GROWING WHEAT ON MARS

Kansas College and Career Readiness Standards

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

3-5-ETS1- 3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

3-5-ETS1- 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.

Subjects
Science

Grade Level
5th Grade

Time Required
3-4 weeks, one activity per week

Overview

Students will support an argument that plants get materials they need for growth chiefly from air and water and engineering a way to grow wheat without soil.

Lesson 1

Materials

Lesson 1 - Per Student

- 2” x 3” resealable plastic bags with hole punched in the top
- 1 cotton ball soaked in water
- Water
- Measuring spoons
- Yarn (thick, fuzzy yarn to prevent tangling)

Engage

To test the hypothesis that seeds need nutrients in soil to grow, students will complete the Wheat Germination Necklace lesson plan. Omit Activity 3 from the Wheat Germination lesson plan. Do not plant the seeds in soil.

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Lesson 2

Objective

Students will attempt to grow wheat in three types of water observing the pH level and growth over 5 days. Then students will compare the growth of the wheat in the three types of water on a data table including the pH levels. The purpose of this lesson is to show that seeds will not sprout in water with high pH levels. Students' plants will not develop beyond sprouting without additional fertilizers.

Materials

- Growing Wheat on Mars PowerPoint

Per Group –

- 3 water bottles 16.9 oz. or larger, cut in half so that the top of the bottle when turned upside down will sit inside the bottom of the bottle
- 12 cotton balls, four for each bottle
- 15 wheat seeds, 5 per bottle
- 8 oz. of tap water, set out for at least 24 hours to dispel chlorine 8 oz. of distilled water
- 8 oz. of seltzer water
- Water pH testing device (i.e. Vernier probe or other digital device)
- 3 pieces of cotton fabric to act as wicks for the water to reach from bottom to cotton ball cut fabric; 1 inch by 4 inches

Preparation

1. Collect empty water bottles. Enough for three bottles per student and three for the teacher to demonstrate.
2. Purchase distilled and seltzer water. One eight oz. can of each per student.
3. Set out two gallons of tap water in an open container at least 24 hours prior to the lesson.

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Explore

Display the following steps using the Growing Wheat on Mars PowerPoint

1. Cut the water bottle in half and place the top half upside down inside the bottom half. Repeat with all three bottles.

2. Pour tap water that has set out for at least 24 hours, to dispel the chlorine, into bottle number one until the bottom is approximately ⅓ full. Label the bottle – "Tap Water"

3. Pour distilled water into bottle number two until the bottom is approximately ⅓ full. Label the bottle – "Distilled Water"

4. Pour seltzer water into bottle number three until the bottom is approximately ⅓ full. Label the bottle – "Seltzer Water"

5. Dip pH tester into the tap water and record pH level according to digital readout. Repeat with distilled and seltzer water. Record pH levels on your data sheet.

6. Record predictions of which water type will yield the best results for sprouting wheat on the observation page.

7. Place a piece of cotton fabric in each bottle neck, threading it through the spout so that it lies inside the bottom of the bottle with the water. Fill the top of the bottle with four cotton balls to secure the fabric and provide a place for the seeds to rest.

8. Plant 5 wheat seeds in each bottle top by placing the seeds on top of the cotton balls.

9. Place bottles in an area with equal sunlight and temperature conditions. Students record current observations on their personal observation page.

10. For 5 days, have students record any changes to their bottles on their personal observation pages. On day 5, have students complete the group recording sheet and share their findings with one another or another class.

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Lesson 3

Objective

Students will understand that plants need different elements to grow. Nutrients are needed for a plant to survive and without nutrients, the plant would not be able to live. Students will make a bracelet to represent the elements and nutrients the plant needs to survive.

Materials

- Nourishing the Planet Curriculum flashcards from Nutrients for Life

Per Student –

- 1 green pipe cleaner
- 1 pony bead of each color: blue, clear, green, yellow, purple, and orange

Explain

By this time, students should understand that plants do not need soil to grow, but that they do need certain essential elements in order to grow. Explain that one of the essential elements for a plant to grow is nutrients. Just like people need vitamins to develop, plants need nutrients too. Tell students that they are going to build a model of what nutrients plants need to grow.

1. Pass out one green pipe cleaner or a 7 inch piece of ribbon to each student and tell them that this represents a healthy plant. As they receive a bead, add it to their pipe cleaner to represent the nutrients and conditions it needs to stay healthy.

2. Pass out one blue bead per student and tell them that this represents the essential nutrient water. Water is reliable carrier of nutrients for plants. Often, we add nutrients to the water to help the plant develop.

3. Pass out one clear bead per student and tell them that this represents the air plants need. Clean air is important for a plant's development because unclear air can contain harmful levels of pollutants.

4. Pass out one orange bead per student and tell them that this represents the sun. Plants need energy from the sun to complete photosynthesis.

5. Pass out one green bead per student and tell them that this represents nitrogen. Nitrogen helps the plant create chlorophyll, an essential part of photosynthesis.

6. Pass out one yellow bead per student and tell them that this represents phosphorus. Phosphorus helps the plant capture the sun's energy.

7. Pass out one purple bead per student and tell them that this represents potassium. Potassium has many jobs, including helping the plants flower.

*Adapted from Nutrients for Life NPK Bracelet Lesson

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Lesson 4

Student Engineering Challenge

A young scientist is seeking a way to easily grow plants on Mars and she has come to your engineering firm to help create this system. Using the information you have gathered about what is essential for plants to grow, construct a cost effective, easily transportable, efficient hydroponic growing system to grow wheat on Mars.

Preparation

Collect empty water bottles, yogurt containers, paper towel tubes, straws, 5 gallon buckets and small plastic containers for students to construct their hydroponic systems.

Evaluate

Students will engineer a system to grow wheat without soil. This is an open-ended lesson where students will need to develop a system to grow wheat using the background information from lessons 1-3. Students will follow the engineering process to create their system. (Engineering plan is attached.) Students should be given the rubric to guide their plans and allow for grading.