

STUDENT LABORATORY — Investigating the Behavior of a Paper Helicopter

Full Name: _____
Lab Section: _____ **Lab Instructor:** _____

Lab Date: _____
Credit: 1 lab period

Objective

To make use of scientific inquiry in posing questions and testing hypotheses regarding the behavior of a paper helicopter.

Materials

- Paper helicopter template (see last page), Scissors, 4 Paperclips of the same size (staples or small safety pins can also be used), Ruler, Ballpoint pen, Stopwatch, Calculator

Procedures & Observations — Part 1

1. Construct a helicopter according to the instructions on the last page of this lab.
2. Stand up. Hold the helicopter from its tip between your thumb and index finger. Extend your arm upward and release your helicopter. Observe its flight.
3. Make three observations of the flight of the helicopter. The observations can be qualitative or quantitative.
4. Reverse the orientation of the wings “X” and “Y” and fly your helicopter again. Write down your observations. How did the helicopter respond?
5. How did you verify this observation?
6. List four *variables* that may influence how the helicopter behaves. A variable is any factor that can be manipulated or changed in an experiment. Changing the orientation of the wings is an example of one variable in this experiment.

Part 2 — Going Further

Make a prediction. What do you predict will happen to the helicopter if its weight is increased by adding paperclips?

1. Write your prediction in the form of an “if ____, then ____” *statement* below.
2. When you release the helicopter, you will time how long it takes for the tip to hit the floor. Record the time to the nearest 0.01 sec in the data table below.
3. Start with no paperclips and practice timing the release a few times, always dropping the helicopter from the same height and the using the same release method.
4. Perform three timed trials without a paperclip. Record your data in the table on the next page.

5. Add a paperclip to the tip of the helicopter where it is marked “D” (add a staple or a safety pin if you don’t have paperclips). Release the helicopter and record the time it takes to hit the floor. Repeat for 3 trials.
6. Increase the number of paperclips each round according to data table 1, adding up to 4 paperclips. Record your data for all trials in the table.
7. When calculating your average, round to the nearest tenth (0.01) of a second.

Data Table 1.

Number of paperclips	Air-Time in seconds for each of 3 trials				
	(Record to the nearest 0.01 Sec.)				
	1	2	3	Your Average	
0					
1					
2					
3					
4					

Summary Questions

1. Define the term *independent variable*.

What is the independent variable in this investigation?

2. Define *dependent variable*.

What is the dependent variable in this investigation?

3. Define *control group*.

What is the control group in this investigation?

4. Define a *constant* or *constant variable* in an experiment.

List at least 3 constant variables.

5. Based on your data, what happens when you increase the number of paperclips on the helicopter (Write in a full sentence)?
6. Was your prediction supported by the data? Explain.

***Note — Save this lab for your records. We will be using the data you collected today for next week’s lab.**

Helicopter Template

Paper Helicopter Instructions

**Note – If you can't print out the helicopter master to the right, you can sketch it out on a sheet of paper using the "Dimensions" below. If you can print it out, then skip to "How to make your Helicopter".*

Dimensions

The width of the helicopter is 2" and the total length is 10".

The X and Y blades are 4.5" long, the space between XY and ABC is 1.25". The bottom including A, B, C, and D, is 4.5" long and tab "D" is 0.5" long.

How to make your Helicopter

1. Start by trimming the excess paper by cutting along the heavy dark lines around the perimeter of the template.

2. Cut along the dashed lines between X and Y and above A and C. Be careful not to cut across the top of B.

3. Using a ruler or straight edge, take a ballpoint pen and trace over the thin solid lines with firm, but not heavy pressure. This will make folding easier and more precise.

4. Now fold tab C behind B, and then fold A on top of B. Smooth the folds so the tabs nestle together.

5. Take tab D and fold it up and on top of A B and C. It might stick out a little bit and form a "J" shape at the bottom. That's ok.

6. Fold the "blades" X and Y in opposite directions.

7. Standing up, hold the 'copter by the D tab area between your thumb and index finger and then let go!

8. Fine tune the folds and blade angle to get your helicopter to fly in a proper manner.

Happy flying!

