Name: _____ **Date:** _____

Practice with Hypotheses

Write a testable hypothesis for these situations.

1. Mom and I were baking a cake for my brother's birthday. We didn't have any baking powder. The recipe said to add one teaspoon of baking powder to the cake batter. Since that's such a small amount we baked the cake anyway. We were very disappointed when the cake came out of the oven flat instead of fluffy. We think maybe we needed to add the baking powder.

2. You and your friends were studying lists of spelling and vocabulary lists. It seemed like everyone could easily remember the first word on the list and the fifteenth word on the list. It seemed very hard to remember the words in the middle of the list.

3. The Acme Cleansers Company wants to do some advertising for its new anti-bacterial kitchen cleaner. The advertising executives want to run some tests that show that their new product is better than the best-selling brand of kitchen cleaner.

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Understanding Dependent and Independent Variables

As part of the scientific process, researchers, scientists and even ordinary people conduct experiments every day to find out more about the world we live in. An experiments needs to be carefully designed to make sure it accurately measures what it is supposed to so that the results are correct and so that the experiment can be repeated by someone else.

Basic experiments are based upon a hypothesis that tries to predict the outcome of the experiment. Many experiments do not show that their hypothesis is true. These experiments are still valuable because they help to guide further research into an area that scientists are interested in.

Experiments test the influence of one thing over another. A proper experiment compares two or more things but changes only one variable or factor in the experiment. One example that is often used is an experiment that tests the influence of fertilizer on the growth of plants. The hypothesis states that plants that get fertilizer grow taller than plants that get no fertilizer.

For any particular plant in the experiment, the amount of fertilizer it will get during the experiment is determined in advance by the experimenter. Some plants will get no fertilizer while others will get a measured amount. In this example, the *independent variable* is the amount of fertilizer.

The other term used in experiments is dependent variable. The *dependent variable* is what is measured in the experiment. In this example, the dependent variable is how tall the plants are. The dependent variable (how tall the plants are) depends on the independent variable (the amount of fertilizer).

Example:

Stress increases the heart rate of a person.

Dependent variable (what is measured in the experiment):
heart rate
Independent variable (what is controlled in the experiment):
the amount of stress

Exercise:

Lifting weights increases the breathing rate of a person.

Dependent variable: _____

Independent variable: _____

The Scientific Method

Do you like detective or mystery stories? Why do you like them? Detectives and investigators decipher the clues and try to figure out a logical explanation for what happened and, above all, who did it! Or do you like to play games that make you think and figure out a strategy or an answer? If you enjoy mysteries and figuring out answers to questions or problems, then the chances very good are you already know something about the scientific method. It's just that you haven't called it the scientific method yet.

The scientific method is basically an organized way to investigate something that interests you, when you want to find out why something happens the way it does. The scientific method starts with a *question*. Because the method is scientific, the question you ask needs to be something you can *measure* so you can compare results you are interested in. Maybe there's already a good answer to your question so it's important to do *background research*, looking in the library or searching through the Internet to find out what's already written about your question.

Just like a detective might come up with a list of suspects who might be responsible, the next step in the scientific method is to *formulate a hypothesis*. This hypothesis is an educated guess about how the things you're asking about actually work. For example, "If I give my plants fertilizer in the spring, they will have more flowers." is a simple hypothesis about how plants grow. An important part of formulating a hypothesis is making sure it is something you can *measure*. In this example, you can count the number of flowers. What are some of the other "suspects" that might be responsible for plant growth? Did you come up with water, light and temperature? Take a moment to write some other hypotheses (plural of hypothesis) about plants.

The next step in the scientific method is to show that the hypothesis is correct (true) or incorrect (false). When scientists are doing research into complicated areas of science, many of their hypotheses are false. Scientists are patient and persistent and keep looking for answers. The way to show that a hypothesis is true or false is to design and complete an *experiment*. Scientists must be careful in how they design an experiment to make sure that it tests exactly what the hypothesis states. A proper experiment compares two or more things but changes only one *variable* or factor in the experiment.

In an experiment, one group is the *control group* and the other is the *experimental group*. If a scientist was testing the flower and fertilizer hypothesis, she would select one species of flower to test with and buy a dozen plants. Six of the plants would be the control group and six the experimental group. All the plants would be kept in the same greenhouse and given the same amount of light and water. The experimental group would get a measured amount of fertilizer on a regular schedule while the