6th Grade

Sample Science Learning Plan

Big Idea/ Topic

The Solar System and Beyond

This segment focuses on elements a and c of standard S6E1. Element C should be a continuation of the materials learned about the solar system in grade 4. The procession of the content related to this unit will reflect on models, origin and the evidence of scientific theories as new information is discovered.

Standard Alignment

S6E1. Obtain, evaluate, and communicate information about current scientific views of the universe and how those views evolved.

a. Ask questions to determine changes in models of Earth's position in the solar system, and origins of the universe as evidence that scientific theories change with the addition of new information. (*Clarification statement:* Students should consider Earth's position in geocentric and heliocentric models and the Big Bang as it describes the formation of the universe.)

c. Analyze and interpret data to compare and contrast the planets in our solar system in terms of: size relative to Earth, surface and atmospheric features, relative distance from the sun, and ability to support life.

Connection to other content areas:

ELAGSE6RI7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

ELAGSE6W9: Draw evidence from literary or informational texts to support analysis, reflection, and research.

ELAGSE6SL4: Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

Instructional Design

In this segment students will obtain, evaluate and communicate information about the Solar System

Phenomenon: Think about the longest trip you have been on. How many hours were you in route to your final destination? Think about traveling around Earth. How long do you think it might take to make once complete circle around Earth? View the Video from NASA: Solar System Introduction (Printable transcript available)

Engage:

Have students complete the Universe observation and questions sheet to get students thinking about the universe's size and factors affecting the universe. Then have students create a model of what they think the solar system looks like. Have them include all of the planets and their locations. Then students should answer the following questions about their models:

- Why did you set it up this way?
- Which planets do you think are bigger?
- Which are smaller?
- What is at the center of the solar system?
- What information did you use to set up the solar system?

Then have students share their models and why they set them up the way they did with the group.

The next step is to discuss the historical perspectives of the origin of the universe. Scientists spent years gathering data and sharing ideas about the universe before we had an accurate model. So, ask students:

- What do you know about heliocentric models and geocentric models of the solar system?
- What evidence would scientists have been looking for?
- What evidence have you studied in your school career that scientists might have used when making and revising their ideas?
- How can you derive the meaning of the words?

Complete this exercise on the key words of the origin of the solar system. (Student Handout)

<table>
<tr><td colspan="2">Geocentric: determine if geocentric has a prefix, suffix or root word</td></tr>
<tr><td>Prefix</td><td rowspan="3">Make a list of other words with those same prefixes, suffixes or root words.</td></tr>
<tr><td>Suffix:</td></tr>
<tr><td>Root words:</td></tr>
<tr><td colspan="2">Heliocentric: determine if heliocentric has a prefix, suffix or root word</td></tr>
<tr><td>Prefix</td><td rowspan="3">Make a list of other words with those same prefixes, suffixes or root words.</td></tr>
<tr><td>Prefix</td></tr>
<tr><td>Root words:</td></tr>
</table>

This will help with understanding the origin of the solar system. Have students watch the following video, a similar video or read an article that describes the difference between geocentricism and heliocentrism. Students should check their definitions based on the video. Then everyone should discuss why the heliocentric model is now considered a more correct version of our solar system. Once students can communicate the information about geocentric and heliocentric, have them revise their model. Models may include drawing the

configurations and not actually building a 3D model. Building of a 3D model is part of the Choice Board listed as an assessment choice.

Unplugged: The teacher should provide students with copies of all handouts and articles that students can use to find information. The teacher should identify images that help students understand the differences between Geocentric and Heliocentric models of the universe. The teacher should be sure that students are getting clear and consistent feedback about their work because this will help students adjust their learning as they move through the lesson.

Explore: The student should be familiar with the geocentric (earth is center), heliocentric (sun is center) and now should investigate the Big Bang Theory.

Students should research the Big Bang Theory and scientists that contributed to the theory. Sources such as NASA may be helpful. Students can use this graphic organizer to help keep the information organized. Some of the questions that students should be able to answer about the big bang theory:

- What is the big bang theory?
- What does the big bang theory say about the formation of the universe?
- Did the big bang create everything in the Universe all at once?
- What evidence do scientists use to justify the Big Bang Theory?
- How does the big bang theory relate to the geocentric and heliocentric models of the solar system?

Remember, this element is dealing with evidence that scientific theories change with the addition of new information.

Unplugged: The teacher should provide students with copies of all the handouts and images. The teacher should have a plan to clearly and consistently provide students with feedback. The teacher may want to consider providing students with a way to check their work on the chart before moving forward with the lesson. The teacher may want to send home an answer key packet labeled for parents to be able to check the students understanding.

