Name _____ Date _____

Variables and Fair Tests: Designing a Plant Growth Experiment

Directions: Read the passage, including each step of the procedure, and study the table. Then answer the questions.

A Fair Test with Bean Plants

Gardeners often mix plant food into the water they give their plants. A class wanted to find out whether plant food helps young bean plants grow taller, so they planned a fair test.

In a fair test, you change only one variable on purpose. That variable is called the independent variable. The variable you measure to see what happens is the dependent variable. Everything else that could affect the results is kept as close to the same as possible. These are the controlled variables. Testing many plants instead of just one makes the results more trustworthy, but it does not make them certain.

The class followed these steps:

1. Fill 12 cups of the same size with the same kind of potting soil. Plant one bean seedling about 5 cm tall in each cup.
2. Label 6 cups as the plant food group and the other 6 cups as the plain water group.
3. Set all 12 cups side by side on the same sunny windowsill.
4. Every Monday, Wednesday and Friday, give each cup 50 mL of water. For the plant food group, first mix plant food into the water as the label directs.
5. After three weeks, measure each plant from the top of the soil to the top of its stem, in centimeters. Record each height.
6. Find the mean height of each group.

Height of each bean plant after three weeks

Plant	Group	Height after three weeks (cm)
F1	Plant food	21
F2	Plant food	19
F3	Plant food	23
F4	Plant food	15
F5	Plant food	20
F6	Plant food	22
W1	Plain water	16
W2	Plain water	14
W3	Plain water	17
W4	Plain water	15
W5	Plain water	13
W6	Plain water	15

1. Match each part of the class's test to its role in the experiment.
Write the letter of the matching answer on each line.

1. _____ Whether plant food is mixed into a plant's water
2. _____ Each plant's height after three weeks
3. _____ The kind of potting soil in every cup

A. Independent variable
B. Controlled variable
C. Dependent variable

2. Which two steps make sure every plant gets the same amount of light and the same amount of water?

☐ A. Step 1 ☐ B. Step 5 ☐ C. Step 6
☐ D. Step 4 ☐ E. Step 3 ☐ F. Step 2

3. If you follow step 4, how many milliliters of water does one cup get in one week?
_____ mL

4. According to step 4, what should you do before watering a cup in the plant food group?

A. Measure the plant's height with a ruler
B. Give the cup twice as much water as a plain water cup
C. Mix plant food into the water as the label directs
D. Move the cup to a shady corner for the day

5. A student measured one plant from the bottom of its cup instead of from the top of the soil. Why is that a problem?

A. Measuring from the bottom of the cup would make the plant stop growing.
B. That height would also include the depth of the soil, so it could not be fairly compared with the other heights.
C. Step 5 says to measure the plants only on the first day.
D. Step 5 says to measure each plant in inches, not centimeters.

6. What is the mean height of the 6 plants in the plant food group after three weeks?
_____ cm

7. Looking at the table, which claim about these 12 bean plants holds up?

A. Every plant given plant food grew taller than every plant given plain water.
B. The 6 plants given plant food had a greater mean height after three weeks than the 6 plants given plain water.
C. The plain water plants were shorter because they got less water each week.
D. Plant food will make any kind of plant grow taller than plain water will.

8. Why did the class test 6 plants in each group instead of just 1?

A. With more plants, one unusual plant has less effect on the mean, so the results are more trustworthy.
B. Six plants in a group grow faster than one plant alone.
C. Testing 6 plants makes the results certain to be correct.
D. Using more plants lets the class change more variables at once.

9. Another class put its plant food cups on a sunny windowsill and its plain water cups in a shady corner. Why is that not a fair test?

A. It kept the kind of soil the same, which a fair test does not allow.
B. It used plant food, which is never allowed in a fair test.
C. It changed two things at once, plant food and light, so the class could not tell which one caused any difference in height.
D. It used too many plants, which makes results less trustworthy.