to clue into their composition book. The instructor will provide students will directions: Students will work individually on the questions for 5 minutes and then have 10 minutes to work with a partner prior to the class going over the questions.
2. Students will then be given 5 minutes to think of questions about the moon that they have that the class can research and learn about in this section of the unit.
3. Students will volunteer some of the questions and the class will discuss.
4. The instructor will answer some of these questions now and save the rest for students to learn about on their own.
5. The class will check in with their moon log lab. This will involve students discussing in lab groups about their observations so far.





Part 3

Procedure:

1. Students will enter the classroom and copy down the focus question/answer it, “What does an Earth/Moon scale model look like?”.
2. Students will also be instructed to have their Moon lab out to discuss.
3. The class will begin talking about scaling factor using examples from the instructor. Students will record the vocabulary term.
4. The instructor will blow up a balloon and tell students that this is the Earth. Each group will be given one balloon and told to blow up their balloon as the Moon. The group that gets it the closests wins a prize. The instructor will bring out a large piece of string to check.
5. Students will then be asked to place the balloons somewhere in the room to demonstrate how far apart they are from each other.
6. The instructor will then go through some PowerPoint slides describing the relationship between the Moon and the Earth. This will involve their sizes, distance, gravitation pull, and that the moon is moving away from the Earth. The class will also discuss the Moon’s orbit around the Earth in detail.

Closure: Theory: Students will write down their own hypothesis on what the world would be like without the Moon.

Modifications: *The instructor will provide written and oral instructions to the activity. Students will be given extra time if needed for the home lab. The instructor will give examples and keep a moon log as well.*

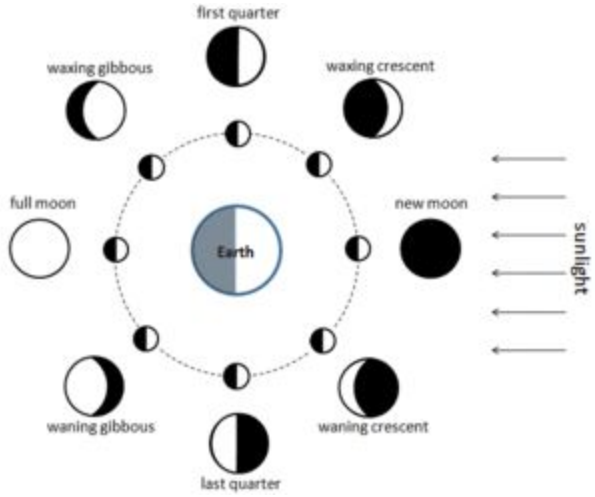
4. *The Moon*

Overview:

This section of the unit reviews what students have learned about the moon and provides a few more details to add onto the knowledge. This section is very short in length, but does go into the moon log, phases of the moon, and the Lunar Calendar. Students will learn phase vocabulary, study moonrise, and use simulations to show moon phases.

Objectives:

SWBAT understand that the moon shines as a result of reflected light from the sun.
SWBAT understand that the moon phase depends on how much of the Moon's illuminated surface is visible to the Earth.
SWBAT observe, record, and analyze the Moon's appearance and position in relation to the Sun over a four-week period.
SWBAT use models of the Sun, the Moon, and Earth to construct explanations of Moon phases and eclipses.



Assessments: Students will be assessed on their ability to recreate the phases on the moon in a real life simulation activity. Students will also be assessed on their ability to compare solar versus lunar eclipse.

Standards: ESS1, ESS1.A, ESS1.B, CCSS.ELA-LITERACY.RST.6-8.1

Material List:

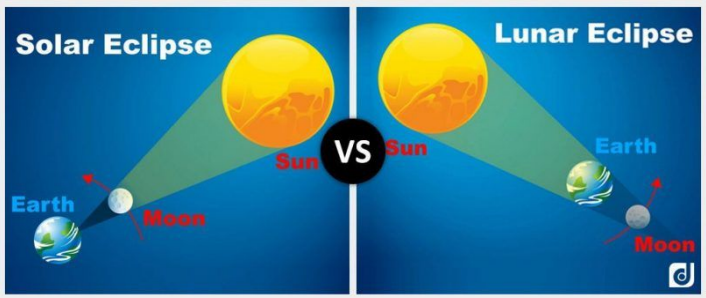
- PowerPoint
- Composition books
- Moon Lab sheet
- Flashlight
- Student name tags (Sun, Earth, Moon)

Part 1

Procedure:

1. The instructor will begin with a review of the Moon and what students can recall from previous lessons or prior knowledge.
2. The class will then check in with the moon logs. Students are permitted to talk in their lab groups about what they have seen thus far.

3. Students will record and answer the focus question on the board, “What Moon-phase patterns can be observed?”.
4. The instructor will contribute to student conversations on the moon log by asking about the shape of the Moon.
5. Students will be shown a PowerPoint slide on the Moon-phase changes and take notes. Vocabulary is recorded in the notes: new Moon, first quarter, third quarter, waxing, waning, crescent, gibbous.
6. Students will go through their moon log and name each phase change.
7. The class will then discuss how the Moon revolves around the Earth and the Earth revolves around the Sun.
8. The instructor will give directions for students to use materials provided (different sized balls and a flashlight) to create these phases on the smallest ball (the moon). Students will need to manipulate the light and position of the balls to achieve each phase. An image of all phases and their names will be on the board up front to look off of. Students will also have these images taped down to their lab bench.
9. The class will be told to clean up in the last 3 minutes of class.

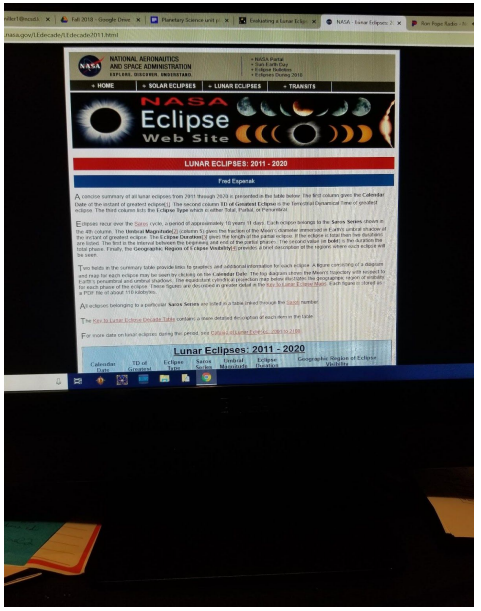


Solar Eclipse vs. Lunar Eclipse

Part 2

Procedure:

1. The class will begin today with a review of the activity in the prior class. Students will discuss what they observed.
2. The instructor will have a couple students assist upfront using their bodies as the Earth, Moon, and Sun to demonstrate a Lunar and Solar eclipse. Students will be given signs to wear around their neck with the names.
3. Students will take notes as the instructor discusses these eclipses and how they are seen through our eyes. This will involve a discussion of the eclipse seen last year.
4. The instructor will then pass out the study guide for the I-check. I-checks are given at the end of sections of the unit. These are small quizzes to assess learning. The I-checks are different than normal quizzes because students have a chance to reflect and fix mistakes for half credit.