Explain:

The next step is for students to explore our solar system. Have students go outside and observe the sky. Students can use the following handout, planet search, to help record data about the planets that they see. There are multiple apps available to assist with viewing stars and solar system objects.

Then students should research the different planets and find the information to fill in the following chart which is available for use using the following link (Student Sheet).

	Distance from Sun	Size Relative to Earth	Atmosphere	Surface Features	Ability to Support Life
Mercury					
Venus					
Earth					
Mars					
Jupiter					
Saturn					
Uranus					
Neptune					

For more Background Information:

- Planets of the Solar System Reviews the planets of the solar system with increasing distance from the sun, their orbits, and rotations. (Variety of information for teachers to determine what is best for their students – articles, videos, etc)

- The background information for the rest of this unit may come from the following Solar System Unit. The unit is available for complete download and will allow you to incorporate the Engineering Design Process.

Now students should create a journal or write a short book to illustrate and summarize data to compare and contrast the planets in our solar system. The journal entry/book should include comparison of size relative to Earth, surface and atmospheric features, relative distance from the sun, and ability to support life.

Unplugged: The teacher should provide student with copies of the handouts and articles/images to help students fill in the chart. Students can still explore the night sky without technology; consider providing charts and resources to help families locate objects. The teacher should provide students with information in various formats such as articles and images. The teacher should, also, provide the students with feedback on their chart. The feedback should be provided following district guidance. The teacher should consider a rubric for the journal entry or book that students are going to write.

Elaborate:

Students should develop a travel mode from Earth to visit other places in the solar system. Students should choose two planets to visit within the solar system and focus on building a vessel to travel to those different places. The design a should be something that would withstand the travel through the atmospheric conditions outside of the conditions of earth and focus on going the distance from earth to those planets. Students may need to research atmospheric conditions outside of Earth and on the planets that they are choosing to visit. In the parental support section are a variety of possible space travel activities that students and families can do together.

Teacher Information: A variety of activities are found in the Solar System Guide at the beginning of the unit.

Unplugged: The teacher should provide instructions and a rubric for this assignment. The teacher will need to provide students with articles that discuss gravity and atmospheric conditions outside of Earth. The teacher should provide written instructions, such as the ones linked in the Engaging Families section below. Most of the activities do not require technology. Students may need additional support with an open-ended task. Consider approved communication channels for students to discuss thinking and to assess standard-level performance.

Evaluate: Students should be able to communicate, verbally or through writing, the understanding of the position of earth in the solar system, from historical to current perspective. Some questions to guide the understanding are:

- *How did thinking change as scientists figured out that the solar system is centered around the sun?*

- *What kinds of observations do you think helped change their thinking?*

- *What technology do you assume provides evidence to support a sun centered system?*

Unplugged: The teacher should provide students with the choice board and any supporting documents needed to complete the assignments.

Evidence of Student Success

As evidence of understanding of the concepts, students should be presented with a choice board and be allowed to complete the assessment of choice. Choice Board handout.
Student mastery is assessed throughout this unit using formative and summative components. Student discussion, explanations and products should reflect the understanding indicated in the Evaluate section above. Each activity in the segment functions as an assessment opportunity as well to plan targeted supports or provide extension items. Formative options using the self-evaluation checklist and the activities at various points during the segment.

Student Learning Supports

The goal for science education in the state of Georgia is as follows: All Students, over multiple years of school, actively engage in science and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields.
The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions.
This lesson includes the disciplinary core ideas, science and engineering practices and crosscutting concepts to actively engage students in exploring science concepts with real world topics. As part of the vision we must support the inclusion of all students in science learning.
Some **general** ideas to assist in supporting students that struggle are as follows:

- Be sure that students can access the information that you they are learning. Make sure that you can answer the following questions:
    - Do students have what they need to get the information? This is about them having the book or internet access to get to the information.
    - Once students obtain the information, are students able to determine what information is important? This is about the students having materials on the appropriate grade level and that is in a format that students can understand.
    - Is the material presented in multiple ways that allows all students to interact with information in a way that works for them? Such as video, audio, and articles.
    - Consider read aloud as a potential option for students that have reading deficits as an option to assist students in accessing the material. This could be done using video or via phone.
- Students may need ideas about where to find information. Providing students with information about what a reliable source is and even where to find reliable sources may be beneficial for students.
- Some students may find it difficult to complete the entire lesson workload. Some students may benefit from a reduced workload (note: this should be used only when absolutely necessary). Be sure that the information that is removed will not negatively impact the student's understanding of the disciplinary core idea.
- Consider how students show their knowledge. Students need multiple ways and opportunities to show their knowledge. Things to consider:
    - Recording video or audio
    - Drawing
    - Writing
    - Typed
    - Verbal
- Provide students with a way to ask questions in a forum that does not cause anxiety. Frequently students do not want to ask questions in front of their peers because they are afraid of what their

peers may think of them. So, be sure to provide students a way to ask questions that is private or anonymous.
- Consider materials that students need to complete the assignments.
  - Do students have needed materials?
  - What are some alternative materials that students may have available to them?
- Have a clear and consistent set of guidelines for providing consistent feedback to all students.
- Utilize graphic organizers such as those from the Wonderofscience.com
- Use high leverage and evidence-based practices to reach all students.

