**Scientific Method**

**Manipulated and Responding Variables**

**Independent Variable** – The part of the experiment that is changed by the scientists or person performing the experiment.

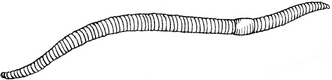
**Dependent Variable** – The part of the experiment that is affected by the independent variable.

**Control Variable** – Every other part of the experiment that will affect the results.

Ex. 1) Jordan is doing a science fair project on the effects of music on the growth of tomatoes. He has two tomato plants, Plant A and Plant B, that he grows in a window and gives the same amount of water. Plant A is exposed to classical music using headphones attached to the soil. Throughout the growth period, Jordan counts the number of tomatoes produced by each plant.

Plant A = 35 Tomatoes | Plant B = 55 Tomatoes

1. What is the manipulated variable (independent variable)?
2. What is the responding variable (dependent variable)?
3. What are some controls for this experiment (control variable)?
4. What should Jordan’s conclusion be? Write this in a complete sentence!
5. Jordan needs to repeat the experiment, but his teacher says that he needs to improve his design. In his second experiment, what should he do different?

Ex. 2) In the same science fair, Tina asks the question “Does caffeine increase the heart rate of an earthworm?” In Test 1, she measures the heart rate by looking at the earthworm under a microscope. The earthworm has a heart rate of 50 bpm (beats per minute). In Test 2, she places a few drops of caffeine on the earthworm’s skin and measures the rate again. In this test, the heart rate is 68 bpm.

1. What is the manipulated variable (independent variable)?
2. What is the responding variable (dependent variable)?
3. What are some controls for this experiment (control variable)?
4. Tina’s experiment should have included a hypothesis. In a complete sentence, suggest a hypothesis for Tina’s experiment.

A picture containing text, shoji

Description automatically generated

Ex. 3) Patrick and Bob love to blow bubbles! Patrick found some Super Bubble Soap at Sail-Mart. The ads claim that Super Bubble Soap will produce bubbles that are twice as big as bubbles made with regular bubble soap. Patrick and Bob made up two samples of bubble solution. One sample was made with 5 oz. of Super Bubble Soap and 5 oz. of water, while the other was made with the same amount of water and 5 oz. of regular bubble soap. Patrick and Bob used their favorite bubble wands to blow 10 different bubbles and did their best to measure the diameter of each one. The results are shown in the chart.

1. What did the Super Bubble ads claim?
   1. Super Bubble produces bubbles twice as large as regular bubble soap.
   2. Super Bubble makes twice as many bubbles as regular bubble soap.
   3. Super Bubble bubbles last twice as long as bubbles made using regular bubble soap.
   4. Super Bubble is cheaper than regular bubble soap.
2. What is the independent and dependent variables?
3. List some 3 control variables.
4. What conclusion can be gained from this experiment?

**Rubber Band Launcher Lab**

**Problem**: Does distance a rubber band is stretched affect the distance it flies when launched?

**Hypothesis:** *(Write as an if/then statement)*

**Procedure:**

1. Measure the initial length of the rubber band on the ruler = \_\_\_\_cm
2. Holding your rubber band horizontal, pull it back an additional 1 cm and release it.
3. Measure the distance travelled in cm and record the distance in the data table. **You will do five trials each.**
4. Repeat the process, each time stretching the rubber band by \_\_\_ cm more. Complete the data table.

**Data Table**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Total stretch | + \_\_\_ cm | + \_\_\_ cm | + \_\_\_ cm | + \_\_\_ cm | + \_\_\_ cm |
| Total Distance Traveled in cm | Trial 1 |  |  |  |  |  |
| Trial 2 |  |  |  |  |  |
| Trial 3 |  |  |  |  |  |
| Trial 4 |  |  |  |  |  |
| Trial 5 |  |  |  |  |  |
| Average |  |  |  |  |  |

**Graph:**

Chart

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Make a line graph of your AVERAGED data. Label the vertical axis (distance travelled) and the horizontal axis (distance stretched).

**Analysis:**

1. Identify the independent, dependent, and control variables for this experiment.

Independent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dependent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Control Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What happen to the distance the rubber band flew as it was stretched further? Was it a linear progression? (Is the graph a straight line or a curved line?)
2. What do you think will happen as the rubber band is stretched further and further?

**Conclusion:** (Was your hypothesis correct? What else did you find out)