Part 3

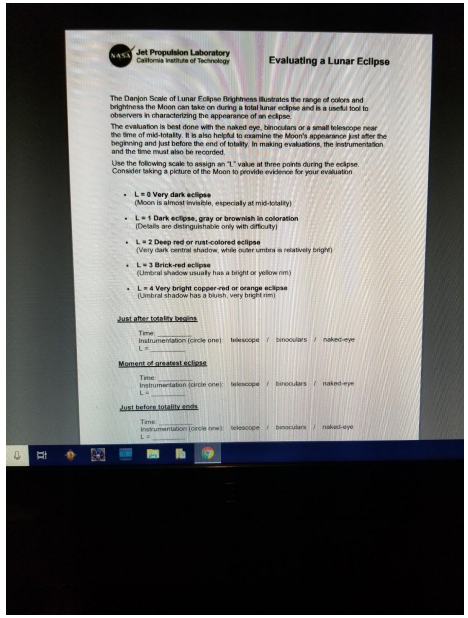
Procedure:

This lesson was provided by NASA. The link and resource is provided below.

Jet Propulsion Laboratory. (2018). Evaluating a Lunar Eclipse Activity. *NASA.* Received from: https://www.jpl.nasa.gov/edu/teach/activity/evaluating-a-lunar-eclipse/

1. Students will enter the classroom and grab a chromebook off of the chart.

2. The class will begin with a discussion on solar and lunar eclipses from the previous class.
3. Students will be working in their lab groups to examine lunar eclipses using a lesson from NASA.
4. Students will be given directions in which they need to identify the times of the start of the total lunar eclipse (U2), the greatest eclipse and the end of the total eclipse (U3) by downloading the appropriate lunar eclipse data sheet here. (Click the date of the eclipse to access the data sheet.)
5. Students will then convert the Universal Time (UTC) to your local time. Directions for this site and sheet are provided on a procedure worksheet given to each student.
6. During the procedure students will need to observe the Moon and make evaluations of the eclipse at the three times indicated. Below is a list of these observations:



   a. L = 0
   b. Very dark eclipse. Moon is almost invisible, especially at mid-totality.
   c. L = 1
   d. Dark eclipse, gray or brownish in coloration. Details are distinguishable only with difficulty.
   e. L = 2
   f. Deep red or rust-colored eclipse. Very dark central shadow, while outer umbra is relatively bright.
   g. L = 3
   h. Brick-red eclipse. Umbral shadow usually has a bright or yellow rim.
   i. L = 4
   j. Very bright copper-red or orange eclipse. Umbral shadow has a bluish, very bright rim.

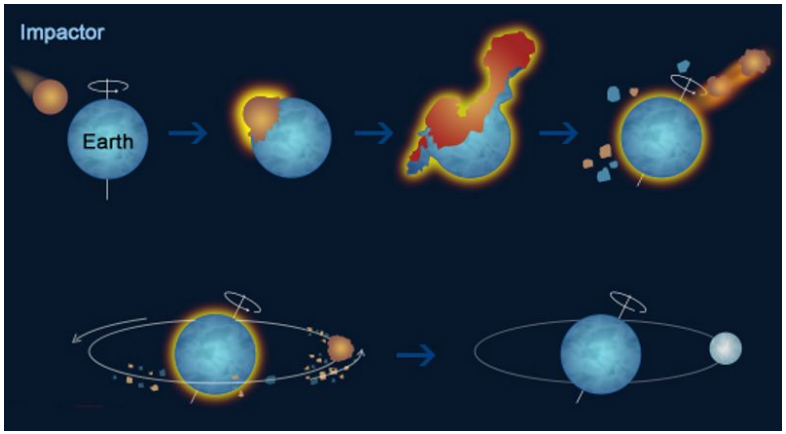
7. After the observations have been made each group will share their reasoning for each evaluation with the class.
8. The instructor will ask students to reflect on their findings; If different values were given at different points during the eclipse, what could have caused the difference in brightness? Have there been any events recently that could contribute to a darker eclipse (e.g. volcanic eruption, wildfires, etc.)?
9. Once complete, students will put away the chromebooks and discuss using the worksheet provided.

Closure: Calculation: Students will calculate how old they will be for the next lunar and solar eclipses.

Modifications: *The instructor will provide written and oral instructions for the activities in this section. Guided notes will be given to students with an IEP indicating that this is recommended for learning. Ability grouping will be used in the final activity through lab groups. Students are unaware of this grouping.*

5. *The Moon Theory*

<u>*Part 1*</u>



Overview:

Students are introduced to the historical controversy regarding the origin of the craters on the Moon: impacts or volcanism? Students design experiments using flour and marbles or rocks to investigate different variables and to determine whether impact events could be responsible for the extensive cratering on the Moon's surface. Students will also scrutinize the Moon's maria to determine the frequency of major impacts since mare formation 4 billion years ago. They will use these data points to determine the number of major impacts for the Earth.

Objectives:

SWBAT understand that craters of various sizes and types result when meteoroids of various sizes impact the surface of planets and satellites.
SWBAT understand that Earth's record of impacts has been erased by the actions of wind, water, and tectonic activity.
SWBAT conduct experiments to determine the effect of meteoroid size and speed on crater characteristics.
SWBAT use mathematical reasoning to determine the frequency of major impacts on Earth.

Assessment: Students will be assessed on their ability to react a simulated ratio of the Earth, Moon, and Sun. Students will also be assessed on their observations and data from the Moon Lab. The lab conducted demonstrating craters will be graded based on student participation and analysis of the data.

Standards:

ESS1, ESS1.A, ESS1.B, ESS1.C, ESS2, ESS2.A, ESS3, ESS3.B, ETS1, ETS1.A, CCSS.ELA-LITERACY.RST.6-8.2, CCSS.ELA-LITERACY.RST.6-8.1

Material List:

- PowerPoint, Composition book, Flour, Cocoa powder, marbles (various sizes), meter stick, bin, Lab sheet, science resource book

Procedure:

1. Class will begin with a review on the Moon. This will be a Q and A between the instructor and the students.
2. Students will write down and answer the focus question on the board given two minutes.
3. The instructor will introduce the lab today by naming the different material used. The flour in the container is simulating the regolith or lunar soil. The marble is simulating the meteoroid. Students will record this vocabulary as it is discussed.

4. Students will come up with their own procedure for the lab prior to directions.
5. The instructor will demonstrate one of the drops from the lab. As the instructor does this the class will discuss craters and evidence that a meteoroid impacted the surface. This will bring up ejecta and rays.
6. The class will discuss the different experiments they could do with this knowledge.
7. Students will plan their own experiment using various size marbles at different heights. The instructor will assist students in their creation of the procedure so that the variables are measured correctly.
8. Students will gather their materials and run the experiment. The instructor will be around to monitor.
9. With the last 5 minutes of class left, students will clean up.

Part 2

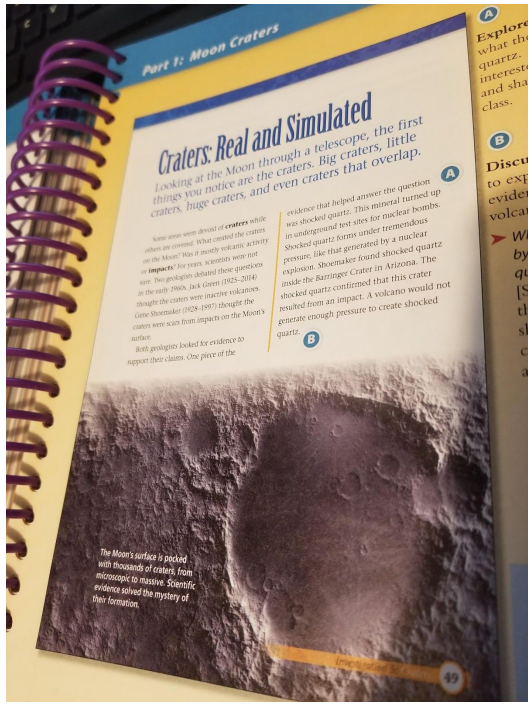
Procedure:

1. Upon entering the classroom students will pull out their data from the previous class and pick up graph paper up front.
2. Students will use this graph paper to plot points of like size marbles against the distance for impact. Students will make a graph for every size marble they used.
3. The class will discuss this data and talk about the findings of the experiment.
4. This will lead to a discussion on comets and asteroids. Students will record these new vocabulary terms and talk about the difference between these objects in space and meteors.
5. The instructor will then show a simulation on the computer to demonstrate the different angles of impact that a meteoroid could have on the surface of a satellite.
6. The class will compare simple and complex impacts for craters.
7. The class will go back to images of the moon and look at mare formation.
8. Students will return to the focus question and back their findings.

