

NAME: _____ PERIOD: ___ DATE: _____

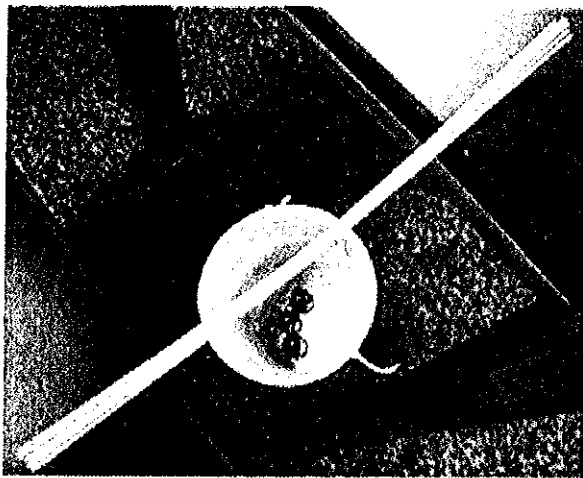
LAB: SPAGHETTI BRIDGE (HONORS)

OBJECTIVE: TO DETERMINE THE RELATIONSHIP BETWEEN THE NUMBER OF SPAGHETTI STRANDS THAT FORM A BRIDGE AND THE MAXIMUM NUMBER OF MASS UNITS THAT CAN BE SUPPORTED.

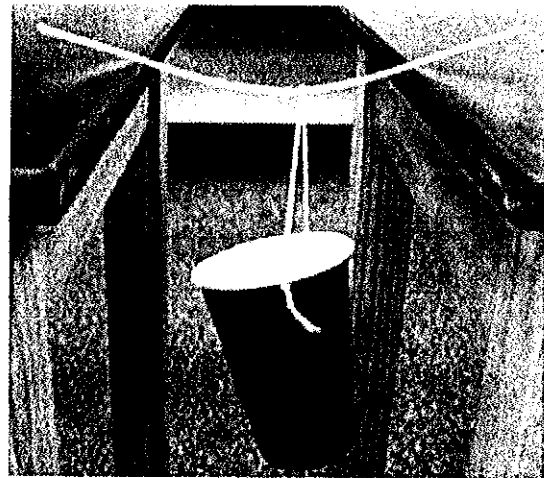
Materials: Uncooked long-strand spaghetti (thick & thin), disposable plastic cups, string, mass units (marbles, washers, nuts, pennies).

Prelab:

Below is the lab set-up:



Top View



Side View

What things can you measure about the bridge?

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 are 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?

What is your dependent variable?

What are your control variables?

Lab Procedure Notes:

1. Separate two desks, but not too far apart.
2. Suspend the cup from the spaghetti and placed it between two desks as demonstrated.
3. Make sure the spaghetti strand overlaps both desks by the same amount with the majority of it between the two desks.
4. Make sure that the cup is suspended in the middle of the two desks.
5. Designate a person to catch the cup before it hits the ground.
6. Gently add mass units one at a time into the cup until the bridge fails either by breaking the spaghetti strand or slipping off the desks.
7. Record the maximum number of mass units supported before failure.
8. Repeat the process using two, three, and four spaghetti strands.
9. After you have completed the testing of regular spaghetti strands, test the strength of thin spaghetti strands.

Data Analysis:

Use the table below to record your data.

Spaghetti Bridge Data Table (Regular)		Spaghetti Bridge Data Table (Thin)	
# of Spaghetti Strands	Maximum # of Mass Units Supported	# of Spaghetti Strands	Maximum # of Mass Units Supported
1		1	
2		2	
3		3	
4		4	
5		5	

1. Draw a graph on graphing paper. Use the entire graph paper.
2. Label the axis (The number of spaghetti strands on the x-axis and the number of mass units supported on the y-axis).
3. Determine the increments for each axis.
4. Evenly space out the numbers in equal increments (number by 1's, 2's, 5's, etc.) Pick one increment and stick with it!

5. Line up the numbers on the lines, not in the spaces.
6. According to the information in the data table, plot the data points where the lines meet.
7. Start at exactly (0,0)
8. Use a ruler to draw a straight line that best fits the data points. The line of best may have some points above it, some point below it, and some points on it. Do not connect the points.
9. Use two points on the line to determine its slope ($y_2 - y_1 / x_2 - x_1$).
10. Plot a line for both regular and thin spaghetti strands on the same graph.

Questions:

1. What does the straight-line graph tell you about the bridge?
2. What does the slope of the line tell you about the bridge?
3. Why do different groups have different values for their slope?
4. 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?
5. How could this experiment be improved if you were to do it again?

Use the data above to predict the number of mass units that 5 spaghetti strands should be able to hold. Predict for both regular and thin spaghetti strands. Then test your hypothesis.

	<u>Prediction</u>	<u>Actual</u>	<u>% Error</u>
Regular Spaghetti Strands	_____	_____	_____
Thin Spaghetti Strands	_____	_____	_____

Use the formula to calculate your percent error for both regular and thin spaghetti strands.