Some considerations, **specific to this lesson**, when planning supports are as follows:

- The links to the Solar System information provides opportunities for students to read and research data on different reading levels. The link (Composition and Structure of Planets) is a historical article on the solar system and the Planets of the Solar System provides information in a condensed way. Students should be able to complete the chart without difficulty.
- Modifications to the journal entry may be made based on individual student needs. For some students, you may allow presentation of inner planets or outer planets, illustrations instead of writings, etc. The individual need of the student may be met based upon the specialized instruction needed.
- The teacher should make sure to provide students with closed captions for any videos used. The teacher may want to show students how to turn the closed captions on/off to fit the needs of the students.
- The teacher should provide students with multiple ways for students to access information. These formats could include video, articles, text to speech or direct instruction as needed.
- The teacher should have clear and consistent guidelines for discussions. These should be applied to all environments where students are going to share their work, ideas and ask questions.
- The teacher should consider providing students with sources to find information about the solar system.
- The teacher may want to consider providing students with a list of common household materials that student can use when making a 3-D model.
- The teacher should consider read aloud for articles. Read aloud could be accomplished by using text to speech programs, reading aloud to students via LMS or phone.
- The teacher should be sure to follow all district guidance when communicating with students.
- The teacher should provide students with multiple formats for students to share their knowledge. These formats could include writing, drawing, or building a model.
- The teacher should consider providing students with rubrics to make sure that requirements of assignments are clear to students.

Engaging Families

As students develop their complete understanding of the solar system we live in, students and families should be able to complete a variety of activities to exhibit travel within our solar system. Some of these activities might include:
Pop Rockets
Rocket Power
Space Craft Design: Beat the Heat
A Round About Way to Mars
Slingshot to Other Planets
Designing Devices for Help Astronauts Eat: Lunch in Outer Space

Additional resources to support this segment can be found at GPB: Georgia Home Classroom.

Video Transcript

Earth is a big place.

If you could drive around the entire planet, it would take more than sixteen days of non-stop driving at highway speeds.

But, compared to some of the planets in our solar system, it's pretty small.

We often see planets displayed as similar in size, like this, to make details on smaller planets easier to see.

In reality, the size of planets compared to each other looks more like this.

Even though this shows the sizes of planets accurately, they aren't that close together.

Because of the great distances between planets, and the planets relatively small sizes compared to those distances, it's practically impossible to create a visual representation on a screen or the page of a book that realistically represents the sizes of the planets and the distance between them.

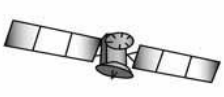
As a result, the best we can usually do is show the accurate sizes of planets or the accurate distances between the planets.

Remember, they're not actually lined up like this.

In space, the planets' positions are constantly changing as they revolve around the Sun.

The Universe: Big Bang Theory (Scientific views of the universe and how those views have evolved)

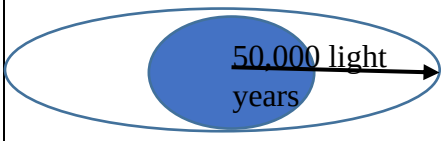
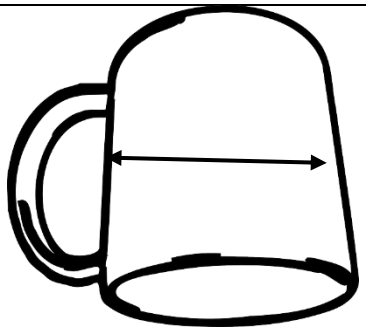
Phenomena: Photos from Different Perspectives

	Photos from Earth 	Photos from Space 	Photos from other Planets 
Things I Know about these images			
Questions Raised			

Statement	True or False: Circle your decision.	**Initial Explanation:** I think this way because….
There are no planets beyond our solar system.	True or False	
Engineers help us explore the universe by designing technology such as telescopes, spectroscopes, and spacecraft.	True or False	
We cannot send spacecraft into the universe beyond our solar system.	True or False	
Our solar system is just a small part of the Milky Way galaxy.	True or False	

How Big is the Universe?

