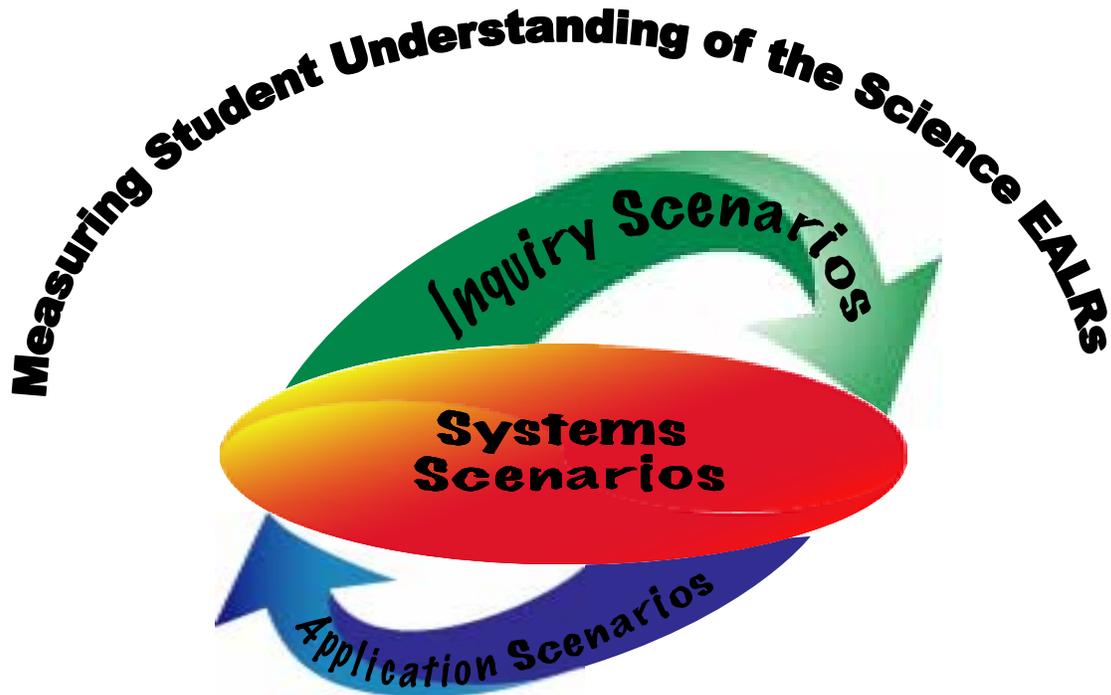


# Powerful Classroom Assessment

## School Garden

### Sample Grade 8 Application Scenario



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### School Garden

**Directions:** Use the following information to answer questions 1 through 10 on pages 4 through 11.

The school garden produced only 13 kilograms (kg) of vegetables from tomato plants, lettuce plants, green bean plants and green pepper plants. The students wanted to redesign the garden the next year to increase the amount of vegetables produced by the plants. The students documented the stages of their design process as follows.

**Problem:** Increase the production of the garden to 26 kg of vegetables.

**Gather Information:** Research the light energy, water, and mineral nutrient needs of plants. Test the garden soil for mineral nutrients and compare to ideal soil. Results of the research are in the table below.

Mineral Nutrients in Soils

Mineral Nutrients	Ideal Soil (ppm)*	Garden Soil (ppm)*
Nitrates	80-150	50
Phosphorous	6-12	4
Potassium	120-200	98.5

\*ppm is a measurement of the amount of a substance present in a sample.

**Explore Ideas:**

- ✓ Water the garden at different times of the day to prevent disease on the plants.
- ✓ Change the amount of sunlight reaching the garden by shading part of the garden.
- ✓ Add *fertilizer* (chemical compounds) or *organic compost* (decomposed plant material) to the soil.
- ✓ Loosen the soil with a shovel.



