Geocentric vs. Heliocentric Solar System

Grade level: 6th - 8th
Lesson Time: 150 minutes
Key Terms:
- Geocentric
- Heliocentric
- Solar System

Resources:
- Answer Key
- Geocentric vs. Heliocentric Solar System worksheet

Materials needed:
- Calculator
- Research materials
- Suggested building materials: Styrofoam balls of various sizes, paint, wire, string, poster board, tape, glue

Lesson Overview

The Solar System refers to the sun and all of the objects that orbit around it. But, history has shown that it has not always been thought of this way. In this lesson, students will learn about two different versions of the Solar System: the geocentric model developed by Greek scientist and philosopher, Claudius Ptolemy, and the heliocentric model developed by astronomer, Nicolaus Copernicus. Students will build scale models of both systems and give presentations explaining their similarities and differences.

Objectives

- Compare and contrast two different models of the Solar System
- Analyze the pros and cons of each model
- Build scale models of the geocentric and heliocentric Solar Systems
- Learn about the nature of science, specifically how scientific knowledge is tentative

Standards (NGSS and Common Core)

For state specific standards visit edu.zspace.com

Next Generation Science Standards

- Earth and Space Science - Earth's Place in the Universe
  - MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
  - MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

Common Core Connections

- Language Arts
  - SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
- Mathematics
  - 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
  - 7.RP.A.2 Recognize and represent proportional relationships between quantities.

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Differentiation (Δ)

- Group students heterogeneously to allow students with a strong command of the English language to assist in reading or interpreting questions
- Give students a variety of presentation styles to choose from (using charts/graphs, PowerPoint, making 3D presentations, creating videos/movies, making posters)
- Enrichment: Students could work on the discussion questions and lead the class discussion
- Enrichment: Students could research similar topics and create presentations

Introduction

You have heard that people once believed the world was flat. People also used to believe that the Sun, Moon, and planets revolved around the Earth. In this lesson, students will compare and contrast the previously accepted geocentric Solar System model with the currently recognized heliocentric Solar System model. Students will recognize these models as a perfect historical example of the nature of science, specifically that scientific knowledge is tentative.

Activity

Geocentric vs. Heliocentric Solar System

This section will be completed in Studio along with the Geocentric vs. Heliocentric Solar System worksheet.

Scene 1

The Solar System refers to the sun and all of the objects that orbit around it, but people did not always believe that the Sun was the center of our system.

- Let's take a look at two different models of the Solar System.

Scene 2

Here is a model of the Solar System that people used to believe before the 16th century. It is called the geocentric model. "Geo-" means Earth and "-centric" means center.

- What is at the center of this Solar System?
- Why do you think people believed that the Earth was at the center of the Solar System?

Scene 3

Here is a model of the Solar System that we currently use today. It is called the heliocentric model. "Helio-" means Sun and "-centric" means center.

- What observations or evidence do you think caused people to change their opinion about the center of the Solar System?

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Scene 4

Now let's look at both Solar System models side-by-side. Astronomers use both models depending on which point of view makes their calculations easier.

- What similarities and differences can you find between the two models?
- Can you think of a situation when one point of view would be more beneficial than the other?

Research and Building of Scale Models

1. Conduct research about the relative sizes and distances of the Sun, Moon, and other planets.
2. Calculate ratios to represent their proportional sizes and distances.
3. Working in partners or small groups, build scale models of the geocentric and heliocentric Solar Systems using the provided materials. See the list of suggested items.
4. Label the Earth, Sun, Moon, and other planets in the Solar System.

Presentation of Solar Systems

5. Together with your partner or small group, present your models of both Solar Systems to the class.
6. Explain their similarities and differences.
7. Describe the pros and cons of each model.

Closing

After listening to all student presentations, students will share what they liked about each other's Solar System models.

Questions for Discussion

1. Why do planets rotate around the Sun and not the Earth?

   Answers will vary. Sample Answer: We say the earth goes around the sun because the sun is (about a million times) more massive than the earth.

2. After analyzing these two different Solar System models, what did you learn about the nature of science?

   Answers will vary. Sample Answer: I learned that scientific knowledge is tentative and subject to change based on new observations and evidence.

3. Do you think there are other current scientific beliefs that we may need to change in the future due to new observations or evidence? Like what?

   Answers will vary. Sample Answer: I think we may find new evidence that shows that life exists on other planets.

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Δ Investigate Further

Follow-Up Activity: Students could complete other zSpace gravity lessons in Studio or Newton's Park. For example in the "Planets - Gravitational Force" lesson, students investigate how the size of a planet and its distance from the sun affect its gravity.

Extension Activity: Students could research and write reports about the Greek scientist and philosopher, Claudius Ptolemy, who developed the geocentric model and the astronomer, Nicolaus Copernicus, who developed the heliocentric model.

Extension Activity: Students could research other historical examples that demonstrate the nature of science and present their findings to the class.

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Answer Key

Activity Questions Provided in Studio

1. What is at the center of the geocentric Solar System model?

   Correct Answer: The Earth is at the center of this model.

2. Why do you think people believed that the Earth was at the center of the Solar System?

   Answers will vary. Sample Answer: Scientists form their opinions based on their current observations. At that time, the geocentric model explained the observable phases of the Moon and the motion of the Sun and stars. It also explained why objects fell towards the Earth (gravity).

3. What is at the center of the heliocentric Solar System model?

   Correct Answer: The Sun is at the center of this model.

4. What observations or evidence do you think caused people to change their opinion about the center of the Solar System?

   Answers will vary. Sample Answer: More advanced technology and astronomy tools were developed to gather evidence. People discovered that the sun is the heaviest object in the Solar System and lighter objects orbit heavier ones.

5. What similarities and differences can you find between the two models?

   Answers will vary. Sample Answer: Similarities - Both models have Mercury, Venus, Mars, Jupiter, and Saturn in the same order. Differences - The geocentric model has Earth at the center while the heliocentric model has the Sun at the center.

6. Can you think of a situation when one point of view would be more beneficial than the other?

   Answers will vary. Sample Answer: The geocentric model might be more useful to calculate distances from the Earth to other planets or stars. The heliocentric model might be more helpful to calculate each planet's gravity or orbital paths.

7. This shift in scientific beliefs from the geocentric to the heliocentric Solar System model is a perfect example of the nature of science, specifically that scientific knowledge is tentative and subject to change based on new observations and evidence. Can you think of another historical example that demonstrates the nature of science?

   Answers will vary. Sample Answer: Yes, people used to believe the Earth was flat.

Name _____ Date _____

Geocentric vs. Heliocentric Solar System

Complete this worksheet as you view the Geocentric vs. Heliocentric Solar System tour in Studio.

What is at the center of the geocentric Solar System model?
Why do you think people believed that the Earth was at the center of the Solar System?
What is at the center of the heliocentric Solar System model?
What observations or evidence do you think caused people to change their opinion about the center of the Solar System?
What similarities and differences can you find between the two models?
Can you think of a situation when one point of view would be more beneficial than the other?
This shift in scientific beliefs from the geocentric to the heliocentric Solar System model is a perfect example of the nature of science... specifically that scientific knowledge is tentative and subject to change based on new observations and evidence. Can you think of another historical example that demonstrates the nature of science?