

Introduction to Science Research
UNIT 4: Science Research in Space

Science Research in Space		
<p>NGSS Performance Expectation(s):</p> <ul style="list-style-type: none"> • HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. • HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. • HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. • HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* 	<p><i>Students will be able to independently use their learning to...</i></p> <p>Goals: <i>Upon completion of this unit students will</i></p> <ul style="list-style-type: none"> • understand the role of the International Space Station in astronomy • communicate the manner in which the ISS was constructed • explain one or more current research goals aboard the ISS 	<p>Lessons</p> <ol style="list-style-type: none"> 1. The International Space Station ISS 2. Environmental Conditions and Engineering ISS 3. Future of the ISS: Sustainable living for Astronauts <p>Adaptations for all Lessons:</p> <ul style="list-style-type: none"> • All materials will be translated into Spanish for ELL • Videos will be close-captioned for those with hearing impairments • Google Docs can be magnified according to the users requirements for visual impairments

Lesson 1: What is That Thing? The International Space Station

<p>Phenomena Description(s): NASAs Video of the Assembly of the ISS</p>	<p>Students will</p> <ul style="list-style-type: none"> -observe the phenomena -ask questions about the phenomena and choose in small groups which question to present to the class. -questions will be written on the shared JamBoard for further explanation. <p>Students will choose from the following resources to answer their exploration questions</p> <p>NASA Reading NASA: What is the ISS Video</p> <p>Students will present the answer to the exploration to the class using images, videos and graphics.</p>	<p>Anticipated Initial Exploration Questions:</p> <ul style="list-style-type: none"> • <i>Some potential questions students might propose:</i> • <i>What are they building?</i> • <i>What does it do?</i> • <i>Do people live there?</i> <p>Anticipated Deeper Understanding Exploration Questions:</p> <ul style="list-style-type: none"> • <i>What do they do for nutrition?</i> • <i>What kinds of research projects are they currently exploring?</i> • <i>What is life like on the ISS? How do they eat/sleep/toilet?</i> • <i>What is the average stay for a scientist at the ISS?</i>
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Students will then devise in 2-3 person groups a follow up deeper understanding exploration questions, ensuring each group has a unique question. (See anticipated questions in the column to the right). Students will research the answers to these questions using the following resources and make a shared Google Slide show which will be presented to the class.

- [Tour through ISS](#)
- [The history of Space Stations](#)
- [A Day in the Life Aboard the ISS](#)

Acquisition
Students will know... Students will be skilled at...

Disciplinary Core Ideas (DCIs):

- LS4.C: Adaptation

Science & Engineering Practices (SEPs):

- Asking Questions and Defining Problems
- Obtaining, Evaluating, and Communicating Information
- Constructing Explanations and Designing Solutions

Crosscutting Concepts (CCCs):

- Stability and Change
- Systems and System Models

Lesson 2: Environmental Conditions and Engineering About the ISS

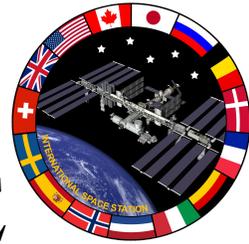
<p>Phenomena Description(s): Water on the ISS (Start at 1:44 and play without sound)</p>	<p>Students will : -Observe the phenomena “Water on the ISS” -Brain storm what is happening using a shared list at the front of the class</p> <p>Besides gravity (as shown in the video) what other environmental conditions might be different on the ISS? Students may propose: Gravity Temperature Pressure Humidity</p> <p>Engineering and Design: Students will choose one potential issue in adapting humans to life on the ISS and design an engineering solution to solve it.</p> <p>Students will use CANVA to create an infographic that defines the problem and create a model that will describe their engineering design.</p>	<p>Anticipated Engineering and Design Exploration Questions:</p> <ul style="list-style-type: none"> • How do the astronauts drink water? • Is there any gravity on the ISS? • What other environmental parameters did engineers have to consider when designing the ISS?
<p><i>Acquisition</i> <i>Students will know... Students will be skilled at...</i></p>		
<p>Disciplinary Core Ideas (DCIs):</p> <ul style="list-style-type: none"> • LS4.C: Adaptation 	<p>Science & Engineering Practices (SEPs):</p> <ul style="list-style-type: none"> • Asking Questions and Defining Problems • Obtaining, Evaluating, and Communicating Information • Constructing Explanations and Designing Solutions 	<p>Crosscutting Concepts (CCCs):</p> <ul style="list-style-type: none"> • Stability and Change • Systems and System Models