Part 3

Procedure:

1. Students will enter the classroom and pick up their science resource book on the side of the room.
2. Students will turn to page 49 and read, “Crater: Real and Simulated”.
3. Once finished, students will answer the three think questions.
4. The class will review the unit thus far with a Q and A using Kahoot. Kahoot is an online resource where someone can make a fun review game. Students will need the chrome books to interact with the game.



Part 4

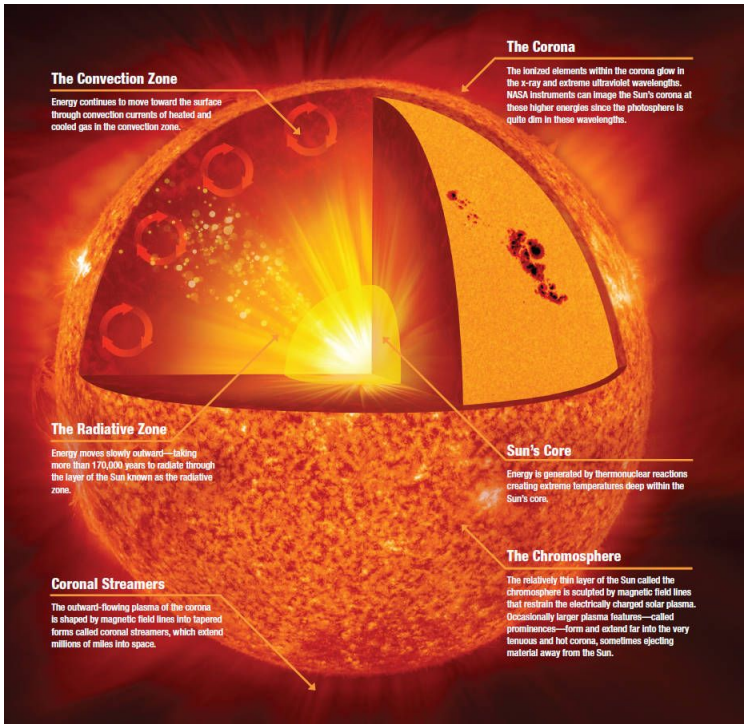
Procedure:

1. Students will enter the classroom and answer the focus question on the board, “Will Earth experience a major impact in the future?”.
2. The instructor will play a video of the meteor impact on Earth in 2013 in Russia.
3. The class will review crater information and discuss the Moon’s craters.
4. The instructor will introduce the 20:1 ratio. This means a crater with a diameter 20 times larger than the diameter of the meteoroid or asteroid that crashed into the surface. This is calculating using the speed of a meteor and/or asteroid.
5. Students will receive a worksheet to be glued into their composition book. This sheet will have the names of the craters on the Moon.
6. The instructor will assist students in the ratio calculations for the first couple. Students will then work through the rest in their lab groups.
7. Students will then use this information to calculate the frequency of the impacts over time. This will help students to estimate the number of impacts on the Earth. The class will discuss this data once it has been calculated.
8. The class will then discuss the possible ways in which we could stop an asteroid. This will be seen as a real situation because we are in space with these celestial bodies around us. The instructor will also bring up the estimated arrival in 11 years of an asteroid colliding with Earth.
9. Students will watch a video on the ways in which we plan on stopping asteroids after coming up with their own ways.

Closure: Exit Slip: How could we stop an asteroid from hitting Earth?

Modifications: *The instructor will provide written and oral instructions to the activities in this section. The class will read through all readings together and answer think questions after to review the passage. Ability grouping is used for lab groups to assist and challenge all learners. To continue to challenge students, they are asked to come up with ways to do the lab in this section before given the procedure. This allows students to consider how they would do the lab and what they would measure. This also calls controls and variables into play.*

6. *The Sun*



Overview:

The instructor will go through slides using PowerPoint on the Sun. This will include: how stars form, the life cycle of stars, the layers of the sun, and discussion on the energy the sun provides us. Students will explore stars and view images from NASA telescopes of the cosmos.

Objectives:

SWBAT list and explain the layers of the Sun; Photosphere, Corona, Chromosphere.
SWBAT describe the life cycle of a star.
SWBAT determine the death of a star based on the mass of the star.
SWBAT explain the effects of the Sun on our planet and how the energy interacts with living organisms.
SWBAT recall key information on the Sun as discussed in the previous class.
SWBAT consider the mission on the Parker Space Probe and discuss what they believe will be discovered.
SWBAT pull key information from a passage and convey this answer to the class.

Assessment:

Students will be assessed on their ability to list the basic steps in the formation of a star and hypothesize on the death of a star based on the initial mass. This will be done on a short quiz on the Sun and stars. Mass will be given for each star.
Students will be assessed on their ability to answer multiple choice questions on the layers of the Sun.
Students will be assessed on their ability to discuss, in class, the effects of the sun on Earth and the living organisms that live here.
Students will be assessed on their ability to transfer information from the discussion on the Sun to a space probe orbiting it to examine the Corona. This will be seen through discussion and answers to a questionnaire after the article from NASA.

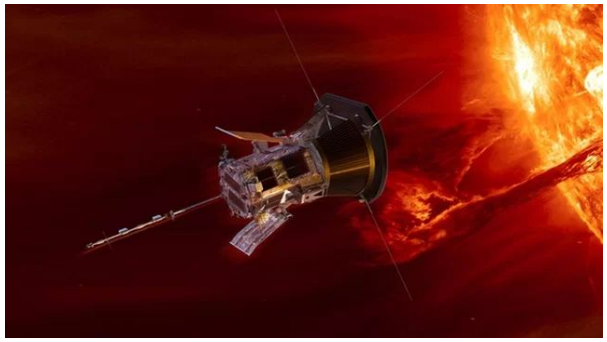
Standards:
ESS1.A, ESS1.B, CCSS.ELA-LITERACY.RST.6-8.1

Material List: PowerPoint, Composition book, Images from NASA, Article on the Parker Space Probe

Part 1

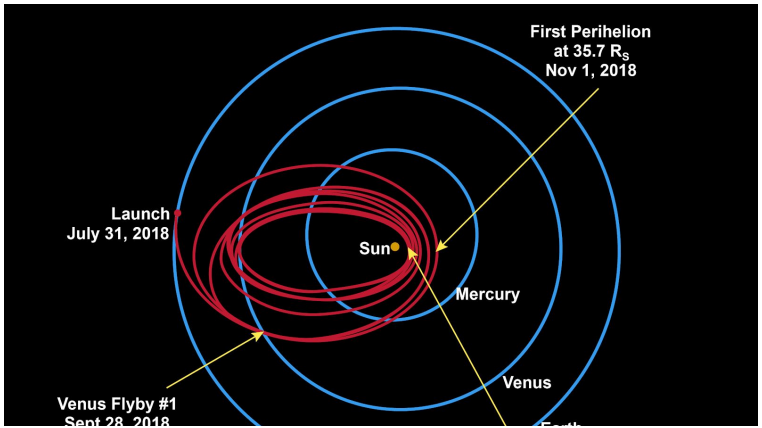
Procedure:

1. Students will enter the classroom and record the focus question for the day in their composition book. Given two minutes after the late bell students will record and answer, "What is the Sun made of?".
2. The instructor will begin the class with a discussion on the Sun and what students already know about the star we go around every year. The class will discuss for roughly 5 minutes.
3. The instructor will show a PowerPoint Presentation on the Sun and its layers, origin, and effects on Earth.
4. The class will discuss these points.
5. The instructor will then move onto stars in general and show students using images from NASA how a star is formed.
6. Students will have the chance to discuss the images as the instructor flips through them.
7. Students will record notes on all topics in their composition books.
8. At the end, the instructor will give a list of how a star is formed in order and discuss the death of a star. Students will learn about the various ways a star can end its life based on the initial mass of the star.



