Endeavor STEM Teaching Certificate Project
Monica Sijder
September 22, 2020

Lesson Title: Choosing to live on Earth or Venus

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Topic: Students will learn about the similarities and differences between planets Earth and Venus. Students will create a situation on which they compare and contrast the two planets by creating a poster board of what life would be on the planet Venus vs the planet Earth.

Targeted Grade Level: 5th to 8th grade

Time Needed: Two weeks (45-minute slots)

Set-up: Students will work in groups of 3-4

Subject Integration: Science, Engineering, Social Studies, Technology

Justification: For this lesson, Science and Engineering are integrated by expanding on missions to Venus and exploring its surface and subsurface. Students also learn about the atmosphere on both planets. Students get to explore, discuss, and research why the planet Earth is livable and what life would be on a planet such as Venus.

Standards: MS-LS2-5, MS-ESS2-4, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ESS1-3, MSESS2-5

NGSS Performance Expectations

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MS-LS2-5- Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. **LS4.D: Biodiversity and Humans** • Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. *(secondary)* **ETS1.B: Developing Possible Solutions** • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. *(secondary)*	**Stability and Change** • Small changes in one part of a system might cause large changes in another part. **Connections to Engineering, Technology, and Applications of Science** **Influence of Science, Engineering, and Technology on Society and the Natural World** • The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. **Connections to Nature of Science** **Science Addresses Questions About the Natural and Material World** • Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.

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NGSS Performance Expectations

MS-ESS2-4- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe unobservable mechanisms.	**ESS2.C: The Roles of Water in Earth's Surface Processes** • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. • Global movements of water and its changes in form are propelled by sunlight and gravity.	**Energy and Matter** • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

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NGSS Performance Expectations

MS-ESS3-3- Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific principles to design an object, tool, process or system.	**ESS3.C: Human Impacts on Earth Systems** • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	**Cause and Effect** • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. **Connections to Engineering, Technology, and Applications of Science** **Influence of Science, Engineering, and Technology on Society and the Natural World** • The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

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NGSS Performance Expectations

MS-ETS1-1- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Asking Questions and Defining Problems Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)	**ETS1.A: Defining and Delimiting Engineering Problems** • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)	**Influence of Science, Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) • The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

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NGSS Performance Expectations

MS-ETS1-3- Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings.	**ETS1.B: Developing Possible Solutions** • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. **ETS1.C: Optimizing the Design Solution** • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design.	

NGSS Performance Expectations

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MS-ESS1-3- Analyze and interpret data to determine scale properties of objects in the solar system.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings.	**ESS1.B: Earth and the Solar System** • The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	**Scale, Proportion, and Quantity** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. - ***Connections to Engineering,Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.

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NGSS Performance Expectations

MS-ESS2-5- Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Planning and Carrying Out Investigations Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. • Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.	**ESS2.C: The Roles of Water in Earth's Surface Processes** • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. **ESS2.D: Weather and Climate** • Because these patterns are so complex, weather can only be predicted probabilistically.	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems.

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Measurable Student Learning Objectives:

Students will be able to:

- Compare and contrast between the two planets: Earth and Venus
- Explain and discuss information researched.
- Describe atmosphere, surface, sub surface, solar system.
- Practice their knowledge on collecting data, research, charts, write-ups, and comparing and contrasting.

Nature of STEM:

Nature of Science- Students are prompted to think about life on outside planet earth.

Nature of Technology- Students research and view technology NASA uses to explore space, and planets such as earth and science

Nature of Engineering- Students explore the role engineers have that b

Engaging Context/Phenomena:

Students are prompted to think about life here on Earth. They'd think about why earth is a planet that can host human beings, the atmosphere, food etc... Then they would look at Venus and compare and contrast the two planets and see if they can live on Venus, if so – they would have create a plan on how that would happen.

A NASA resource I would encourage students to view the following videos and readings:

https://www.nasa.gov/venus

https://www.forbes.com/sites/jamiecartereurope/2020/09/16/venus-nasas-63-minute-mission-to-find-phosphine/#16f0fcd95550

https://www.forbes.com/sites/brucedorminey/2020/02/14/nasa-greenlights-four-potential-missions-to-venus-io-and-triton/#5d32d1b53820

https://www.bing.com/videos/search?q=nasa+mission+to+venus&&view=detail&mid=B08BC5F7C4E10AF18034B08BC5F7C4E10AF18034&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dnasa%2Bmission%2Bto%2Bvenus%26FORM%3DHDRSC4

https://spaceplace.nasa.gov/all-about-venus/en/

https://spaceplace.nasa.gov/gallery-solar-system/en/

These videos and readings would allow them to review for their field trip to ARC.

Data Integration: As an extension, data could be used to discuss whether life on Venus is possible. Students grab to compare and contrast with earth.

Differentiation of Instruction: Students will be given links to videos and readings to guide their research.

Real-life Connection: Real life connection to this lesson plan is we depend on earth to provide us a home, but we also do not treat earth by protecting it from being destroyed. Students will look at the Venus to see if life on Venus is possible.