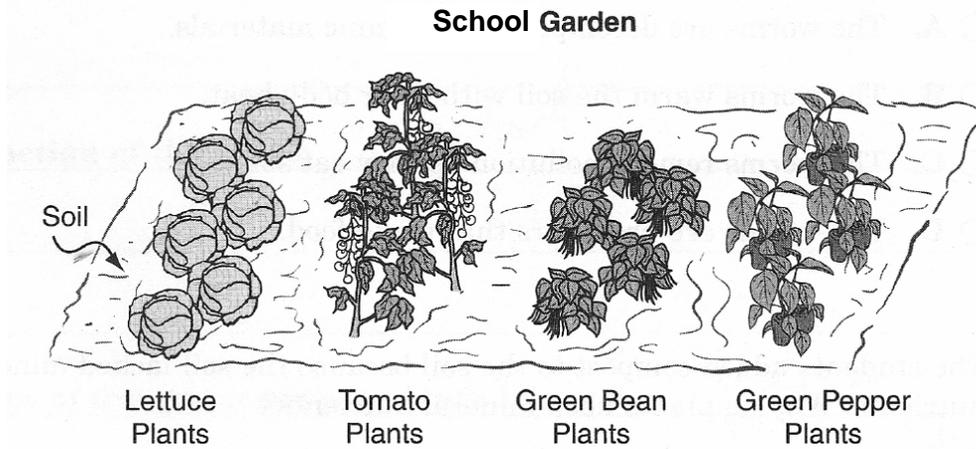
**School Garden, a Middle School Powerful Classroom Assessment (PCA)**

**Plan Summary:** Add *organic compost* to increase the mineral nutrient levels of the garden soil.

**Steps to Do the Plan:**

1. Remove all of last year's plants and weeds from the garden.
2. Add one bag (3 cubic feet) of *organic compost* to the garden soil. Mix the *organic compost* into the soil.
3. Plant the garden with the same type and number of plants as last year.
4. Water the garden in the morning every day.
5. Weed the garden every week.

**Diagram of Solution:**



**Test Solution:** Record observations of the plants in a notebook. Measure and record the mass of the vegetables harvested.

**Test Results:**

**Summary of Observations**

<b>Lettuce plants</b>	Two of the six lettuce plants produced few leaves.
<b>Tomato plants</b>	Plant in the middle did not produce as many tomatoes as the other two plants.
<b>Green bean plants</b>	Grew very quickly and produced lots of green beans.
<b>Green pepper plants</b>	Grew more slowly than the other plants. Had more beetles eating the leaves than the other plants.
<b>Total mass of vegetables</b>	18 kg



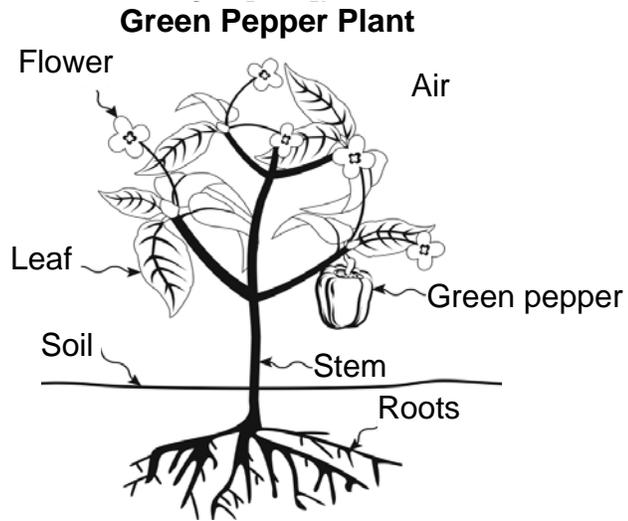
## School Garden, a Middle School Powerful Classroom Assessment (PCA)

- 1 The students added *organic compost* to the garden in order to increase the mineral nutrients in the soil. Why did this solution increase the garden's production?
- A. Mineral nutrients are used by plants to make food.
  - B. Mineral nutrients keep predators away from leaves.
  - C. Mineral nutrients are a source of energy for the roots.
  - D. Mineral nutrients increase the amount of water in the soil.
- 2 What type of energy do plants obtain **directly** from the Sun?
- A. Potential energy
  - B. Chemical energy
  - C. Light energy
  - D. Heat energy



**School Garden, a Middle School Powerful Classroom Assessment (PCA)**

- 3** Describe the steps in the life cycle of the green pepper plant shown below. Begin with a seed and end with a green pepper on the new plant.



