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Snoopy Snacks! (Growing Food in Space)

GRADE K – 5
PAGE 1

OBJECTIVES

Students will:

- Read *Snoopy, First Beagle on the Moon!* and *Shoot for the Moon, Snoopy!* to give students some background knowledge.
- Explore the process of photosynthesis, including the parts of the plant that are essential to this process.
- Learn about hydroponics, and its importance to long-duration space travel.
- Build a hydroponic germinator.

SUGGESTED GRADE LEVELS

K – 5

SUBJECT AREAS

Life Science & Engineering Design

TIMELINE

60 minutes

NEXT GENERATION SCIENCE STANDARDS

- K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.
- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- 1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
- 2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.
- 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-5-ETS.1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

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- 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

21st CENTURY ESSENTIAL SKILLS

Critical Thinking/Problem Solving, Collaboration and Teamwork, Communication, Leadership, Initiative, Social Skills, Constructing Explanations, Obtaining/Evaluating/Communicating Ideas

BACKGROUND

- NASA has proudly shared an association with Charles M. Schulz and his American icon Snoopy since Apollo missions began in the 1960s. Schulz created comic strips depicting Snoopy on the Moon, capturing public excitement about America's achievements in space. In May 1969, Apollo 10 astronauts traveled to the Moon for a final trial run before the lunar landings took place on later missions. Because that mission required the lunar module to skim within 50,000 feet of the Moon's surface and "snoop around" to determine the landing site for Apollo 11, the crew named the lunar module Snoopy. The command module was named Charlie Brown, Snoopy's loyal owner.
- These books are a united effort between Peanuts Worldwide, NASA and Simon & Schuster to generate interest in space among today's younger children.
- The search for life beyond planet Earth dates back to the beginning of human existence when early man gazed at the stars and wondered, "What if?" This innate human drive to push beyond what's possible has led to discoveries beyond our wildest imagination. In 2012, the Curiosity rover discovered historical evidence that water once existed on the surface of Mars. Recently, huge reservoirs containing water ice have been discovered at the lunar polar ice caps of the Moon, renewing the search for life in space and providing a sense of urgency. As we look back at the first step on the Moon, taken by Neil Armstrong on July 20th, 1969, we must continue forward . . . taking giant leaps towards our next great mission, to go "back to the Moon and on to Mars!"
- With the initial preparations already underway to send astronauts beyond low-Earth orbit for the first time in over 50 years, the need for water and food in order to sustain life has presented us with new challenges. Water ice is critical for human survival on the Moon, providing both drinking water and the water required for growing food. The cost of sending one, 16-oz. bottle of water to the International Space Station (ISS), which is equivalent to one pound, is estimated to cost anywhere from $9,100 up to $43,180. Just imagine how many pounds of FOOD it

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would take to feed a crew of 4-6 astronauts for 6 months or MORE! With the increased demands to sustain life for missions to the Moon, Mars, and BEYOND, potentially lasting for years, this astronomical cost is simply beyond NASA's current budgetary constraints.

- Therefore, most of the food these astronauts will eat must be grown on the Moon once they arrive. However, growing food on the Moon will be difficult. Since there is only a trace atmosphere on the Moon, and the temperatures vary from 250°F to -410°F, plants will need to be grown in a human-engineered environment like a greenhouse. Even if those other issues could be solved, the soil on the Moon does not have the right nutrients to grow food . . . and the cost of sending nutrient-rich soil on a rocket to the Moon would be just as expensive as sending food that has already been grown.
- Enter hydroponics. This method of growing plants dates back to the ancient Babylonians and the Aztecs, and is currently being used by people both on Earth and on the ISS. Instead of putting seeds in soil, those seeds are suspended above a water-filled container, eventually growing into food!
- As an added bonus, growing crops on the Moon will help provide oxygen gas as a by-product of photosynthesis, the process by which plants use carbon dioxide, sunlight, and water to create food for the plant (glucose) . . . releasing life-giving oxygen along the way.

