Week 1 Lab #1: Spaghetti Bridge 2pts ec printing Name_____pd__ Number____

The basis of this lab is the ability to design an experiment to determine the relationship between two quantities and to interpret and apply the results of these experiments to future problems and situations. In this lab you will make a spaghetti "bridge" and determine the maximum load in can hold before breaking.

Procedure:

- Puncture two holes in the top of the cup and thread a string through the holes. Tie the ends of the string together so that the string acts like a handle.

Below is the lab set-up:

- Place one piece of spaghetti under the string so that the cup hangs from the middle of the piece of spaghetti. Tape the ends of the spaghetti to the chair or table. What are things can you measure about the bridge

1. _____
2. _____
3. _____
4. _____

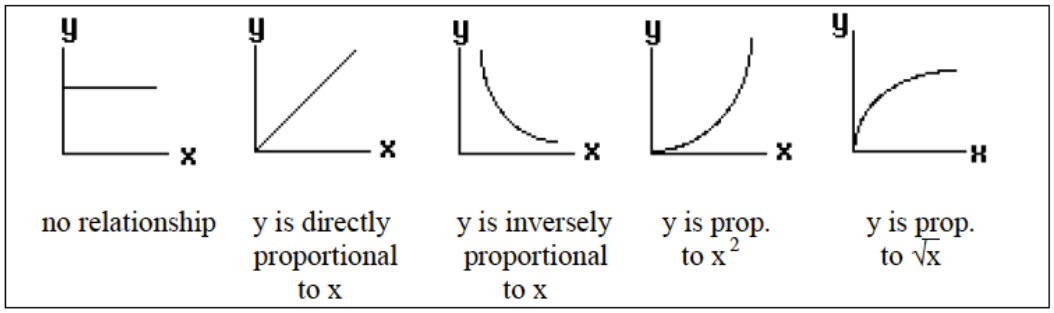
When scientists set up experiments they often attempt to determine how a given variable affects another variable. This requires the experiment to be designed in such a way that when the experimenter changes one variable, the effects of this change on a second variable can be measured. If any other variable that could affect the second variable is changed, the experimenter would have no way of knowing which variable was responsible for the results. For this reason, scientists always attempt to conduct controlled experiments. This is done by choosing only one variable to manipulate in an experiment, observing its effect on a second variable, and holding all other variables in the experiment constant.

There are only two variables that area allowed to change in a well-designed experiment. The variable manipulated or changed by the experimenter is called the **independent variable**. The **dependent variable** is the one that responds to or depends on the variable that was manipulated. Any other variable which might affect the value of the dependent value must be held constant. These are the **control variables**. When an experiment is conducted with one (and only one) independent variable and one (and only one) dependent variable while holding all other variables constant, it is a **controlled experiment**.

What is your independent variable going to be? _____
What is your dependent variable going to be? _____
What are your control variables going to be? _____

Now you are ready to write the purpose statement that will direct your experimental design:
Purpose: To find the relationship between _____ (dependent variable) and _____ (independent variable) before the bridge breaks.

Which graph to use? Glad you asked!



For this lab, let's consider only the first three cases. In the first graph, the independent variable has no effect on the dependent variable. In the second graph, as the independent variable gets larger, the dependent variable gets larger. In the third graph, as the independent variable gets larger, the dependent variable gets smaller.

Hypothesis (complete the statement and explain why you think this is true):

The _____ (dependent variable) is:

not related / directly proportional / inversely proportional **(circle one)**

to the _____ (independent variable) before the bridge breaks.

I believe this is true because: _____

_____

_____

Procedure: One person should begin to add washers to the cup. When the spaghetti breaks, record the number of washers needed to break the spaghetti. Be sure to mass them & record. After you have broken one piece of spaghetti, use two new pieces and again place pennies in the cup until the spaghetti breaks.
Repeat the experiment twice, to complete the table below.

Procedure Notes: Don't get the tables/chairs too far apart! Measure and record the value for all of your control variables Assign a "catcher" for the cup, otherwise there will be potentially washers scattered all over the floor. Increase the number of washers until the bridge breaks. Record the last number of washers actually supported in your data table. You have 30 washers to start, make sure you have 30 when you are done.

Pieces of Spaghetti	Trial 1: Number of washers needed	Trial 2: Number of washers needed
1		
2		
4		

Data Analysis: Graph your data (**READ:** Characteristics of a Good Graph below)

Characteristics of Good Graphs:

It is plotted on a grid or graph paper.
Both axes are labeled with the variable name and its units. Note that we do not label them x or y!
The independent variable is plotted on the horizontal (x) axis (generally).
The dependent variable is plotted on the vertical (y) axis (generally).
The axes are properly scaled so that the graph fits the space, the grids are consistently scaled, and all of the data fits on the graph.
A line of best fit is drawn which shows the trend of the data. The line of best fit may have some points above it, some below it, and some on it. If the trend of the data is linear, the line of best fit is drawn with a ruler.
If the trend of the data is curved, a smooth curve should be drawn.
The graph is clearly titled using the convention dependent variable vs. independent variable.

Conclusions: (write your answers in complete sentences)

1. How are your dependent and independent related? How do you know (discuss the shape of your graph)?

2. Does this agree with your hypothesis? Why or why not?

3. All experiments have experimental error, which occurs because no measurement can be made perfectly. An example of experimental error could be when making timings with a stopwatch. Sometimes you may stop the watch too soon, sometimes too late. Sometimes the measuring tool itself may not be precise. This is also a source of error in measurements. What are areas of experimental error in this experiment?

4. How could this experiment be improved if you were to do it again?

Week 1: Lab #2: Melting ice cubes

Goal:_____
Hypothesis: I think:_____
_____
Materials: _____
Draw Set Up:

Summarize Procedures:

_____
_____
_____
_____
_____

Observations:	**Evidence**

Results & Discussion:

_____
_____
_____
_____
_____
_____

Conclusion:

_____
_____
_____
_____
_____
_____