Part 2: Parker Space Probe

Overview: Students will be given an article to read about the launch of the newest probe. This Probe is heading for the sun and will orbit around it collecting data on the corona. Students will discuss the mission and what they hope will be discovered.



Procedure:

1. The class will begin with a review on the Sun. A Q and A will occur for roughly 5 minutes between the instructor and class on what was covered yesterday.
2. An image of the Parker Space Probe will appear on the screen from the PowerPoint. Students will be asked if they know what this is.
3. The instructor will then go through and discuss this space probe; the structure, design, mission, and data to be collected.
4. Students will then read through the latest article on this probe and answer questions at the end of the article.
5. The class will discuss their own thoughts on the probe and what they hope to be discovered. This could also lead to other discussions on exploring the cosmos and other stars.

Closure: Discussion: What kind of technology would you like to see for space exploration and what would you want to examine in space?

Modifications: *Students will be provided guided notes if recommended on their IEP.*

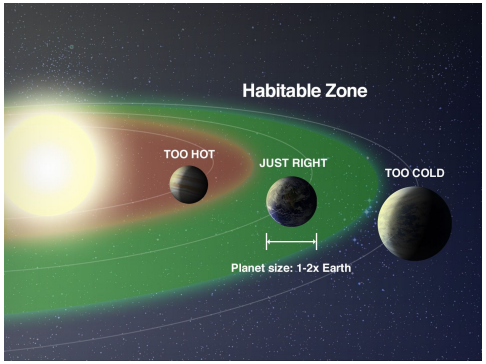
7. Exploring other Planets

Overview:

Students will start this section of the unit with information and images of the celestial bodies that reside in space. Students will place these images into three different categories: solar system, Milky Way, and universe. Students will then take the solar system objects and gather more information about the planets, comets, asteroids, and clouds of matter to place the events of the creation of the solar system in order. The instructor will assist by starting them with a Nebula.

Objectives:

SWBAT describe the solar system; this would include: The Sun, eight planets, satellites, dwarf planets, asteroids, comets, Kuiper Belt objects, and Oort Cloud matter.
SWBAT explain the creation of the solar system through a sequence of events that started with a nebula of dust and gas.
SWBAT analyze and interpret data to sequence the events and process that resulted in the formation of the solar system.
SWBAT carry out investigation to organize objects in the cosmos into three nested systems: solar system, galaxy, universe.
SWBAT list the planets in order and explain characteristics of each.



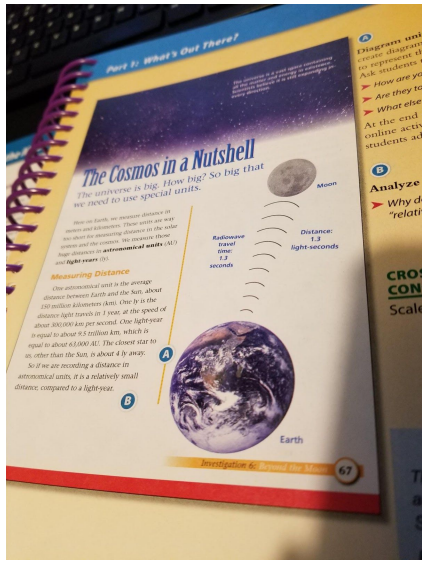
Assessment: Students will be assessed on their ability to group celestial bodies into categories then use those categories to place the creation of the solar system in order. Students will be assessed on their knowledge of the planets in our solar system. This will be seen using a quiz on the planets in which students must list them all in order and answer multiple choice questions about their distinguishing features.

Standards:
ESS1, ESS1.A, ESS1.B, PS2, PS2.B, MS-PS2-4, MS-ESS1-2, CCSS.ELA-LITERACY.RST.6-8.2, CCSS.ELA-LITERACY.RST.6-8.1

Material List:
- PowerPoint
- Composition books
- Cosmos Cards
- Chromebooks
- Science Resource book
- Model of the solar system

Part 1

Procedure:
1. Students will enter the classroom and write the focus question in their composition book given two minutes, "What is in the solar system?". The instructor may give an extra minute to students to generate a list of all celestial bodies they can think of.
2. (Incorporating Art into the classroom) Students will draw the objects they believe resides within space. Students will be given 10 minutes for their drawing.
3. Students will have a chance to show their drawings and the class will discuss.
4. The instructor will then introduce the cosmos cards. These are images of the objects in space.
5. Students will have a chance to look at and explore the cards in their lab groups (5 minutes).
6. The instructor will ask students several questions about the cards and ask them to locate different things, Craters, galaxies…
7. The instructor will then ask students to sort the cards based on distance from the sun. Students will need to use information given on the back of the cards and the internet (a chromebook will be provided).
8. The instructor will use the PowerPoint slides to introduce measuring distance in space. This will involve astronomical units and light-year.



Part 2

Procedure:
1. Students will enter the classroom and pick up the cosmos cards from the front of the room for their group.
2. The instructor will have students divide the cards into three groups: solar system, galaxy, and universe.
3. The class will discuss their groups and put the groups on the board using magnets.

4. The class will then read through “The Cosmos in a Nutshell” together on page 67 in the science resource book.
5. Students will answer the two questions at the end on their own in their composition book. The class will then go over it together and discuss.

Part 3

Procedure:

1. Students would enter the classroom and answer the focus question on the board, “Where did the solar system come from?”.
2. Students will have a chance (5 minutes) in their lab group to discuss this thought.
3. The instructor will then pass out, “Solar System Origin cards”.
4. Students will look through the cards and the instructor introduces each celestial objects. Students will record definitions to nebula and accretion. The class will discuss old vocabulary like heating, contracting, and condensing from the unit on thermal energy in Chemical Interactions.
5. Students will work with their lab group to place the cards in the order they believe it happened.
6. The instructor will discuss the correct theory scientists have about the creation of the solar system and students will reflect on the similarities and differences in their layout.
7. The class will consider gravity and its role in this creation.
8. The instructor will discuss gravity and what we know about it.
9. Students will receive a study guide and complete the questions for homework for the I-check.

Part 4

Procedure:

1. The instructor will ask students to look up upon entering the classroom. The ceiling of the classroom has styrofoam models of the solar system. Students will be given the Planets quiz at the beginning of class to see what they already know. (The same test for the pre and post test is provided at the end of this lesson plan).
2. After the tests are completed and placed in the tray, the instructor will review the solar system from the previous lesson. In this lesson the formation of the solar system was discussed.
3. The instructor will then show a PowerPoint presentation on the Planets in our solar system from Mercury to the dwarf planet Pluto.
4. The PowerPoint will show features/Characteristics of the planet, highest temperatures, lowest temperatures, atmosphere composition, rotation, revolution, distance from the sun, and any satellites. The Roman Gods they are named after will also be discussed.
5. Students will take notes and discuss.
6. Each students will then create their own acronym for the order of the planets and share it with the people in their lab group. The instructor will ask for volunteers to share their acronyms.

