Name Period Date

DESIGNING EXPERIMENTS

Identifying Variables

Variables are any of the factors that could change in a scientific investigation. A controlled scientific investigation is designed so that only one factor is changed or manipulated. However, one or more factors may be measured during an experiment. All other factors remain constant throughout the study. Suppose that you wanted to conduct an experiment to see how the amount of water a plant receives affects its growth. Your hypothesis for this experiment might be "If I give different plants different amounts of water, then the plants will grow at different rates, because the amount of water a plant receives affects its growth rate."

- The **independent variable** is the factor that you wish to test and that you manipulate or change so that you identify its effects. When you use the "If . . . , then . . . , because . . ." form to write your hypothesis, the independent variable is found after the word *if*. In the example above, you are intentionally changing the amount of water. Therefore, the amount of water given to the plants is the independent variable.
- The **dependent variable** is the factor that you measure to gather results. It is expressed in your hypothesis after the word *then*. In the example above, you are measuring plant growth. Therefore, plant growth is the dependent variable.

Identify the independent variable and the dependent variable in each hypothesis.

1. Problem: What is the effect of an object's height on its potential energy?

Hypothesis: If you increase the height from which a golf ball is dropped onto a flat surface of flour, then the resulting crater will be bigger, because the golf ball will have more speed.

Independent variable: the height from which a golf ball is dropped

Dependent variable: size of crater

2. Problem: What is the effect of surface area on evaporation?

Hypothesis: If you increase the number of pieces into which you cut saturated sponges, then those cut into smaller pieces will dry faster than those cut into bigger pieces, because the smaller pieces have more surface area.

Independent variable: the size/surface area of saturated sponges

Dependent variable: the rate of drying (evaporation)

3. Problem: What is the effect of instant messaging on students' grades?

Hypothesis: If students spend more time per week instant messaging, then they will have lower GPAs than students who spend less time instant messaging, because the time spent instant messaging will reduce the amount of time spent studying.

Independent variable: time spend on instant messaging

Dependent variable: GPAs

Name Period Date

4. Problem: What are the effects of different sunblock SPF factors on sunburn?

Hypothesis: If the SPF factor of sunblock is higher, then it takes longer to get sunburned, because the sunblock filters out more UV rays.

Independent variable: SPF factor of sunblock

Dependent variable: the time taken to get sunburned

5. Problem: What is the relationship between the frequency of brushing teeth and the number of fillings someone has?

Hypothesis: If students brush their teeth more times per day, then they will have fewer fillings, because they will have less tooth decay.

Independent variable: the frequency of brushing teeth

Dependent variable: the number of fillings one has

6. Problem: What is the effect of a surface's color on its temperature?

Hypothesis: The darker the color of a surface, then the warmer the surface will become in sunlight, because darker colors absorb more light than lighter colors.

Independent variable: the color of a surface

Dependent variable: the temperature of the surface

Challenge Identify the independent and dependent variables in the following investigation. A group of students chose to study acceleration. The students used small toy cars and made a ramp from a wooden board. They held one end of the ramp on the floor at various angles, which they measured using a protractor. Then they used a meter stick to measure how far the cars ran off the ramp from the different slopes.

Independent variable: the steepness of the slope / ramp

Dependent variable: the speed of the cars