**Scientific Method & Measurements Lab**

This lab is to help you understand the scientific method, how to use instruments (balance, ruler, graduated cylinder, & thermometer) to measure objects, and how to derive units from your measurements.

**Station 1:**

Measure the volume of water in each of the graduated cylinders. **At your desk with your group**, draw a bar graph comparing the three volumes in the grid below. Use colored pencils.

Green water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Red water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Blue water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Station 2:**

Measure the mass of each of the objects using the balance. Remember to include SI units.

Object #1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Object #2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Object #3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Station 3:**

Record the length, width, and height of each of the objects using the ruler. Remember to include SI units. **At your desk with your group**, calculate the volume and density of each object and record in the data table.

**Volume = L x W x H**

**Density = mass/volume (g/cm3) (calculate next time)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Object #1** | **Object #2** | **Object #3** |
| **Length** |  |  |  |
| **Width** |  |  |  |
| **Height** |  |  |  |
| **Volume** |  |  |  |
| **Mass** |  |  |  |
| **Density** |  |  |  |

**Station 4:**

Calculate the volume of an irregularly shaped object using a graduated cylinder. The object will displace (push up) its volume in the water in the graduated cylinder.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Rock #1 | Rock #2 | Rock #3 |
| **Volume of water with rock** |  |  |  |
| **Volume of water without the rock** |  |  |  |
| **Volume of rock** |  |  |  |
| **Mass** |  |  |  |
| **Density** |  |  |  |

**Station 5:**

Measure the temperature in °C of the substance in the beaker using the thermometer. **At your desk with your group**, convert the temperature to Fahrenheit and Kelvin.

**°K = ºC + 273.15 ºF = (1.8 x ºC) + 32**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Beaker #1 | Beaker #2 | Beaker#3 |
| °C |  |  |  |
| °F |  |  |  |
| °K |  |  |  |

**Scientific Method & Experimental Design**

**At your desk with your group**, answer the following questions about the scientific method and experimental design.

1. Josh wants to impress his latest crush so he enlists his sister, Megan to help create a long-lasting cologne for him to wear around her. Megan and Josh set up five jars, with all of them having a base ingredient of old spice and every jar except one having more ingredients added to it. After producing all five different colognes, Josh wore each one of the colognes for a week and never wearing the previous t-shirts during the following weeks. Josh observes his crush’s behavior during each week. After five weeks, Josh notices that his crush is more distant than before.

What is the observation? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the independent variable?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the control group?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What should Josh’s conclusion be?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Josh has heard that if you take vitamin C when you first feel sick with a cold that it will get rid of your cold. He decides to test this when Drake and Megan both get a cold. He gives Megan three vitamin C pills twice a day for five days, and gives Drake three sugar pills twice a day for five days. Both Drake and Megan took seven days to get over their colds.

What is the independent variable?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the control group?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What should Josh’s conclusion be?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Mr. Nichols saw an advertisement for a new hair growth serum called Magic that claims to causes hair to grow back in five days. He decides to perform an experiment to see if the claim is true. He chose 100 males from his hometown in California. In Group A, twenty people were given Magic and were told to use it daily for 10 days. In Group B, twenty people were told to let their hair grow naturally. In Groups C, D, & E, twenty people in each group were given non-name brand hair growth serum which Mr. Nichols used previously. Group A reported having their hair grow back in 7 days. Group B reported slow growth – needed more time. Group C, D & E all reported their hair to have grown back in three days.

What is the independent variable?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the control group?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Was the advertisement’s claim supported or not supported by the data?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If you were Mr. Nichols which serum would you pick? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. An experiment was designed to investigate the effect of caffeine on the heartbeat of water fleas. Two populations of water fleas were cultured. Both populations had water with the same mineral content, were supplied identical amounts of bacteria for food, received the same amount of light, and had the water temperatures maintained at 20°C. Every two hours, water fleas from both populations were selected and their heart rates monitored. The fleas of population 1 had caffeine administered five minutes before the heart rate was checked. The fleas of population 2 were not given any caffeine before their heart rates were checked. Population 1 had an average heart rate of 115 beats per minute. Population 2 had an average heart rate of 75 beats per minute.

What is the independent variable?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the control group?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What were the experimental controls? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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What should the conclusion be?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Scientists want to know which hand sanitizer brand gets rid of bacteria better: Purrell or Germ-X. In Group A, ten people were given 5 mL of Purrell sanitizer. In Group B, ten people were given 5 mL of Germ-X hand sanitizer. In Group C, ten people were given 5 mL of a water-based gel with no germ killing ingredients. After using the sanitizers and gel, Group A showed a 95% decrease in bacteria on their hands, Group B showed an 89% decrease in bacteria on their hands, and Group C showed a 25% decrease in the bacteria on their hands.

What is the independent variable?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the control group?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Which brand of hand sanitizer is better?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. If an experiment is designed to find out if a specific shape of dog food is preferred by dogs, it would be best to: (circle answer) and explain WHY that is the best choice!

A. use different brands of dog food

B. use the same brand of dog food, but use different colors

C. use the same brand of dog food, but use different shapes

D. use the same brand of dog food, but add a special ingredient

E. use different brands of dog food with different shapes and sizes

7. Two companies make baseballs, and each claims their baseball goes farther when hit. Which would be the best method to test these claims? (circle answer) and explain WHY that is the best choice!

A. have one baseball player hit each of the balls and see which goes further

B. use a machine to hit each ball with the exact same force and measure how far each ball travels

C. ask 50 baseball players which ball they think would travel the furthest when hit

D. read the results of tests conducted by each company on their own baseball and see which one goes the farthest