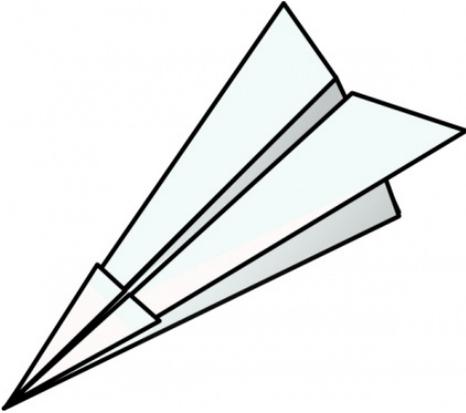


Name _____ Science Course _____

Pre Lab Due _____ Post Lab Due _____ Grade _____

Best Flying Paper Airplane



We will be making paper airplanes to practice the following scientific reasoning skills:

- Problem solving
- Determining cause and effect
- Making inferences
- Drawing conclusions
- Predicting/hypothesizing
- Building models

The research question we are trying to answer in this lab is:

How can we make a paper airplane travel farther?

Prelab Questions

1. Make a list of modifications we could make to a “regular” paper airplane to make it go farther. (example: weight—could make it heavier or lighter) List at least 5.

2. Pick ONLY ONE of the modifications (variables) to test. Which one are you choosing? Describe how you will make modifications for this variable. (For example if you choose to change the weight, how will you add or subtract weight?) This variable is called your **independent variable**; it is the ONE thing you change in the experiment. Pick a independent variable that you can increase and decrease (for example make heavier or lighter).

3. The purpose of running trials is to determine how far the plane is able to fly. This distance is what you will measure. In an experiment what you are measuring is called the **dependent variable**, because the distance it flies is dependent on the independent variable you are changing. Because you won't get the same distance every time, you will need to run a series of trials. You should do your best to use the same technique every time. These are called “constants.” **Constants** are the ways you keep the

environment and methods the same so they won't influence your results. What are constants you will use to help keep the trials the same?

4. A **hypothesis** is a statement that describes a connection between your independent variable and dependent variable. For example, "If I increase the weight of my plane, it will fly farther." What is your hypothesis for your experiment?
5. If your hypothesis is correct, what do you predict will happen? Which trials (control, experimental group #1 or #2) will fly the farthest? Which trial will fly the shortest distance.

Procedure:

1. Pick a paper airplane style and construct it.
2. Run 8 trials of this airplane. For each trial, record how far the airplane flies. Take any other notes about that trial in the data table. For example, if the plane hits the wall or ceiling, record this.
3. Introduce a low level of your independent variable. This is called your experimental group #2. Run 8 trials with this variable.
4. Increase the level of your independent variable again, and run 8 more trials for experimental group #3.
5. Calculate mean, median, mode, and range for the control and experimental groups.

Ways to Find the Central Tendency of a set of numbers

Mean: a number that is midway in value between the other numbers; the average To calculate mean: Add all the numbers, and divide by the total number

Example: $22 + 36 + 44 + 24 + 31 + 20 + 45 + 19 + 24 + 40 / 10 = 305 / 10 = 30.5$

Median: the middle number in a sequence of numbers listed from smallest to largest

To calculate median: list all the numbers from your data table from smallest to largest; if you have an odd number, the median is the middle number; if you have an even number (like we do) calculate the mean of the TWO middle numbers.

Example: 19, 20, 22, 24, 24, 31, 36, 40, 44, 45 = $24 + 31 / 2 = 55 / 2 = 27.5$

Mode: the number that occurs MOST in the set of data

Example: 19, 20, 22, 24, 24, 31, 36, 40, 44, 45 = 24 (because it occurs twice)

Range: the difference between the smallest and largest number in a set of data

Example: $45 - 19 = 26$

Paper Airplane Data Table

Trials	Control Trials Airplane without modifications	Experimental Group #1 Airplane with	Experimental Group #2 Airplane with
1			
2			
3			
4			
5			
6			
7			
8			
(total)			
Mean			
Median			
Mode			
Range			

Post Lab Questions

1. Which of the central tendency calculations most accurately describe the three sets of data? Why? [Use this calculation to answer the following post lab questions.]

2. Which group did you predict would go the farthest? (From prelab question #5.) Were you correct? Why do you think that is?

3. Which group did you predict would go the shortest distance? (From prelab question #5.) Were you correct? Why do you think that is?

4. Was your hypothesis supported?

5. How confident are you that the independent variable (what you changed) influenced the dependent variable (how far it flew)? Is there a strong or weak connection?

6. How reliable (consistent) were your data? Why is that?

7. Were there things you could have kept constant that you didn't? If you were to perform the experiment again, how would you change your methods to improve the reliability of your data?

8. Describe another way to test your independent variable. Why might this have resulted in better or different results?

References

Jorgenson, O., Cleveland, J. and R. Vanosdall. "Doing Good Science in Middle School: A Practical Guide to Inquiry-based Instruction." Arlington, NSTA Press. 2004.

