Speeding Around the Sun

Prentice Hall

Focus on Inquiry

The student will form a hypothesis and design a test on how the distance from the sun will affect the period of revolution of a planet.

Lesson Overview

Students will test how a planet's distance from the sun is related to its period of revolution.

Duration	Setting	Grouping	PTI Inquiry Subskills
75 + minutes	Classroom	Individual students	**1.3, 2.1, 3.2, 3.6, 5.2, 5.8, 5.9, 7.3**

Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	5 min	None	None	2	Students are engaged in a discussion on the planets
Explore	30 min	1.3, 3.1, 3.2, 5.8	None	3	Students write a hypothesis and then test their hypothesis by creating a model of a planet.
Explain	10 min	3.6, 5.2, 5.9	None	2	Students will describe planets in relation to other planets, propose an explanation based on observation, and recognize limitations of their models.
Expand	30 min	2.1, 3.6	None	3	Students will discuss the comparisons and differences between planets and design an investigation to test their hypotheses
Evaluate	Varies	7.3	PowerPoint (optional)	3	Student presentations.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry

Identify questions that can be answered through scientific investigations.
Use appropriate tools and techniques to gather, analyze, and interpret data.
Think critically and logically to make the relationships between evidence and explanations.
Communicate scientific procedures and explanations.

National Science Education Standards – Earth Science

The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.

Louisiana Grade Level Expectations – Inquiry

Gr. 8, Inquiry GLE#4 - Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
Gr. 8, Inquiry GLE#6 - Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
Gr. 8, Inquiry GLE#12 - Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
Gr. 8, Inquiry GLE#14 – Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
Gr. 8, Inquiry GLE#15 – Identify and explain the limitations of models used to represent the natural world (SI-M-A5)
Gr. 8, Inquiry GLE#19 - Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)

Louisiana Grade Level Expectations Earth Science

Gr. 8, GLE#38 - Use data to compare the planets in terms of orbit, size, composition, density, rotation, revolution, and atmosphere (ESS-M-C2)

Materials List

- String (1.5m)
- Plastic tube
- Straw (6cm)
- Meter stick
- Tennis ball
- Washers
- Stoppers
- Stopwatch
- Safety goggles
- 1 picture of the planets for students to view

Advance Preparation

1. Obtain materials listed in the materials list.
2. Print enough student copies of **Blackline Master #1**

Other Information

Objectives

The learner will:

- formulate hypotheses concerning the revolution of a planet around the Sun related to its distance from the Sun.
- test their hypotheses.
- determine whether their hypotheses should be accepted or rejected based on the results of their tests.

Prior Knowledge Needed by the Students

- Students should know how to use a stopwatch and measure with a meter stick.

Procedure

Engage

1. Start off by asking your students how the inner and outer planets are different? Ask them what determines the planets movement around the Sun? Have the students explain how Jupiter's movement would be different from Mercury? Have the students try to explain their answers. Show the class a picture of the planets as they discuss this. Accept all explanations.

Explore

1. Have students follow the instructions on **Blackline Master #1**.

Explain

1. Students should answer the questions on **Blackline Master #1.** They should also discuss their answers with each other.

Expand

1. Students will discuss what other factors are different from one planet to the next. As some point "mass" will probably come up. Allow the students to **design an experiment** for testing how mass will affect a plane period of revolution. (add more stoppers) Give the students time to test their ideas and present their conclusions to the class. Students may also research the actual periods of revolution for a comparison.

Evaluate

1. Students can present their data to the class in the form of a lab report or PowerPoint presentation for the class. The questions to be covered in the reports are on **Blackline Master #1**.

Blackline Master

1. **Lab Sheet: Speeding Around the Sun**

Supplementary Resources

Teachers

The Satellites Orbit site
http://www.sciencenetlinks.com/lessons.cfm?Grade=6-8&BenchmarkID=4&DocID=338
The Satellites Orbit site is an extension of the above lesson. Students can go beyond mass and distance of the planets and apply the knowledge they have gained to better understand how satellites orbit.

Unitedstreaming: What is an Orbit?
http://www.unitedstreaming.com
Orbit is the name for the path that an object takes as it moves on a continuous course around a larger object. The strong pull of gravity from the large sun keeps the planets, which are much smaller, orbiting in the same, predictable paths. Each planet travels its own orbit – some planets travel a circular path around the sun, while others go around in a longer, elliptical orbit

Students

The Adler Planetarium provides hands on learning for all ages.
http://www.adlerplanetarium.org/home.shtml

Celestial Exploration Activity
http://learn.arc.nasa.gov/planets/9/challenge1.html
Students can visit the planets and discover the "speed" of their revolution. Other information is also available on this website.

Lab Sheet: Speeding Around the Sun

Name_____**Date**_____**Block**_____

Procedure:

1. What do you think is the relationship between a planet's distance from the Sun and its period of revolution? Write your hypothesis in an "if…then.." statement.

2. To test your hypothesis, you need to make a model planet.
    a. Thread the string through the rubber stopper hole or tennis ball.
    b. Tie the end of the string to the main part of the string. Pull tightly to make sure that they knot will not become untied.
    c. Thread the other end of the string through the plastic tube and tie a weight to that end.
    d. Hold the plastic tube in your hand above your head. Swing the stopper around above your head. Practice keeping the stopper moving at a constant speed. **Be sure to stay away from other students in the group. **Do not let go of the string.
3. What does the circular path represent about the planet?

4. Pull the string so the stopper is 20 cm away from the plastic tube. Swing the stopper just fast enough to keep the stopper moving.
5. Have your partner time how long it takes for the stopper to make 10 revolutions.
6. Divide this by 10 to find the time for one revolution. Record this as Trial 1 in the chart at the bottom of the lab sheet.
7. Repeat Steps #4-5 two more times. Record your data as Trial 2 and 3.
8. Add the three trials together and divide by three to get the average.
9. If you pull the stopper out to 40 cm, what do you think will happen to the period of revolution? Write your hypothesis down.

10. Pull out your stopper to 60 cm. Repeat steps# 4-6. Record your data.
11. Based on your results in step# 7, you may want to revise your hypothesis. Make any needed changes.

12. Pull the stopper out to 60 cm and repeat steps 4-6. Record your data.

Analyze and Conclude:

1. Which object in your model represented the Sun?_____
2. Which object represented the planet?_____
3. What force did the pull on the string represent?_____
4. What you pulled the stopper out to make the orbit larger, did the string then represent a stronger or weaker force of gravity?_____

5. Why?

6. What happened to the period of revolution when you make the orbit larger in steps# 6 and 7?

7. Did your observations support your hypothesis? Summarize your conclusions based on your observations

8. Which planets take less time to revolve around the Sun-those closer to the Sun or those farther away? Use the model to support your answer.

9. If you changed your hypothesis what experimental data helped you modify your hypothesis?

10. Write a conclusion about the relationship of the distance a planet is from the Sun relative to its period of revolution.

11. What other factor may also affect the period of revolution? How would you test this idea? (Look at a picture of the planets)

12. What are the limitations of the model used in the testing?

Period of Revolution

Distance (cm)	Trial 1	Trial 2	Trial 3	Average
20				
40				
60				