(adapt from https://imagine.gsfc.nasa.gov/educators/galaxies/imagine/imagine_book_2009.pdf)

Measurement	Visual Representation: *Add appropriate values within the visuals. The first one has been modeled for you.*	Question
The Milky Way has a radius of about 50,000 light years.		What is the approximate diameter of the Milky Way Galaxy?
The visible universe has a radius of approximately 15 billion light years.		What is the approximate diameter of the visible universe?
Scale Model: An 8 cm wide coffee cup represents the diameter of the Milky Way Galaxy.		If the Milky Way is represented by an 8 centimeter wide coffee cup, how big would the rest of the universe be in kilometers?

Show your calculations:

Brainstorm: What other models could you develop to represent our Galaxy?...our Universe?

Planet Search

Your Challenge:

The planets orbit the Sun in their own orbits. Each night the planets will be in a slightly different location. Your challenge is to discover where the planets are tonight.

Discovering:

1. Use a program or app that gives a view of the night sky.
2. Start with the 8PM view. Search North, South, East, West, and Zenith (Overhead). Record any planets you can see at 8PM on the chart below. Describe when to look, which direction to face and the name of the constellation in which you found the planet.
3. Next choose 5AM in the program in all directions. Record any additional planets you find.
4. Any planets that are NOT visible at either time are too close to the Sun in our sky - either in front of the Sun or behind it. Put "too close to the Sun" in the blanks.

Where it is tonight

Planet	How It Looks	Time	Direction	Constellation
Mercury	bright but always in twilight	_____	_____	_____
Venus	brightest in Earth sky, looks white	_____	_____	_____
Mars	red planet, bright as a bright star	_____	_____	_____
Jupiter	second brightest, brighter than stars	_____	_____	_____
Saturn	bright as a bright star, yellowish-white	_____	_____	_____
Uranus	faint, requires binoculars, greenish	_____	_____	_____
Neptune	faint, requires small telescope	_____	_____	_____
Pluto	very faint, requires large telescope		_____	_____

5. Take this information outside tonight or tomorrow morning and record any planets you see. Remember that planets shine with a steady light and do not twinkle as the stars do.

Making Science Sense:

The orbits of the planets lie in almost the same plane (or disk). The Zodiac constellations are also in this plane. Use this information to explain why the planets are never in the Big Dipper.

Key Words

Look at the word: **Geocentric**

Break the word into syllables and write it here: _____

Complete the chart by filling in prefix, suffix and root word. Add additional words with the same prefixes, suffixes and root words.

Prefix:	Other Words:
Suffix:	
Root Word:	

Look at the word: **Heliocentric**

Break the word into syllables and write it here: _____

Complete the chart by filling in prefix, suffix and root word. Add additional words with the same prefixes, suffixes and root words.

Prefix:	Other Words:
Suffix:	
Root Word:	

Big Bang Theory Organizer

Scientist	*Ideas (in words)*	*Ideas (in visuals)*	*Related Terms*	*General Time frame*

Planets of the Solar System

Data Collection Sheet

Use information from Composition and Structure of Planets and Planets of Solar System to complete the chart.

	Distance from Sun	Size Relative to Earth	Atmosphere	Surface Features	Ability to Support Life
Mercury					
Venus					
Earth					
Mars					
Jupiter					
Saturn					
Uranus					
Neptune					

Other information deemed necessary or interesting for completion of your Solar System journal

MOVIE	POWERPOINT/SLIDE SHOW	MODEL of SOLAR SYTEM
Students should create a video using props to demonstrate their understanding of the Solar System. Understanding should include the information researched during the Explore section of the lesson. Each planet should be presented in a compare and contrast scenario. A minimum of a 5-minute video must be presented.	Students should create a slide show to demonstrate their understanding of the Solar System. Slides should include illustrations and animation. The information presented comes from the Explore section of the lesson. A minimum of 10 slides must be presented.	An accurate to 3D scale model of the solar system should be presented to demonstrate their understanding of the solar system. Information to build the model should be gathered from the Explore section of the lesson. A variety of materials may be used and is up to the student. The model must include labels and an explanation of the model should be included.
POSTER	**HELIOCENTRIC/GEOCENTRIC MODEL**	**SPACE TRAVEL VIDEO**
Students may present an illustration of the solar system. This illustration should include all planets and be drawn to scale. Included on your poster should be an accurate of each planet and any other gathered information from the explore section.	Students may create a model of the universe in the heliocentric and geocentric time. The completed assignment must include both models and requires a written paper (at least one page) explaining the models, the scientists which defined the models and the conclusion of our present-day solar system. Dates and scientists should be included in the paper.	Students, with the assistance of parents, may complete one (or more) of the family engagement activities. The student should complete the engineering design process with the activity. Video clips should be captured throughout the activity and the launch of the object should be recorded in entirety. Students should be videoed with an explanation of the design, launch and redesign.