7. Students will be taking the Planets Quiz tomorrow at the start of class.

The Planets Quiz

Directions: List the planets in order (you may look to the ceiling if you need help. Try to remember the acronym you made yesterday.)

1.

2.

3.

4.

5.

6.

7.

8.

Directions: Answer the following multiple choice questions. Recall yesterday!

1. Which Planet is known as the Red Planet?

    a. Earth
    b. Mercury
    c. Mars

d. Venus

2. Which planet is closest to the sun?
    a. Earth
    b. Mercury
    c. Mars
    d. Venus

3. Which is the hottest planet?
    a. Earth
    b. Mercury
    c. Mars
    d. Venus

4. Which planet has 2 moons?

    a. Earth
    b. Mercury
    c. Mars
    d. Venus

5. Which planet is named after the Goddess of Love?

    a. Earth
    b. Mercury
    c. Mars
    d. Venus

6. Which planets do not have a moon?

    a. Earth
    b. Mercury
    c. Mars
    d. Venus

7. Which planet is not named after a Greek God?

    a. Earth
    b. Mercury
    c. Mars
    d. Venus

8. Which planet(s) has water?

    a. Earth
    b. Mercury
    c. Mars
    d. Venus

9. Which planet rotates the same as Earth?

    a. Earth
    b. Mercury
    c. Mars
    d. Venus

10. Which planet rotates in the opposite direction?

a. Earth
b. Mercury
c. Mars
d. Venus

11. Which planet rotates horizontally?

a. Neptune
b. Uranus
c. Jupiter
d. Saturn

12. Which planet is named after Poseidon?

a. Neptune
b. Uranus
c. Jupiter
d. Saturn

13. Which planet has millions of rocks and dust orbiting it?

a. Neptune
b. Uranus
c. Jupiter
d. Saturn

14. Which planet is the largest?

a. Neptune
b. Uranus
c. Jupiter
d. Saturn

15. Which planet has methane gas to make it dark blue?
    a. Neptune
    b. Uranus
    c. Jupiter
    d. Saturn

16. Which planet has a red spot?
    a. Neptune
    b. Uranus
    c. Jupiter
    d. Saturn

17. Which planet has the shortest rotation of all?
    a. Neptune
    b. Uranus
    c. Jupiter
    d. Saturn

18. Which planet is the <u>first</u> king of the Gods?
    a. Neptune
    b. Uranus
    c. Jupiter
    d. Saturn

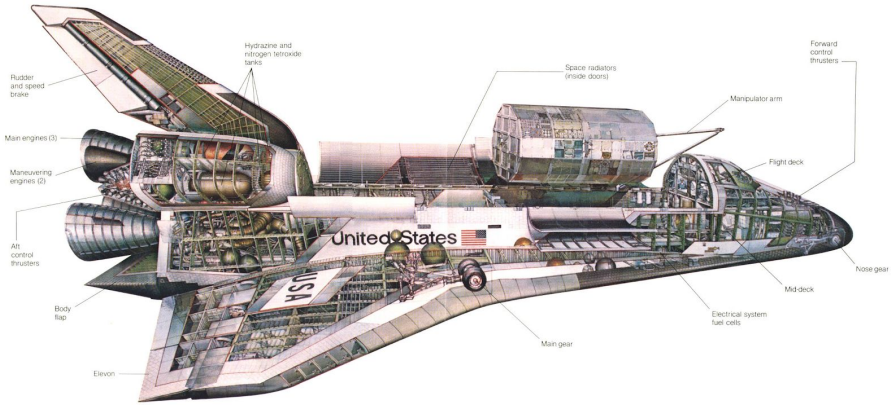
19. Which planet is the God of the sky?

a. Neptune
b. Uranus
c. Jupiter
d. Saturn

20. Which planet was once next to the sun?
a. Neptune
b. Uranus
c. Jupiter
d. Saturn

Closure: Video: Song on the solar system. Activity: What kind of genre of song would you pick for the planets?

Modifications: *The class will be reading through the passage in this section together and answering think questions to review the information. Students will be provided guided notes if indicated on their IEP for the lecture portion on this section of the unit. For the planet quiz, students will be provided the names of the planets, or in some classes, there will not be a list. Students will be given as much time as needed to finish the test. Assistance from the instructor will be available and choices taken away from the multiple choice (IEP).*



8. *Technology in Space*

Overview:

Students will watch videos provided by the International Space Station about what living in space is like. The class will discuss and research technology created for space. Students will also come up with ways that this technology could be used here on Earth. The instructor will show some videos on the James Webb and Hubble Telescope. The class will look at images from the Hubble Telescope and discuss. The instructor will also introduce the newest telescope set to launch in 2021. Students will research the Hubble space telescope and the James Webb Space Telescope. Students will then need to compare the two using a Venn Diagram. A worksheet will be provided to

students to follow.

Objectives:
SWBAT list questions they would have for an astronaut on the international Space Station.
SWBAT describe the design and structure of a spaceship built by several different organizations, including NASA.
SWBAT create applications for technology, used in space, here on Earth.
SWBAT compare the Hubble Telescope to the James Webb Space Telescope.

Standards: ESS3.A, MS-ESS3.1, MS-ESS3.2, RST.6-8.1, WHST.6-8.9

Assessment: Students will be assessed on their ability to generate, ask, then follow up with a discussion on the life of an astronaut on the ISS. Students will be assessed on their ability to create a list of at least 5 applications for technology discussed in class to be used in their everyday lives. Students will be assessed on a Venn Diagram to compare two different space telescopes in their design, features, size, and capacity to view the cosmos.

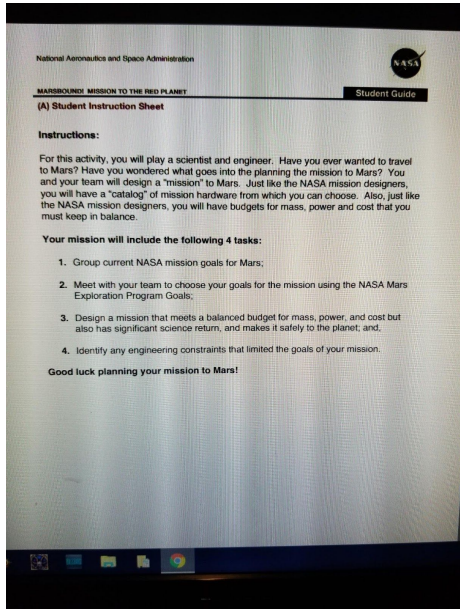
Procedure:
1. Students will enter the classroom and answer the focus question on the board, "What kinds of technology do you use that was created to be used in space?".
2. The class will discuss what kind of technology is needed to view objects in space, what it takes to get to outer space, and what is needed to live in space.
3. The instructor will show a PowerPoint presentation on technology in space and how it was created. This will involve satellites, spaceships, and telescopes.
4. One of the videos will be from the NASA website: https://www.jpl.nasa.gov/edu/teach/activity/bouncing-radio-waves-off-titans-lakes/
5. The instructor will then talk about technology that was originally created for space travel and exploration and is now used here on Earth.
6. The class will also look at pictures and talk about the contributions to everyday life on Earth from NASA.
7. Students will have some time to contemplate the newest technology and advances being made for space exploration and come up with ways to use this in their everyday life. The class as a whole will discuss these ideas.
8. Students will generate a list of questions they would ask an astronaut about living in space.
9. The instructor will show a series of videos created by cosmonauts from Canada living on the international space station where they answer questions from students about living in space.
10. If there is time left in class we will discuss the videos and any questions they still have.