Possible Misconceptions: *Can't think of any…*

5E Model	5E Objectives
Engage *Introduce the lesson with an anchoring phenomenon. Facilitate student questions, discussion, etc. as*	• **Procedure:** Show photographs of solar system and point out Venus and Earth. https://spaceplace.nasa.gov/gallery-solar-system/en/ • Vocabulary to be covered: atmosphere, surface, sub surface, terrestrial, magnetic field, ionosphere, dense, sphere, storms, thunder, weather, forecast, layer, **Modifications:** Provide ppt. slides in order for students to preview the facility and engage them to

appropriate. Learn about what students already know and want to know.	what they will be learning about Venus and Earth **Standards Addressed:** MS-LS2-5; MS-ESS2-4 **Formative/Summative Assessments:** asking questions
Explore *Plan for students to engage in hands-on activities that are designed to facilitate conceptual change.*	**Procedure:** Students work in groups to research both planets (Earth and Venus). They compare and contrasts by reading and learning what each planet is composed of. They discuss why Earth is a planet in which we live in. they then compare their findings to Venus **Modifications:** Someone will guide the students with the research process by providing links and readings **Standards Addressed:** MS-ETS1-2; MS-ETS1-1; MS-ESS-3 **Formative/Summative Assessments:** Teacher allows for questions and a preview of what students have researched to allow them to stay on track **Resources:** internet, readings, poster board and materials,
Explain *Facilitate opportunities for students to explain their understanding of concepts and processes and make sense of new concepts.*	**Procedure:** Students are to discuss with their group why earth in ideal to live in and if it is possible for venus to inhabit humans. **Modifications:** *N/A* **Standards Addressed:** MS-ETS-1-2; MS-ETS1-1 **Formative/Summative Assessments:** Students complete the worksheet provided allowing them to evaluate their decisions **Resources:** Provided worksheet
Elaborate	

Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend understanding and skills.	**Procedure:** Students present their findings to their classmates and teacher. They give us an overview of what it is like to live on earth compared to what it would be like to live on Venus. **Modifications:** compare and contrast atmosphere, surface, temperatures, etc… **Standards Addressed:** MS-ETS1-1 **Formative/Summative Assessments:** They discuss how they've set up living arrangements on Venus. Do we live underground? due to the temperatures. **Resources:** NA
Evaluate *Assess students knowledge, skills and abilities.*	**Procedure:** Students discuss the similarities and differences between the 2 planets • Place in the solar system? • Characteristics of each planet. • Discuss in which missions Venus has been explored though NASA • What tools are being used to get information on planets **Modifications:** NA **Standards Addressed:** MS-ETS1-3 **Formative/Summative Assessments:** Through Discussion **Resources:** NA

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Group Name:

Student Names:

Articles used to do research and read about Earth and Venus:

Websites used to do research and read about Earth and Venus:

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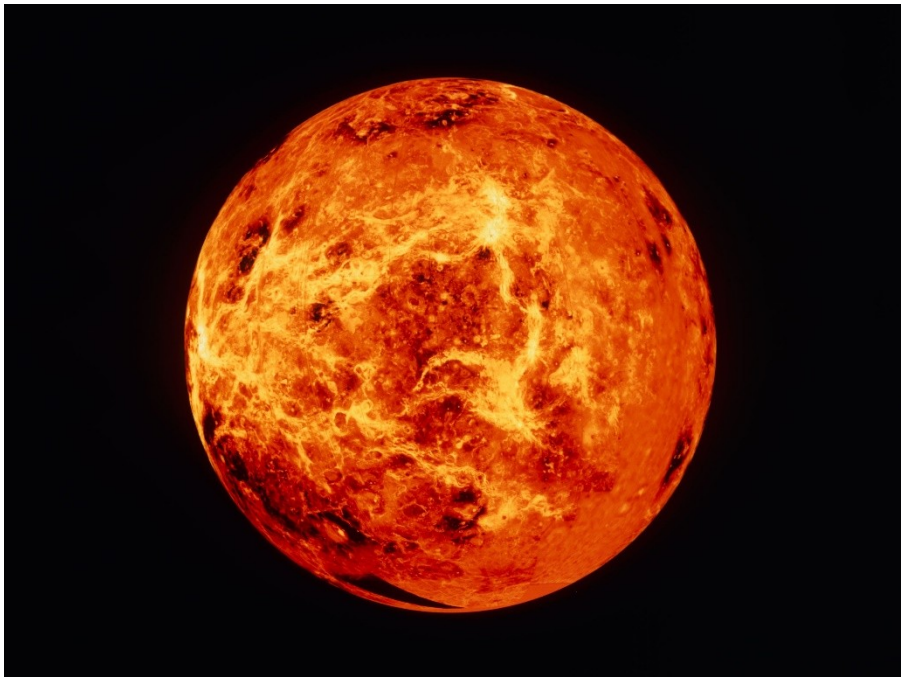

Compare a

https://www
F_The_Pla

https://www

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	Temperature	Atmosphere	Surface	Dense	Storms	Weather	layers
Venus							
Earth							

Venus							
Earth							

Data Collected: Compare and contrast.

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List three ways in which Venus and Earth are alike?

1.

2.

3.

List three way in which Venus and Earth are different?

1.

2.

3.

What makes Earth habitable?

What makes Venus habitable or inhabitable?

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Describe what life is like on earth? Include what the city looks like, food, people.

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Describe what life is like on venus? Include what the city looks like, food, people.