VOCABULARY

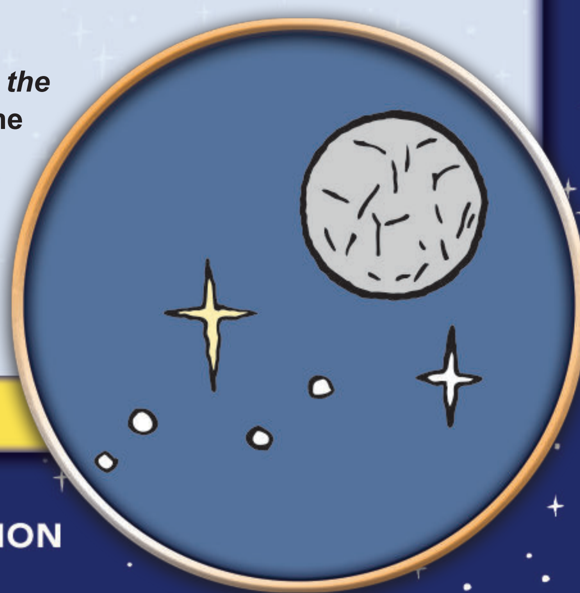
Carbon Dioxide, Hydroponics, Microgravity, Oxygen, Photosynthesis

MATERIALS

- 2-liter soda bottle, clean and empty, cut in half approximately 1 inch below the point where the curved part of the bottle straightens into the sides of the bottle (older students can assist in this process with adult supervision, using a utility knife or scissors) – 1 per group
- Fast-growing seeds (radishes or squash work best) – 1 packet per group
- Paper towels – 1 roll per group
- Water – 1 liter per group

LESSON PROCEDURES

1. Read *Snoopy, First Beagle on the Moon!* and *Shoot for the Moon, Snoopy!* to the entire class to give students some background knowledge.
2. Create an anchor chart with your students, explaining and labeling the different parts of a plant.
   a. Roots
   b. Stems
   c. Leaves



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3. Explain photosynthesis to your students, the process by which plants use carbon dioxide, sunlight, and water to make food for the plant. Oxygen, being a byproduct of photosynthesis, is released back into the atmosphere.
   a. Add a diagram to the plant anchor chart in order to provide a visual depiction of the process of photosynthesis for students.
   b. This explanation can be scaled up or down, depending on the age and ability level of your students.
4. Explain hydroponics to students, and why it is essential to long-term space travel.
   a. Hydroponics allows people to grow food without soil, which is important because the soil on the Moon is not like the soil here on Earth.
5. Organize students into groups of 2 or 3.
6. Hand out supplies to each group: a 2-liter soda bottle (already cut), a packet of seeds, a roll of paper towels, and 1 liter of water.
7. Fill the bottom of the 2-liter soda bottle approximately 2/3 full of water, which should be equivalent to 1 liter of water.
8. Turn the top section of the 2-liter soda bottle upside down, with the mouth of the bottle pointing down.
9. Lay a wet paper towel in the top section of the 2-liter soda bottle to create a bed for the seeds.
10. Place the seeds from the packet on the wet paper towel.
11. Cover those seeds with another wet paper towel.
12. Roll a third paper towel, and insert it into the mouth of the bottle from underneath. The paper towel should be hanging down approximately 6 inches from the bottle, and must also be touching the covered seeds.
13. Insert the top section of the bottle into the bottom section of the bottle, again with the mouth of the bottle pointed down. The rolled paper towel should be hanging low enough to touch the water in the bottom section of the bottle.
14. The water will be pulled up through the rolled paper towel and into the bed of seeds.
15. Place the hydroponic germinator in sunlight.
16. Explain that the seeds should sprout after a few days. Once this happens, remove the top paper towel so the seedlings can receive sunlight.
17. Record observations.

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EXTENSIONS

- Discuss how hydroponics would work in different biomes here on Earth (desert, rain forest, and the tundra). Compare and contrast that information with the environment on the Moon in order to determine if there are any similarities that might unlock clues to hydroponics in lunar gravity.
- Explain zeoponics to students, which involves the growing of plants in soil infused with nutrients. Discuss the benefits of both hydroponics and zeoponics. Where on Earth and/or the Moon would these types of processes be used and why?
- Repeat the steps above, this time using a soil-only germinator, zeolite/soil germinator, and a hydroponic germinator, and then compare the results.
- Measure the growth of plants grown under different types of light, and then compare the results. (red, green, blue)

RESOURCES

Dunbar, B. Growing Plants and Vegetables in a Space Garden. Retrieved from https://www.nasa.gov/mission_pages/station/research/10-074.html

Garcia, M. (2018, July 9). NASA and Peanuts Celebrate Apollo 10’s 50th Anniversary. Retrieved from https://www.nasa.gov/feature/nasa-and-peanuts-celebrate-apollo-10-s-50th-anniversary

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