

NGSS 5E Lesson Plan

Grade/ Grade Band: 10-12	Topic: How does space affect living organisms?	Lesson # 1 in a series of 1 lessons
Brief Lesson Description: Students will investigate if there is any change to living organisms when they are exposed to space		
<p>Performance Expectation(s):</p> <p>HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis</p> <p>HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.</p> <p>HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.</p>		
<p>Specific Learning Outcomes:</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● create and conduct an investigation ● investigate the effect space has on living organisms ● effectively communicate the results of their investigation verbally and in writing ● create an argument in support of, or against to humans going into space ● investigate and interpret data from NASA’s lifetime surveillance of astronaut health website 		
Narrative / Background Information		
<p>Prior Student Knowledge:</p> <ul style="list-style-type: none"> ● Photosynthesis ● General Characteristics of Space ● Genetics of Identical Twins ● Characteristics of Life 		
<p><u>Science & Engineering Practices:</u></p> <p>Planning and Carrying out Investigations: Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of</p>	<p><u>Disciplinary Core Ideas:</u></p> <p>LS1.A: Structure and Function</p> <p>Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions</p>	<p><u>Crosscutting Concepts:</u></p> <p>Stability and Change</p> <p>Feedback (negative or positive) can stabilize or destabilize a system.</p> <p>Systems and System Models</p>

<p>data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.</p> <p>Developing and Using Models: Use a model based on evidence to illustrate the relationships between systems or between components of a system.</p>	<p>change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.</p> <p>LS1.B: Growth and Development of Organisms</p> <p>In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.</p> <p>LS1.C: Organization for Matter and Energy Flow in Organisms</p> <p>The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.</p>	<p>Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.</p> <p>Energy and Matter</p> <p>Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.</p>
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LESSON PLAN – 5-E Model

ENGAGE:

Video of NASA twins study: <https://www.youtube.com/watch?v=EFYRDSiSXzc>

Watch up to about 3:20 and then stop for discussion.

Do students think that there will be a change in Scott Kelly after his year in space? Why or why not? Justify reasoning based on knowledge of the characteristics of space vs. earth.

EXPLORE:

Students will create an investigation using space-exposed seeds and seeds not exposed to space. Seeds of the same species, will be put under the same conditions and observations will be made in the growth of each seed set for differences and commonalities. Students will be able to choose their specific conditions, and will get their investigation checked off by the teacher. Teacher will ensure that the investigation and parameters set are reasonable and feasible for the environment and supplies that are provided. This investigation will take place over an extended period of time, approximately 4-6 weeks. Students will record observations over this time, at the intervals that they have chosen.

EXPLAIN:

Students will research, and then discuss the characteristics of life, essentials for survival, and the differences in conditions on Earth versus space as a class. Students will make predictions on the results of the NASA twin experiment using evidence from their research, the lab they conducted and their knowledge of relevant information.

Watch remainder of video after lab is completed to summarize the results of the NASA twin experiment. Have students compare and contrast the twin experiment with the lab they created.

ELABORATE:

Applications and Extensions:

Class Discussion: How can the results of the NASA twin study and our plants be used to support life during space travel?

Have students view other data taken from astronauts in space via NASA lifetime surveillance of astronaut health website (https://lsda.jsc.nasa.gov/LSAH/LSAH_Home) Students will review their choice of human research program evidence summaries that relate to human health.

What does the executive summary show us regarding the impact of space travel on the human body, and why is this important?

Have students reflect on whether the impact on the human body in space is worth the information it provides and why, citing evidence from reputable sources.

Students may complete their summary and reflection in writing, as a Flipgrid video, or verbal presentation to the class.

EVALUATE:

Formative Monitoring: questioning, discussion, progress checks, lab notebook checks

Summative Assessment: Effects of space on living organisms lab report, executive summary evidence and reflection

Materials Required for This Lesson/Activity

Quantity	Description	Potential Supplier (item #)	Estimated Price
32	iPads, chromebook or laptop	class set provided by school	
32	Lab notebook	office supply store	
32	pen	office supply store	
5 packs	space-exposed seeds	parkseed.com	
5 packs	seeds not exposed to space	parkseed.com	
25 qt bag	soil	home depot	
16	pots	home depot	
4	grow light	amazon	
varies	water	tap or distilled	

Resources

<https://www.nasa.gov/hhp/human-systems-academy>

<https://lsda.jsc.nasa.gov/>