Lesson 3: Growing Food on the ISS

<p>Phenomena Description(s):</p> <p>Why is it important to study plant growth in space? (I think I can find something better than this)</p>	<p>Students will :</p> <ul style="list-style-type: none"> ● Observe the phenomena “Why is it important to study Plants” ● Complete the Pre-Lab Questions (Linked below) ● Students will be divided into two groups and sow their tomatosphere seeds. ● Make Observations of Germination Rates every two days after sowing ● Methods, Data Collection and Pre-Lab Questions ● Student will continue upon emergency of 8 leaves with assessing nutrient levels in the tomato plants. 	<p>Anticipated Engineering and Design Exploration Questions:</p> <ul style="list-style-type: none"> ● How do the astronauts drink water? ● Is there any gravity on the ISS? ● What other environmental parameters did engineers have to consider when designing the ISS? ● Are tomato plants that have been to the ISS as healthy as those that have spent their life on earth?
<p><i>Acquisition</i> <i>Students will know... Students will be skilled at...</i></p>		
<p>Disciplinary Core Ideas (DCIs):</p> <ul style="list-style-type: none"> ● LS4.C: Adaptation 	<p>Science & Engineering Practices SEPs):</p> <ul style="list-style-type: none"> ● Asking Questions and Defining Problems ● Obtaining, Evaluating, and Communicating Information ● Constructing Explanations and Designing Solutions 	<p>Crosscutting Concepts (CCCs):</p> <ul style="list-style-type: none"> ● Stability and Change ● Systems and System Models



TOMATOSPHERE



Germination and Nutrient Analysis

Name:

For this project, each group will be given tomato seeds. Some of the groups will receive seeds that have stayed on earth. Some groups will receive seeds that have spent 100 days on the International Space Station. You will not find out which seeds you have until later in the year.

Class (Period/A or B)

Group Members:

Letter written on your Seed Packet: V or W

Research and Seed Planting

Research (Use Google). Complete sentences

1. Define Germination:

2. What are signs of germination?

3. What do tomato seeds require to germinate?

4. What is the international space station (ISS)?

5. How would you expect environmental conditions (temperature, pressure, gas levels, etc) in the ISS would compare to earth?

Research Question: How do the environmental conditions of the International Space Station (ISS) affect the germination rate of tomato seeds?

Hypothesis:

Procedure:

1. Plant your seeds according to the teachers instructions (this will vary by class)
2. Water with _____ mL of tap water.
3. Place on the lab bench
4. Observe daily and record data in the table below.

Date and Time that you planted the seeds:

How many seeds did you plant?

In this first experiment, we want to determine the average germination time for your seeds. We will do this by recording the number of seeds that have germinated

each day. Remember you will be only checking your seeds every-other day. Replace the word “Date” With the dates you’ll be checking on your seeds.

Date				
A. Total Number of Seeds Planted				
B. Number of Seeds Germinated				
% Seeds Germinated $(B/A)*100$				

Add your Data to the shared spreadsheet when instructed

Part II

Macronutrients:

Growing plants for food about the ISS for the purposed of nutrition and sustenance, botanists and nutritionists must be able to determine if food will maintain the same nutritional qualities as earth-bound food.

In this section of the lab, you will test the tomatosphere plants for the presence of Nitrogen, Phosphorous and Potassium.

Pre-Experimentation Questions

1. Why are Nitrogen and Phosphorus (N, P) important to test for in food?
(Think about the macromolecules that they may be found in).

2. Why bodily processes are nitrogen and phosphorous important for?

3. Why is Potassium (K) important in the body?

4. Why is it important to ensure that food grown on the ISS has sufficient levels of N,P and K?

Experimental Procedure:

1. Remove 3 leaves from your tomato plant
2. Using the manufacturers instructions, macerate the plant tissue and combine with the appropriate chemical tablet.
3. Compare the color of the solution to the bar on the side of the indicator.

Record your Results Here and on the Shared Google Spreadsheet

Packet of Seeds (Circle one): V or W

Date	Nitrogen (N) Concentration	Phosphorous (P) Concentration	Potassium (K) Concentration

Data Analysis:

Using the data on the Shared Google Spreadsheet and DataClassroom compare the data for germination rates and nutrient levels of seed Groups V and W.

For each comparison:

1. Create a box and whisker plot
2. Calculate the p-value between the two groups.
3. Paste the graph and statistics below.

Graph/Stats for Germination Rate:



What does this graph show?

Graph/Stats for Nitrogen:



What does this graph show?

Graph/Stats for Phosphorous:



What does this graph show?

Graph/Stats for Potassium:

What does this graph show?

Conclusion/Discussion

Write three well developed paragraphs for the conclusion and discussion. Be sure to include the following information:

What is the purpose of this study

What did you do?

What did you find?

What else do you want to know?

