

# Questions to Solutions

Use evidence, cause and effect, and design limits.

**4.1.a** "asking questions and defining problems identify scientific and non-scientific questions develop hypotheses as cause-and-effect relations define a simple design problem that can be solved through the development of an object, tool, process..."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## 1 READ AND MARK \_\_\_\_\_ Read it twice

**YOUR JOB** Underline each scientific question or testable idea. Circle the words that show a cause and an effect, and number the limits in the design problem.

### Bean Plants and Garden Needs

- ① At Willow Creek School, students noticed that some bean plants near a window leaned toward the light. A scientific question can be investigated by making observations or measurements. A question about a favorite plant cannot be settled with evidence because it depends on personal taste. The class could ask how the number of daylight hours affects a bean plant's height, then measure plants over time and record results.
- ② A hypothesis is a possible explanation that can be tested. It states a cause and an effect. The class might write, "If a bean plant gets more daylight hours, then it will grow taller because light helps the plant make food." The students would then compare measurements to see whether evidence supports the idea.
- ③ Sometimes students face a design problem instead of a science question. The garden hose leaves muddy puddles by the door. A clear design problem names a need and limits. Students could design a tool that carries water from the hose to the garden bed without spilling, using only recycled materials and taking less than five minutes to set up.

**2 ANSWER WITH EVIDENCE** \_\_\_\_\_ Use the passage

**1** Jada asks, "Does a tomato plant grow more leaves when it receives more water?" What makes this a scientific question?

**2** Omar asks, "Which tomato plant has the nicest shape?" Is this scientific or nonscientific? Explain.

**3** Write a hypothesis about the amount of water and the number of tomato leaves. Use if, then, and because.

**4** A school garden needs a way to move small seedlings from the classroom to the garden. Write a design problem that includes a need and one limit.

**3 YOUR TURN** \_\_\_\_\_ Your own words

Choose a school situation. Write exactly three sentences: a scientific question, a cause-and-effect hypothesis, and a design problem that names an object, tool, process, or system and one limit.

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**PART 1 • READ AND MARK**

Underline each scientific question or testable idea. Circle the words that show a cause and an effect, and number the limits in the design problem. Accept any marking that follows this job and points at the right text.

**PART 2 • ANSWERS**

| # | QUESTION                                                                                                                                         | ANSWER                                                                                                                                                 |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Jada asks, "Does a tomato plant grow more leaves when it receives more water?" What makes this a scientific question?                            | <b>It can be tested by changing the amount of water and observing or counting the leaves.</b>                                                          |
| 2 | Omar asks, "Which tomato plant has the nicest shape?" Is this scientific or nonscientific? Explain.                                              | <b>It is nonscientific because "nicest" depends on personal taste and cannot be settled with evidence.</b>                                             |
| 3 | Write a hypothesis about the amount of water and the number of tomato leaves. Use if, then, and because.                                         | <b>If tomato plants receive 100 mL of water each day, then they will grow more leaves than plants receiving 50 mL because water helps plants grow.</b> |
| 4 | A school garden needs a way to move small seedlings from the classroom to the garden. Write a design problem that includes a need and one limit. | <b>The class needs a tray that carries small seedlings from the classroom to the garden without damaging them, using only recycled materials.</b>      |

**PART 3 • YOUR TURN (SAMPLE ANSWER)**

How does the amount of shade affect the temperature of water in a cup during recess? If a cup of water stays in more shade, then its temperature will be lower because it receives less direct sunlight. Our class needs to design a reusable shade cover for a water cup that uses only cardboard and tape.

Accept scientific questions that can be answered with observations or measurements, and reject questions based only on opinions or preferences. Accept hypotheses with a clear cause and effect, and design problems that state a need, a possible solution type, and at least one limit.