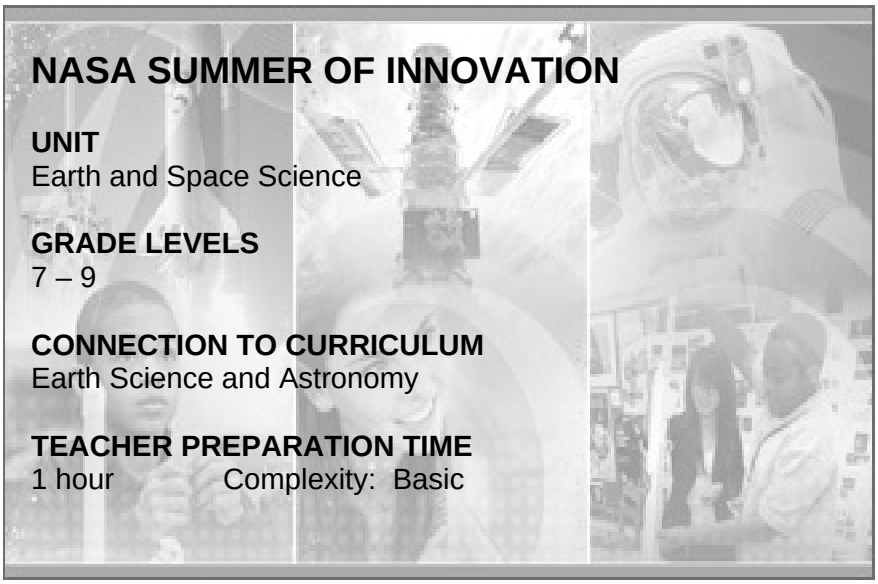
What Influences Planetary Weather?



LESSON DESCRIPTION
This lesson combines a series of activities to provide students with an understanding of the dynamics of weather on planets.

OBJECTIVES
Students will

- Create a simulation to model how the principles of the Coriolis Effect influence weather patterns on a planet with gaseous atmospheres.
- Research the characteristics of what makes a planet habitable by engaging in a Web-based interactive game.

NATIONAL STANDARDS

National Science Education Standards (NSTA)
Earth and Space Science

- Origin and evolution of the Earth system
- Structure of the Earth system
- Earth in the solar system

History and Nature of Science

- Science as a human endeavor

Common Core State Mathematics Standards (NCTM)
Ratios and Proportional Relationships

- Analyze proportional relationships and use them to solve real-world and mathematical problems

Expressions and Equations

- Understand the connections between proportional relationships, lines, and linear equations

U.S. National Geography Standards (NCGE)
The World in Spatial Terms

- How to use mental maps to organize information about people, places, and environments in a spatial context.

The ISTE NETS and Performance Indicators for Students
Creativity and Innovation

- Apply existing knowledge to generate new ideas, products, or processes

Critical Thinking, Problem Solving, and Decision Making

- Use multiple processes and diverse perspectives to explore alternative solutions

MANAGEMENT

These activities require that students work in groups of two or four to allow them to make observations. It is important to provide enough preparation time and supply each learning group the needed materials for these activities. Students are encouraged to work in pairs when using computers to do the Atmospheric, Geology, and Design a Planet activities.

CONTENT RESEARCH

All planets have weather. Some planets may not have a dynamic atmosphere of gases being driven by solar action, like Earth and Jupiter, but all will be under the influence of some kind of force, maybe direct solar or stellar heating, or even the extreme cold or energized matter comprising space weather.

VOCABULARY

Coriolis Effect—As it relates to weather, the rotational speed of a planet with a gaseous atmosphere that results in deflection of wind patterns depended upon the direction of the planet's rotation.
Life—Living organisms undergo metabolism, maintain homeostasis, possess a capacity to grow, respond to stimuli, reproduce, and through natural selection, adapt to their environment in successive generations.
Habitable—Capable of sustaining life.
Hospitable—Offering an environment for life.

MATERIALS

Coriolis Effect

- For each group of students a turntable that can be spun both ways, paper tape, 3 colored markers. A "Lazy Susan" can be substituted for a turntable.

Atmospheric, Geology, and Design a Planet

- Computers with Internet access

LESSON ACTIVITIES

Coriolis Effect. Demonstrate the true and apparent motions of objects as they move across the real Earth.
Planetary Geology Guide
Atmospheric, Geology, and Design a Planet—Explore what makes a world habitable. This interactive Web site allows students to determine what makes a planet habitable and hospitable for life.
http://astroventure.arc.nasa.gov/

RELATED RESOURCES

Solar System Lithograph Set—This picture set features images of all the planets, especially those with dynamic atmospheres such as Earth, Jupiter, and Saturn.
Lithograph Set

Atmosphere—Volcanoes on planets, especially on Earth can contribute to climate change. Learn how at
http://scifiles.larc.nasa.gov/text/kids/Problem_
Board/problems/light/sim3.html

NASA CORE (Central Operation of Resources for Educators) —Established in cooperation with Lorain County Joint Vocational School, serves as the worldwide distribution center for NASA-produced multimedia materials.

For a minimal charge, CORE will provide a valuable service to educators unable to visit one of the NASA Educator Resource Centers by making NASA educational materials available through its mail order service.
http://www.nasa.gov/offices/education/programs/national/core/about/
index.html

Studying Other Planet's Atmospheres—There are scientists that devote their careers studying the atmospheres of planets. Meet one person that does just that at the NASA Jet Propulsion Laboratory in Pasadena, California.
http://science.jpl.nasa.gov/people/Orton/

DISCUSSION QUESTIONS
Weather patterns are influenced by the direction of a planet's rotation, for example, either east to west, or a west to east direction. How would weather fronts move in different hemispheres on an Earth-like planet if the planet rotated opposite ours? HINT: Earth rotates on its axis west to east. *On our hypothetical Earth-like planet, rotating east to west, the weather patterns would be opposite ours in each hemisphere.*

Do stars, like our Sun show characteristics of the Coriolis Effect? *Yes, our Sun appears to show that part of the Sun rotates at different speeds, which may be depended in part upon the principles of the Coriolis Effect.*

ASSESSMENT ACTIVITIES
Students are to research gaseous atmospheres of planets in our solar system and compare them to Earth and then determine if any other planets have similar weather patterns.

ENRICHMENT
Invite a local television weather reporter to speak to students about weather and some influences besides the Coriolis Effect that can influence weather.

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