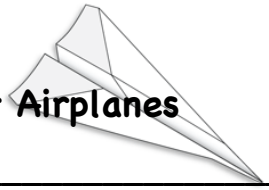
Scientific Method Project: Paper Airplanes



Names:_____

Period:_____

Record this lab on a separate sheet of paper. Be sure to include everyone's name, the bolded headings, and the group's answers.

In this lab, you will apply the scientific method to determine the best construction of a paper airplane. You will have the following materials available: paper, paper clips, cellophane tape, laptop and a meter stick.

1. **Identify and state the problem:** You want to know which paper airplane design is best. The first thing you have to do is decide what "best" means. This is called an *operational definition* – the definition you will use during the investigation. For this investigation, we will define "best" as the plane that flies the furthest in the forward direction.
    a. As a group, decide what ONE construction variable you would like to test: length of the plane, the weight of the plane, the design or style of the plane, the position of weights on the plane, winglets on the plane or something else.
2. **Write a question** that states what your group would like to investigate about paper airplane construction:
3. **Gather Data:** Spend some time brainstorming together all that you as a group know about making paper airplanes, as well as searching on the Internet for paper airplane designs and flight information. Maybe try making a few and observing how they fly, how they are constructed, modifications that could be made or other notable facts. Record your brainstorming and Internet search results.
4. **State a hypothesis:** Based on how we defined "best" and what you now know about paper airplanes, write a hypothesis that states which variable of constructing a paper airplane (what you are testing) will fly the greatest distance and why you think it will. You should use complete sentences:

5. **Write a Procedure for Experiment:** When you design an experiment, you must first pick *ONE* thing to test, example: length of the plane, the weight of the plane, the design or style of the plane, the position of weights on the plane, winglets on the plane or something else and so on. This is called the *independent variable* – it is what you will change or test. Everything else that could possibly change, but doesn't are called controlled variables. Scientists' control all the variables they can so that they can be sure that the results of the investigation are due to the change in one variable that is tested.
    a. You must decide what kind of data you will collect or what you will observe and measure. This is called the *dependent variable*. You need to repeat the experiment several times. These are called trials. Multiple trials help make sure that your data is consistent. Repeating the experiment allows you to be confident in your findings. The procedure for this investigation is partially done for you. Add any extra steps needed for your investigation.
    b. Construct 3 different paper airplanes. (Remember the *only thing* that is different among them is the *ONE* variable you have decided to test).
    Tested Planes:
        1) _____
        2) _____
        3) _____

Guidelines: You will need to write your own experiment and create a data table. Here is a general guideline to help you design your experiment and data table:

1. Throw the first airplane.
2. Measure? _____
3. Repeat 4 more times. (Measurements?)
4. Throw the second airplane.
5. Measure? _____
6. Record the data.
7. Repeat 4 more times (Measurements?)
8. Throw the third airplane

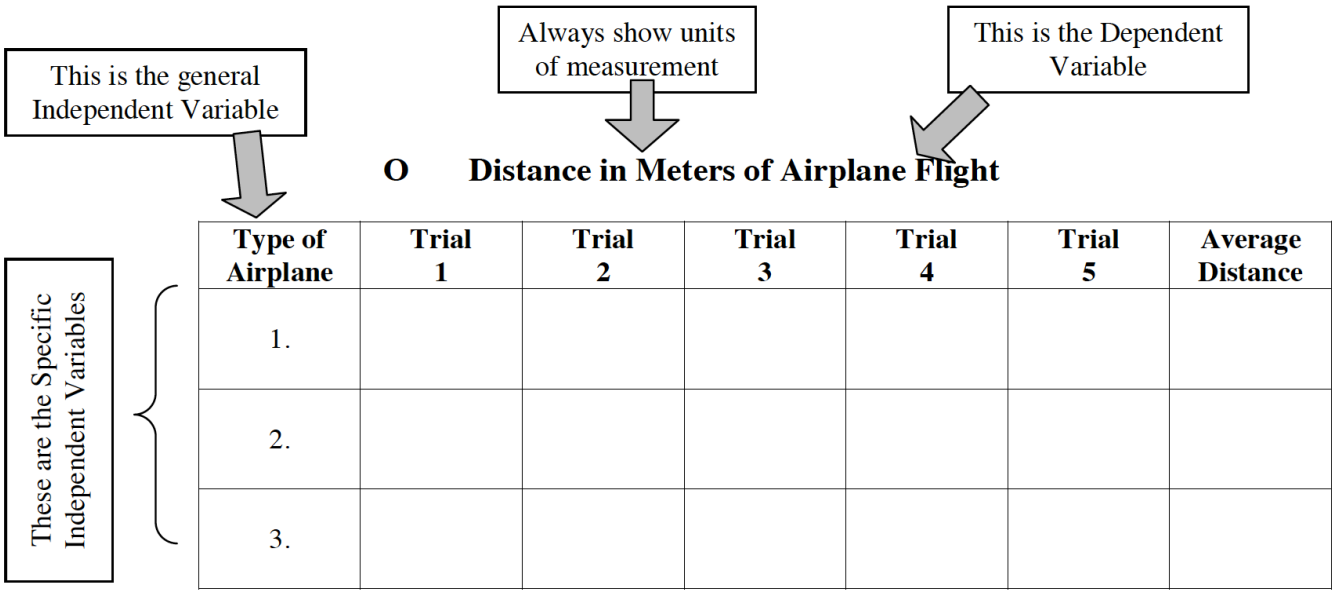
9. Measure? _____

10. Record the data

11. Repeat 4 more times. (Measurements?)

6. **Collect and Record data:** The *responding or dependent variable* is the data you collect. Data is frequently recorded in some type of chart or table. The chart has a place to show each specific manipulated/independent variable, a place to record measurements (data), and a place to show averages or other statistics.

You will use a similar table below to record your data; each part of the chart is labeled for you.



Type of Airplane	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average Distance
1.						
2.						
3.						

7. **Analyze Data:** After your data is collected and recorded, you have to make sense of it. You look for patterns, trends, and relationships. You are really asking yourself, "What does this data mean?" Making a graph, pictogram or chart is a good way to help analyze your data.

   a. **Make a bar graph** that places the independent variable on one axis and dependent variable on the other. Be sure to include numerical values on the axis and a title for your graph.

8. **Draw Conclusions:** A conclusion is a discussion of the data. The data is described and explained and the hypothesis is accepted or rejected. A hypothesis is not described as "right" or "wrong" but rather as accepted, supported by data, or rejected, not supported by data. Write a conclusion that restates the hypothesis and states why the hypothesis is either accepted or rejected:

9. **Retest:** In a real laboratory you would retest your conclusion if your hypothesis was accepted, or change the hypothesis based on the data collected and test the new hypothesis. In this lab, you will simply answer the following questions:

    a. Would you expect the same results if you repeated the experiment? Explain why.

    b. How could you change your procedure to better test your hypothesis?