Resource: Jet Propulsion Laboratory. (2018). Bouncing Radio Waves Off Titan Lakes. *NASA.* Received from: https://www.jpl.nasa.gov/edu/teach/activity/bouncing-radio-waves-off-titans-lakes/

Part 2

Procedure:

1. Exploration into the technology used to explore space will continue with the following class.
2. The instructor discuss several different missions to explore other planets. This will involve the explorations to Jupiter.
3. This information will be followed by a series of videos from Bill Nye. https://www.jpl.nasa.gov/edu/teach/activity/why-with-nye-mission-to-jupiter/
4. The class will spend the rest of the period focusing on the mission to mars. This means the class will go through what we already know about the planet, rovers, future missions, and the purpose of our focus on the red planet.
5. The instructor will introduce the activity for the following class.


National Aeronautics and Space Administration

MARSBOUND! MISSION TO THE RED PLANET Student Guide

(A) Student Instruction Sheet

Instructions:

For this activity, you will play a scientist and engineer. Have you ever wanted to travel to Mars? Have you wondered what goes into the planning the mission to Mars? You and your team will design a "mission" to Mars. Just like the NASA mission designers, you will have a "catalog" of mission hardware from which you can choose. Also, just like the NASA mission designers, you will have budgets for mass, power, and cost that you must keep in balance.

Your mission will include the following 4 tasks:

1. Group current NASA mission goals for Mars;
2. Meet with your team to choose your goals for the mission using the NASA Mars Exploration Program Goals;
3. Design a mission that meets a balanced budget for mass, power, and cost but also has significant science return, and makes it safely to the planet; and,
4. Identify any engineering constraints that limited the goals of your mission.

Good luck planning your mission to Mars!

Resource: Jet Propulsion Laboratory. (2018). Why with Nye: Mission to Jupiter. *NASA.* Received from: https://www.jpl.nasa.gov/edu/teach/activity/why-with-nye-mission-to-jupiter/

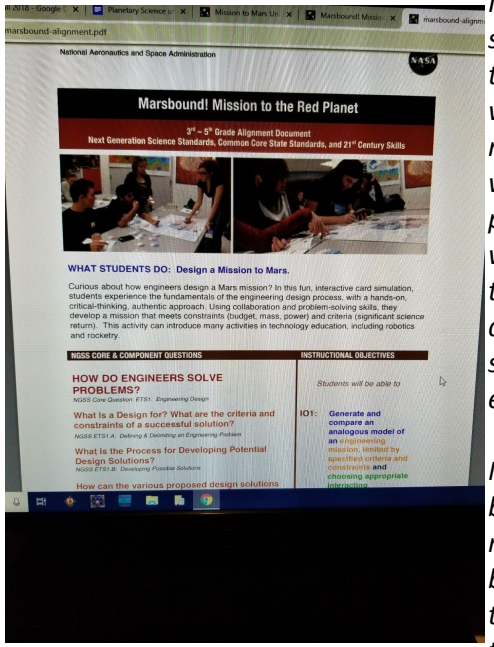
Part 3 (possible 2 day lesson)
This lesson was provided by NASA. The link and resource is provided below.
Jet Propulsion Laboratory. (2018). Marsbound! Mission to the Red Planet. *NASA.* Received from: https://www.jpl.nasa.gov/edu/teach/activity/evaluating-a-lunar-eclipse/

Materials:

- **Equipment Cards (1 per team) – Download PDF**
- **Design Mat (1 per team) – 8.5x11 tiles PDF | large-format PDF**
- **Marsbound! Student Guide (1 per student) – Download PDF**
- **(Optional) Marsbound! Alignment Guide – Download PDF**
- **(Optional) Marsbound! Quick Reference Guide – Download PDF**

Procedure:

1. The instructor will begin the lesson by reading the mission to the students (Provided by the NASA lesson plan).

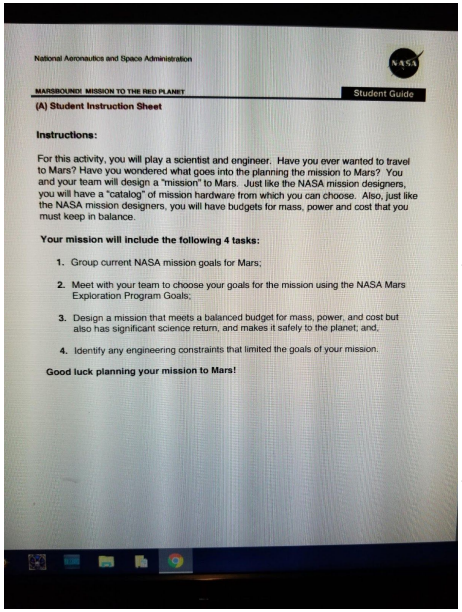


Imagine that today, your school principal announces that you will be working on a new, very complex school project, a project that no one has ever done before. This project will be the single most important task you have ever been asked to complete thus far in your life. This project will be a group project, and you will be working with some people you know and others you don't know. Everyone in your entire group will need to complete the group project successfully or no one will pass. In fact, the project is so important, you will be working on it in every one of your classes, during an afterschool program, and as homework. You will probably be working on it at least 12+ hours a day and during many weeks; you will work through the weekend, too! You will have just 2 years to complete the project. The project is so complex and difficult, that you will have to revise and rewrite the plans for the project constantly. When the project deadline arrives, the group will have to show the completed project to the school, principal and, oh yes, all the news stations in the world will be there as well. You will have no extensions on the deadline. No pressure, but everyone is counting on you!

NASA mission planners, engineers, and scientists go through much the same process when designing and building space missions to Mars and other destinations. Many times, they are faced with tasks that have never been tried before. Imagine that they have spent 2 years of their lives, 12+ hours a day, planning, building, planning, testing, retesting, re-planning, re-building, re-testing, packaging, shipping, unpacking, testing, and re-testing, all in an attempt to do everything in their power to ensure their mission makes it to the surface of Mars.

2. The instructor will give directions orally and using a procedural sheet for students.
3. Once finished with directions the instructor will pass out the student guide, equipment cards and design mat.
4. The instructor will describe the mission and read over the sheets with the students.
5. Students will be moved into their lab groups to work together on the mission.
6. The mission will begin by determining the climate of Mars.
7. Students will use the chromebooks in their lab groups to research the geology of mars and draw a basic landscape of an area of Mars where they would want to conduct their mission.
8. Students will have to determine the human needs and challenges that would occur with a man mission to Mars. This will require more research. One person in the lab group will be incharge of keeping this data listed in their composition book for planning the mission. Each group will come up with a mission statement, this would be what they hope to discover or accomplish in their mission.
9. Another lab group member will be in charge of sketching their technological solution to achieving the mission. This would be the spaceship and if they want to fly a lander, orbiter, or fly-by mission.

10. In order for students to build their spaceships they will use the trading cards provided.


National Aeronautics and Space Administration

MARSBOUND! MISSION TO THE RED PLANET — Student Guide

(A) Student Instruction Sheet

Instructions:

For this activity, you will play a scientist and engineer. Have you ever wanted to travel to Mars? Have you wondered what goes into the planning the mission to Mars? You and your team will design a "mission" to Mars. Just like the NASA mission designers, you will have a "catalog" of mission hardware from which you can choose. Also, just like the NASA mission designers, you will have budgets for mass, power and cost that you must keep in balance.

Your mission will include the following 4 tasks:

1. Group current NASA mission goals for Mars;
2. Meet with your team to choose your goals for the mission using the NASA Mars Exploration Program Goals;
3. Design a mission that meets a balanced budget for mass, power, and cost but also has significant science return, and makes it safely to the planet; and,
4. Identify any engineering constraints that limited the goals of your mission.

