

The Solar System

<http://quest.arc.nasa.gov/projects/astrobiology/astroventure/teachers/pdf/AV-Astronolesson-Part3.pdf>

Lesson 8

Focus on Inquiry

The student will explain how the solar system is a system and explain how gravity affects the solar system.

Lesson Overview

Students explore the planetary temperature system the explore how each aspect (e.g., mass, temperature, and gravity) influences the system and the consequences of disrupting that system

Duration Three 45-minute class periods	Setting Classroom or lab	Grouping Small cooperative groups of 3-4 students	PTI Inquiry Subskills 2.1, 3.6, 3.7, 5.8, 7.2
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<i>Engage (Day 1)</i>	10 min	3.6, 3.7	None	2	Review the concept of “systems.” Students identify parts of the <i>solar system</i> and how these parts interact with one another.
<i>Explore (Day 1)</i>	25 min	2.1, 5.8	None	1, 3	Students observe a teacher demonstration and then participate in the “Finding a Balance” activity using a ruler and balls of clay.
<i>Explain (Day 1)</i>	10 min	7.2	None	3, 1	Students discuss their results with the class. Students are shown the Center of Mass and how this affects orbits.
<i>Expand (Day 2)</i>	45 min	5.8	None	3	Students complete the Solar System Illustration activity.
<i>Evaluate (Day 3)</i>	45 min	7.2	None	1	Students share illustrations and write their essay on the results of their exploration in the AstroJournals. Rubrics are provided.

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

Develop descriptions, explanations, predictions, and models using evidence.
Communicate scientific procedures and explanations.



National Science Education Standards – Earth Science

Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion 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#7 – Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
- Gr. 8, Inquiry GLE#14 – Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
- Gr. 8, Inquiry GLE#22 – Use evidence and observations to explain and communicate the results of investigations (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)
- Gr. 8, GLE#39 – Relate Newton’s laws of gravity to the motions of celestial bodies and objects on Earth. (ESS-M-C3)

Materials List (per group)

- container of clay or play dough for each group
- rulers for each student
- scale (balance) or string (24") for each group
- computer with browser and Internet connection
- construction paper or butcher paper for each student
- 1 sheet of chart paper
- 2 Styrofoam balls (optional)
- 2 barbecue skewers (optional)
- Adhesive tape (optional)

Advance Preparation

1. Gather materials. See materials list.
2. Make copies of set of AstroJournal Lesson 8: The Solar System. (found on web site, p. 148)
3. Make copies of Solar System Illustration Activity. (found on web site, p. 149, 150)
4. A tennis (or other) ball with a string securely attached.
5. Overhead transparency of Center of Mass. (found on web site, p. 151)
6. Scientific Inquiry Evaluation Rubric. (found on web site)
7. Preview the links for Orrery sites.

NOTE: AstroJournal is simply a lab notebook. It does not have a specific form. It is a place for students to write up their procedure, observations and results.

Other Information

Learner Objective

The learner will...

- explain the solar system as a system.
- explain how gravity affects the solar system.
- explain how mass affects the solar system.

Prior Knowledge Needed by the Students

- Mass is the measure of the quantity of matter.
- Gravity is a force of attraction that exists between objects. The greater the mass the greater its gravitational pull. The smaller the distance between objects, the greater the gravitational pull.
- The Sun's gravitational pull holds Earth and other planets in orbit and the planets' gravitational pull keeps the planets' moons in orbits around them.
- Everything on or near the Earth is pulled towards Earth's center by gravitational force.
- Earth is one of several planets that orbit the sun.
- A system consists of many parts that usually influence each other.

Procedure

Day 1: Engage, Explore, and Explain sections

Engage

1. Use Engage section (p. 138) of the lesson plan. Review the concept of "system" with students. What are the parts of the solar system?

Explore

1. Use the Explore section (p. 139) of the lesson plan.
 - As a demonstration, swing a tethered ball around your head. How is this model like the solar system? How is it different?
 - Students engage in "Finding a Balance" activity (#3, p. 140) of lesson plan by balancing a ruler on their finger. Students will use balls of clay to balance their rulers and record their results.
 - Address misconceptions between mass and weight (if necessary).

Explain

1. Use the Explain section (p. 142) of the lesson plan.

- Have students share their finding with other in their group to see if they got similar results.
- Show students the Center of Mass overhead transparency.
- Optional—Show students a model of the wobble of the Sun. What does a wobble tell us about a star? (The star has a massive planet orbiting it, which is the cause of the wobble.)
- Students complete their AstroJournals about the day's activities.

Day 2: Extend/Apply section

Expand

1. Use the Extend section (p. 143) of the lesson plan.
 - Students model the Solar System.
 - Students complete the Results portion of their AstroJournals.

Day 3: Evaluate section

Evaluate

1. Use the Evaluate section of the lesson plan. Assessment can include the student's written work in Journal, Solar System Illustration, and Solar System Essay. Rubrics found on activity website.
 - Have students share their illustrations and explain to a partner or in a small group how the solar system has the characteristics of systems.
 - Have students do the Results section for the lesson in the AstroJournals.
 - Discuss students' essays.

Blackline Master

None (All handouts are located on website)

Supplementary Resources

A Simulation of the Solar System

<http://www.schoolsobservatory.org.uk/uninow/orrery/>

A "virtual" orrery (model) which will let you see where the planets are *today*, where they were in the *past*, and where they will be in the *future*.

The Orrery

<http://www.scienceu.com/observatory/handson/orr/orr.html>

A "virtual" orrery (model) which will let you see different images of the planets from different points in the solar system.