Use words, labeled pictures, and/or labeled diagrams in your answer.

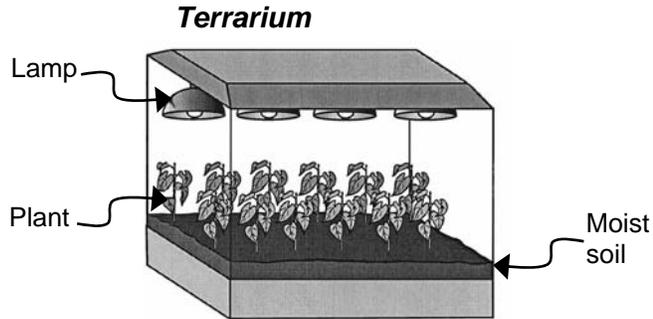

**School Garden, a Middle School Powerful Classroom Assessment (PCA)**

- 4** Green pepper plants and tomato plants are closely related. Which characteristic of both plants **best** shows that these two plants are closely related?
- A. Both plants obtain carbon dioxide from air.
  - B. Both plants produce seeds inside a fruit.
  - C. Both plants obtain water from the soil.
  - D. Both plants are eaten by animals.
- 5** The students tested the solution by finding the total mass of the vegetables harvested. What is another way to scientifically test whether the compost was an effective way to increase the production of the garden?
- A. Survey other students about the taste of the vegetables.
  - B. Write down the types of insects found on the plants.
  - C. Count the number of birds eating in the garden.
  - D. Record the heights of the plants for both years.



**School Garden, a Middle School Powerful Classroom Assessment (PCA)**

- 6** One of the students investigated the effect of using *fertilizer* to add mineral nutrients instead of *organic compost* for her science project. She used a *terrarium* (a covered glass box) containing moist soil and plants as a model of the school garden, shown in the diagram.



Explain **two** disadvantages of using a *terrarium* as a model of the school garden.

In your description, be sure to:

- Identify two ways the *terrarium* is different than a real garden.
- Describe **how** each difference affects the plants in a *terrarium*.

Use words, labeled pictures and/or labeled diagrams in your answer.

<b>One difference:</b>
<b>Another difference:</b>

**School Garden, a Middle School Powerful Classroom Assessment (PCA)**

- 7** What is the role of green bean plants in the ecosystem?
- A. Producer, because green bean plants make their own food
  - B. Producer, because green bean plants provide food for animals
  - C. Consumer, because green bean plants use minerals in the soil
  - D. Consumer, because green bean plant seeds form inside a seed pod
- 8** Besides water, what is the main source of the mass of a plant?
- A. Mineral nutrients
  - B. Carbon dioxide
  - C. Sunlight
  - D. Oxygen



**School Garden, a Middle School Powerful Classroom Assessment (PCA)**

- 9** Which human body system performs some of the same functions as the stem of a plant?
- A. Nervous
  - B. Digestive
  - C. Skeletal
  - D. Reproductive



**School Garden, a Middle School Powerful Classroom Assessment (PCA)**

**10** The students have a new problem. Although the correct amount of water was being added to the garden, puddles formed and remained for most of the day each time the garden was watered. They want to redesign next year’s garden so that the puddles will not form.

Describe how you would scientifically design a solution to this problem. You may use some or all of the materials listed below.

**Use any tools and only these additional materials:** Sand, clay, gravel, *fertilizer, organic compost*, wooden boards, plastic sheeting, nails, hammer, shovel, stepping stones.

Be sure to describe the following stages of your design process:

- **Gather Information:** Describe the information needed and how to collect that information.
- **Explore Ideas:** Describe several ideas including any useful scientific concepts.
- **Plan Summary:** Write a summary of the plan including **reasons** for choosing this solution.
- **Steps to Do the Plan:** Write the steps including all the materials used in the Plan Summary and in the Diagram of Solution.
- **Diagram of Solution:** Make a labeled diagram.
- **Test Solution:** Describe the process to measure or observe how well this solution may solve the problem.

<b>Problem: Each time the garden is watered the correct amount for the</b>
<b>plants, puddles form and remain for the entire day.</b>
<b>Gather Information:</b>
<b>Explore Ideas:</b>