Good luck planning your mission to Mars!

- *Students will begin the simulation by choosing a (Red) Rocket Card and Rocket Nose Cone (required). The rocket card will determine the Mass Limit for the mission and will include the Cost in millions of dollars. The nose cone will be additional Weight and money, so students will need to record this information into their (G) Spacecraft Design Log.*
- *Students will then choose a (Orange) Power System Card. This card will determine the Power available during the mission.*
- *From here, students will choose their (Purple) Computer Systems, (Aqua) Communication Systems, and (Blue) Science Instruments cards to achieve their science goals stated in Activity 2. These will help to increase Science Return.*
- *If students have chosen a rover or lander for their mission, rovers will need to include a (Fuchsia) Mobility System, and both rovers and landers will require (White) Entry, Descent, & Landing Systems.*
- *The final decision will be optional (Yellow) Mechanical Systems. These can increase the Science Return, but should be considered last due to budget constraints. Remind students to keep a tally in their (G) Spacecraft Design Log to ensure they are staying within budget, power and mass. *Tip: The teacher will need to define the budget. Lower amounts make it a more challenging activity, while higher amounts make it less challenging. Starting with $250 million is recommended as a good "average" level of difficulty for any of the missions.*
- *When students have created a mission within budget, power, and mass, they can now select a (Green) Special Events card. Half of these cards are Spin-offs or advances in technology that can be commercialized. These add money to the budget. The other half of the cards is failures or cuts to the budget. These take away money from the budget. Allow students time to adjust their mission to accommodate these scenarios. *Tip: Ask students to use a pencil on their (G) Spacecraft Design Log so that they can easily erase when necessary.*
- *The final step will be launch day. The Budget: Science Return ratio will establish the order of launch. For each mission, calculate the $/science ratio by dividing the amount of money spent on the mission by the number of science stars earned. The first place team with the lowest Science Return ratio and falling at or below budget, mass and power. Students will roll the die to determine if their mission launched successfully. The type of rocket they chose will determine the success rate. For example, the Heavy-Lift Rocket is high risk, only lifting off successfully 3 out of 6 times. If students roll a 1, 2, or 3, they lift successfully. If they roll a 4, 5, or 6, launch fails and the mission is over* (Jet Propulsion Laboratory, 2018).

11. Students will go through their design once completed and make a list of constraints for their design. Another student in the group will be incharge of this list. Some examples of this would be: size, mass, budget, and power. Each group will share their constraints to see if

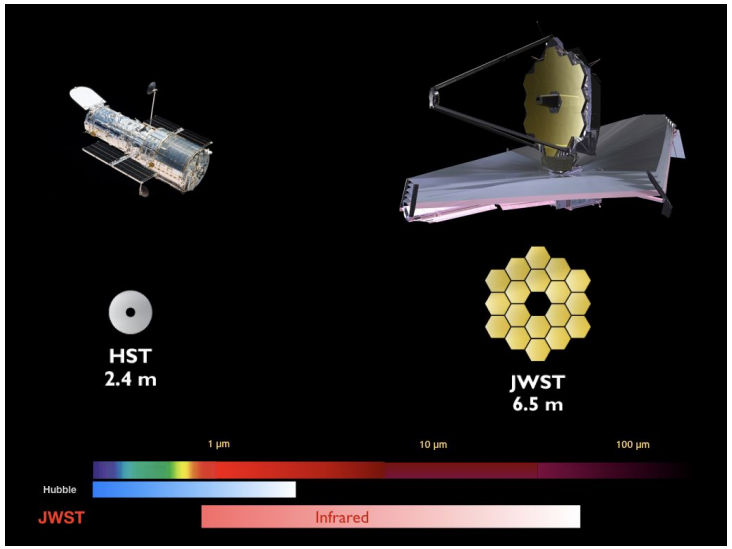
another group has thought of a way around this. The instructor will explain to students that all programs are working off of each other and helping to achieve space travel.

12. Groups will trade their ideas for the mission with another group to check. These groups will keep a list of modifications separate from the sheet and give back after 10 minutes.
13. The instructor will end the class by playing simulations of possible plans from different programs for landing a man mission to Mars. Students will discuss these missions and compare to their own. Students will also have to identify complications for these missions.

Part 4: James Webb Space Telescope

Procedure:

1. Students will enter the classroom and answer the focus question on the board, "List everything you know about telescopes".
2. The class will go over this list. The answers could be from the previous class or prior knowledge coming into this unit.
3. The instructor will talk about the structure, creation, use, and missions on the Hubble Space Telescope.
4. The instructor will show images from the Hubble Telescope on the whiteboard.
5. Students will learn about what they are seeing and what is not seen in the images.
6. Students will then be introduced to the James Webb Space Telescope. The instructor will allow students to conduct their own research on this new advancement in space research. Students will work in pairs to answer the questions given from the instructor using the chromebooks. At the end of the research there is a Venn Diagram to fill out comparing the Hubble Space Telescope and the James Webb Space Telescope.

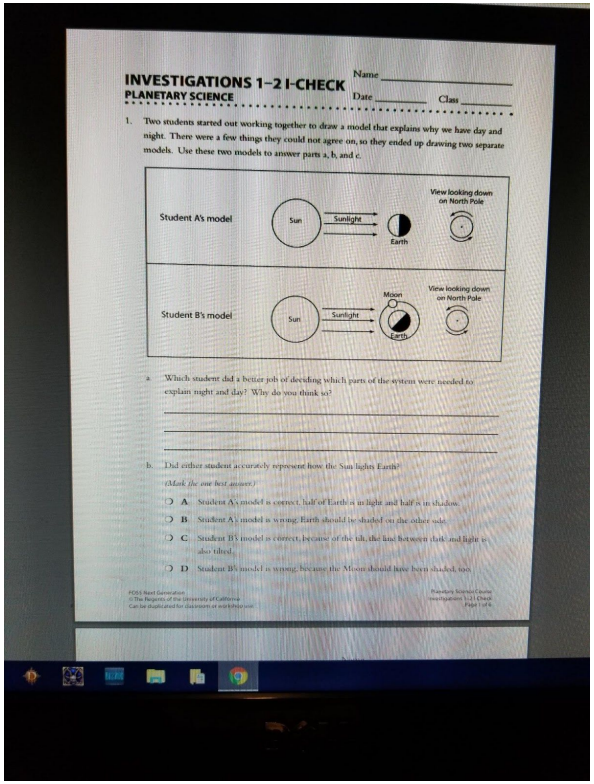


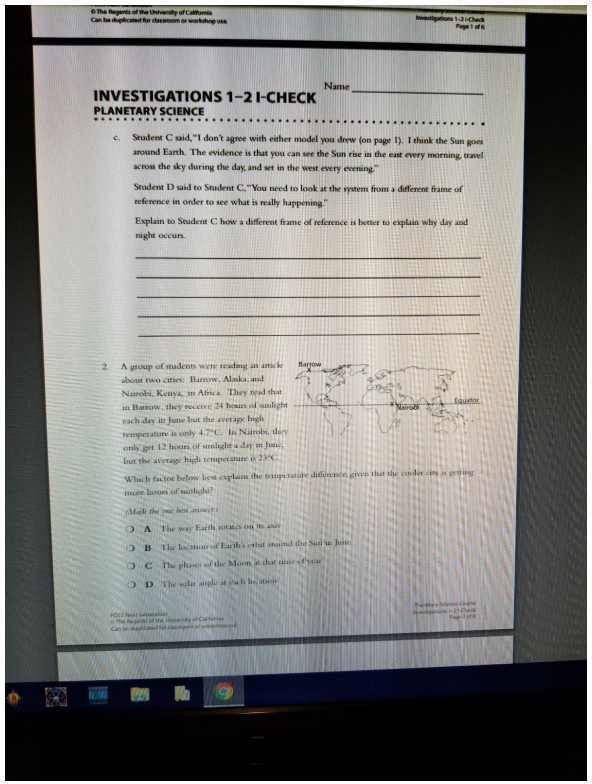
Closure: Exit Slip: What do you hope is discovered using the James Webb Telescope? If you could invent technology for space what would you want to invent?

