

CHAPTER 1**Applying Scientific Methods**

A group of students wanted to find out if changing the composition of the atmosphere could affect the growth rate of plants. After researching the problem, they formed two hypotheses.

Hypothesis 1: Will increasing the percentage of oxygen in the atmosphere make plants grow more rapidly?

Hypothesis 2: Will increasing the percentage of carbon dioxide in the atmosphere make plants grow more rapidly?

Using a mixing valve and tanks of pure oxygen, carbon dioxide, and nitrogen, the students created artificial atmospheres with varying percentages of the three gases. They adjusted the percentage of nitrogen to compensate for changes in the other two gases. In the first experiment, the students varied the percentage of oxygen and kept the carbon dioxide level at 0.03 percent, the value in normal air. In the second experiment, the students varied the percentage of carbon dioxide and kept the oxygen level at 21 percent, the value in normal air.

The students grew pea plants in airtight chambers, replacing the air in the chambers with the artificial atmospheres. The students assessed the growth rate of the plants by measuring the plants' heights each day for 10 days.

1. Identify the independent variable and the dependent variable in Experiment 1.

2. Identify the independent variable and the dependent variable in Experiment 2.

3. The students could have done just one experiment in which they varied both the oxygen and carbon dioxide percentages at the same time. Why do you think they chose instead to vary the oxygen and carbon dioxide percentages in separate experiments?

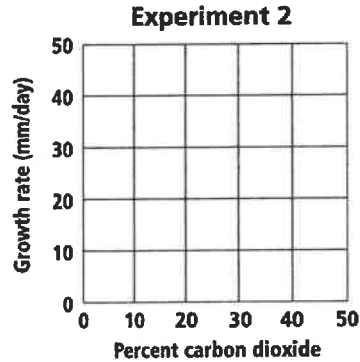
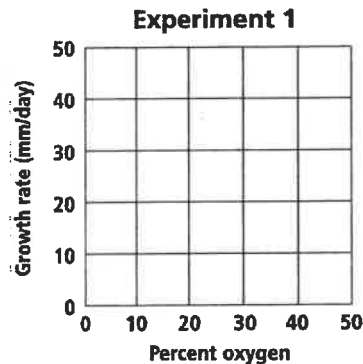
4. Are the carbon dioxide level in the first experiment and the oxygen level in the second experiment controls, constants, dependent variables, or independent variables?

CHAPTER 1**Applying Scientific Methods, continued**

The table below shows the results of the students' two experiments.

Experiment 1				Experiment 2			
Percent Oxygen	Percent Carbon Dioxide	Percent Nitrogen	Growth Rate (mm/day)	Percent Oxygen	Percent Carbon Dioxide	Percent Nitrogen	Growth Rate (mm/day)
1	0.03	98.67	10	21	1	78	15
10	0.03	89.97	11	21	10	69	25
20	0.03	79.97	10	21	20	59	35
30	0.03	69.97	12	21	30	49	43
40	0.03	59.97	11	21	40	39	44
50	0.03	49.97	10	21	50	29	44

11. On the grids below, plot the data for each experiment. Connect the data points on each graph with a line.



12. Describe the relationship between growth rate and the percentage of oxygen or carbon dioxide in these experiments.

13. Which of the students' hypotheses correlate with the results?

14. The growth of plants also depends upon other factors, including temperature, soil water content, and light intensity. What should the students have done with such factors in these two experiments? Why?
