**Station #1: Variables**

**Directions: Read the information below to answer the questions.**

Scientists design experiments to search for cause-and-effect relationships. In other words, they design an experiment so that changes to one item cause something else to vary in a predictable way. These changing quantities are called variables. A **variable** is any factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: independent, dependent, and controlled.

The **independent variable** is the one that is changed/controlled by the scientist. To ensure a fair test, a good experiment has only one independent variable. As the scientist changes the independent variable, he or she observes what happens or results from that change.

Scientists collect data on the **dependent variable** to see how it responds to the change made to the independent variable. The new value of the dependent variable is caused by and depends on the value of the independent variable. For example, if you open a faucet part way (the independent variable), the quantity of water flowing (dependent variable) changes in response--you observe that the water flow increases.

Experiments also have **constants or controlled variables**. Controlled variables are things that a scientist wants to remain the same throughout the experiment. Consequently, they must watch over the constants carefully so they do not influence the dependent variable in a misleading way. For example, if we want to measure how much water flow increases when we open a faucet, it is important to make sure that the water pressure in the pipes (the controlled variable) is the same through the entire experiment. That's because both the water pressure and the opening of a faucet have an impact on how much water flows. If we change both of them at the same time, we can't be sure how much of the change in water flow is because of the faucet opening and how much because of the water pressure. In other words, it would not be a fair test. Most experiments have more than one controlled variable.

**Station #2: Experimental Design**

**Directions: Choose a claim below to answer the questions.**

**Claim #1**: Jean told Riley, “Did you know that plants will grow taller if you use coffee?”

**Claim #2**: Dylan claims that there are more crab holes on the driving side of the beach then the non-driving side.

**Claim #3**: Bounty claims their paper towels absorb the most liquid.

**Station #3: Collecting Data**

**Directions: Use the lab procedure below to collect data.**

1. Drop the helicopter from one meter height and measure how close the helicopter lands to the bullseye.
2. Repeat step 1, 3 times. Recording your data on the chart.
3. Repeat step one but add a paperclip to the bottom of the helicopter. Measure the distance it lands from the bullseye.
4. Repeat step 3, 3 times. Recording your data on the chart.
5. Repeat step one but add 2 paperclips to the bottom of the helicopter. Measure the distance it lands from the bullseye.
6. Repeat step 5, 3 times. Recording your data on the chart.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Paper Clips** | **Trial 1** | **Trial 2** | **Trial 3** | **Average** |
| **No paper clips** |  |  |  |  |
| **One paper clip** |  |  |  |  |
| **Two paper clips** |  |  |  |  |

**Station # 4: Graphing**

**Directions: Use the data table to graph Mrs. Lopez’s results.**

**Penny Lab**

Mrs. Lopez was teaching her biology class about cohesion and adhesion, two special properties of water that involve water sticking to itself and water sticking to other objects. She asked the class how many drops of water could they get to stay on top of a penny? She began dropping drops of water on the penny using a pipette and counted how many drops stayed on the penny. She continued dropping water on the penny until it overflowed onto the paper towel. She did this five times. The students wondered if this worked with other liquids. Mrs. Lopez said let’s test it. She had one group drop water on the penny. The other group used water with rubbing alcohol. The final group used water with dish soap. See the chart below for the results.

**Data Table**

|  |  |  |
| --- | --- | --- |
| Type of Solution | Trial # | Number of Drops |
| Water | 1 | 25 |
| 2 | 30 |
| 3 | 35 |
| 4 | 27 |
| 5 | 28 |
| Water with rubbing alcohol | Trial # | Number of Drops |
| 1 | 10 |
| 2 | 12 |
| 3 | 15 |
| 4 | 18 |
| 5 | 5 |
| Water with dish soap | Trial # | Number of Drops |
| 1 | 9 |
| 2 | 10 |
| 3 | 5 |
| 4 | 16 |
| 5 | 7 |

**Station # 5: What is the Science Process?**

**Directions: Read the article about Science Process and answer the questions.**

Scientists use an experiment to search for cause-and-effect relationships in nature. In other words, they design an experiment so that changes to an item cause something else to vary in a predictable way.

These changing quantities are called **variables**. A variable is any factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: **independent, dependent, and controlled**.

The **independent variable** is the one that is changed by the scientist. To ensure a fair test, a good experiment has only one independent variable. As the scientist changes the independent variable, he or she observes what happens.

The scientist focuses his or her observations on the **dependent variable** to see how it responds to the change made to the independent variable. The new value of the dependent variable is caused by and depends on the value of the independent variable.

For example, if you open a faucet **(the independent variable)**, the quantity of water flowing **(dependent variable)** changes in response--you observe that the water flow increases. The number of dependent variables in an experiment varies, but there is often more than one.

Experiments also have **controlled variables**. Controlled variables are quantities that a scientist wants to remain constant, and he must observe them as carefully as the dependent variables. For example, if we want to measure how much water flow increases when we open a faucet, it is important to make sure that the water pressure (the controlled variable) is held constant. That's because both the water pressure and the opening of a faucet have an impact on how much water flows. If we change both of them at the same time, we can't be sure how much of the change in water flow is because of the faucet opening and how much because of the water pressure. In other words, it would not be a fair test. Most experiments have more than one controlled variable. Some people refer to controlled variables as **"constant variables**."

In a good experiment, the scientist must be able to measure the values for each variable. Weight or mass is an example of a variable that is very easy to measure. However, imagine trying to do an experiment where one of the variables is love. There is no such thing as a "love-meter." You might have a belief that someone is in love, but you cannot really be sure, and you would probably have friends that don't agree with you. So, love is not measurable in a scientific sense; therefore, it would be a poor variable to use in an experiment.