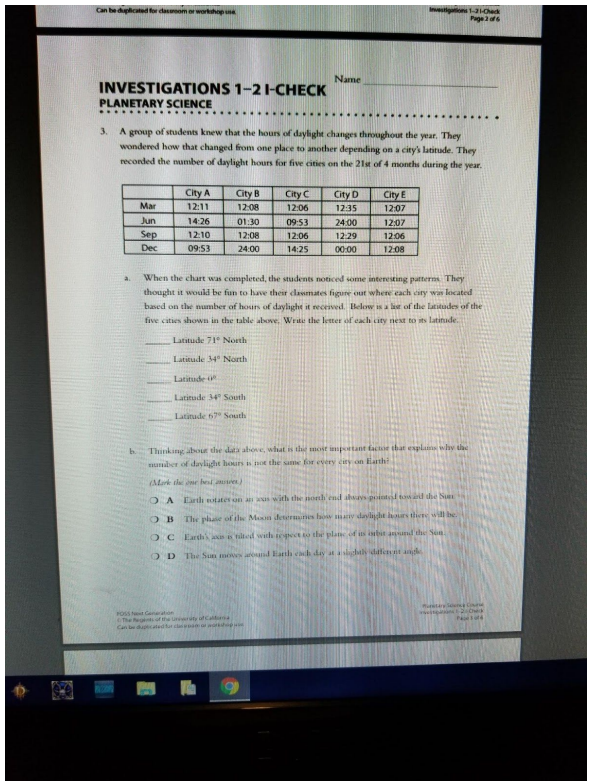
Modifications: *Students will be provided as much time as needed to complete activities and assignments. Ability grouping will be used for the NASA lesson plan. The instructor will provide both oral and written directions.*

Quizzes: Quizzes called I-checks will be given throughout as evidence in stage 2. The I-check is a quiz in which students received back after the first round of grading to reflect on what they chose or explained. Students then have the chance to fix these answers and receive half credit. All quizzes and tests are created and owned by the FOSS company.
FOSS. 2018. Delta Education. Received from: https://www.fossweb.com/

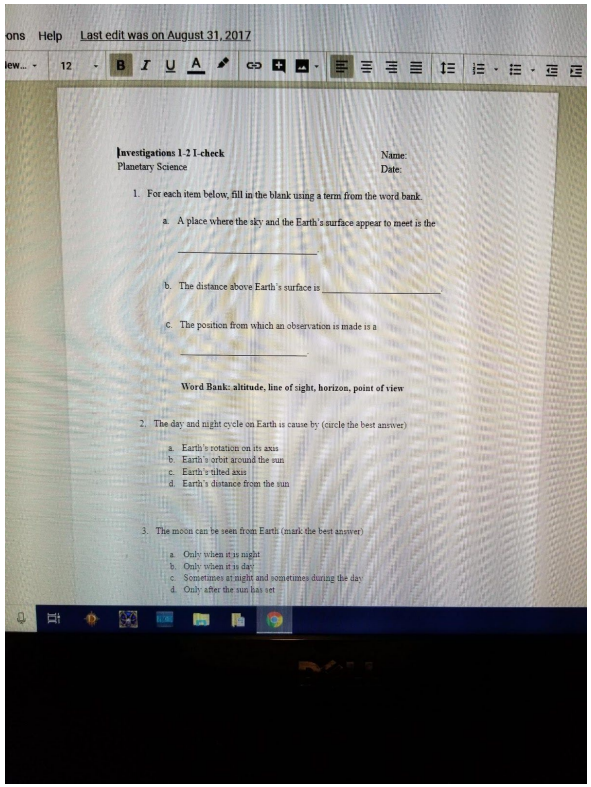
Below is a sample of an I-check, this is from investigations 1 and 2, which would be the first two lessons provided in this unit plan.







*Below is a sample of a **modified** I-check, this is from investigations 1 and 2, which would be the first two lessons provided in this unit plan.*



ons Help Last edit was on August 31, 2017

Investigations 1-2 I-check
Planetary Science

Name:
Date:

1. For each item below, fill in the blank using a term from the word bank.

   a. A place where the sky and the Earth's surface appear to meet is the _____

   b. The distance above Earth's surface is _____

   c. The position from which an observation is made is a _____

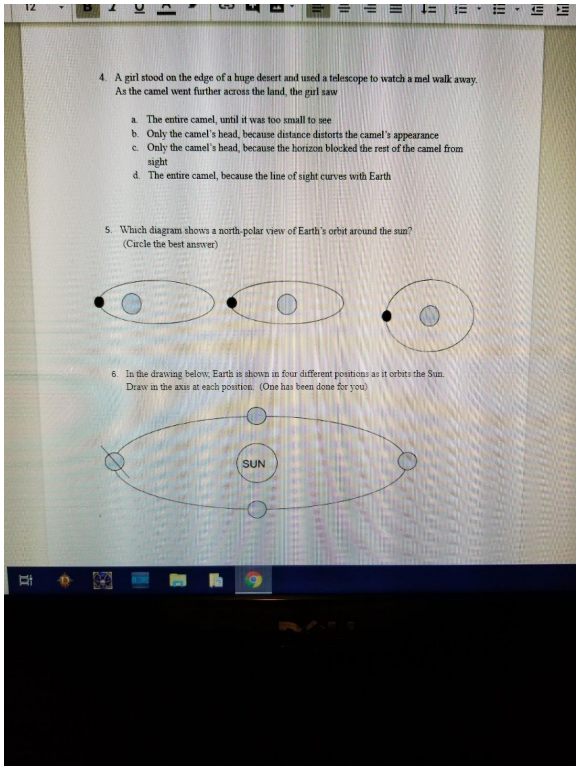
   Word Bank: altitude, line of sight, horizon, point of view

2. The day and night cycle on Earth is cause by (circle the best answer)

   a. Earth's rotation on its axis
   b. Earth's orbit around the sun
   c. Earth's tilted axis
   d. Earth's distance from the sun

3. The moon can be seen from Earth (mark the best answer)

   a. Only when it is night
   b. Only when it is day
   c. Sometimes at night and sometimes during the day
   d. Only after the sun has set



4. A girl stood on the edge of a huge desert and used a telescope to watch a mel walk away. As the camel went further across the land, the girl saw

   a. The entire camel, until it was too small to see
   b. Only the camel's head, because distance distorts the camel's appearance
   c. Only the camel's head, because the horizon blocked the rest of the camel from sight
   d. The entire camel, because the line of sight curves with Earth

5. Which diagram shows a north-polar view of Earth's orbit around the sun? (Circle the best answer)

6. In the drawing below, Earth is shown in four different positions as it orbits the Sun. Draw in the axis at each position. (One has been done for you)

SUN

Final Exam: This is the same exam as the Pretest. It is given to students at the end of the unit to measure their growth. The test is then stapled to the pretest and given back to students so they can see their growth as well. All quizzes and exams are created by and owned by FOSS. FOSS. 2018. Delta Education. Received from: https://www.fossweb.com/

References:

FOSS. 2018. Delta Education. Received from: https://www.fossweb.com/

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