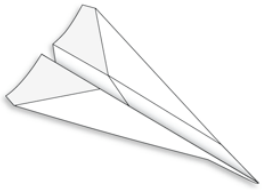
Lab: Paper Airplanes

2 pts ec printing

Purpose: To design & create a paper airplane that can either cover the **greatest distance** or have the **greatest speed**. You will be working with a partner to take turns being the **Pilot** (throw the plane) or the **Engineer** (measures and records the plane's flight time and distance).



Consider all of the factors that are important in a paper airplane:

1. Plane design
2. Size of paper
3. Plane mass (add paper clips?)
4. Throw technique & angle

Decide which ONE factor from above you are going to explore in today's lab:

Independent Variable: We are going to **change** the_____

Dependent Variable: We are going to **measure** the _____

Controls: We will **not change** the: _____

Airplane #1

1. Make a paper airplane (duh).
2. Head to the testing area. The Pilot should stand at the Launch Line while the Engineer heads to the waiting area with the meter sticks, stopwatch, & clipboard.
3. The Engineer prepares the stopwatch, tells the Pilot when to throw, records the flight time of the plane, and measures the flight distance. Repeat this two more times for a total of three trials.
4. Reconvene to calculate the average time, distance, & speed of this plane.

Flight	**Time** (s)	**Distance** (m)	**Speed** (m/s)	**Notes about Flights**
Trial 1				
Trial 2				
Trial 3				
Average				

13. Based on your data, what improvements can be made to your airplane?

14. What ONE variable are you going to change for Airplane #2? _____

Airplane #2

15. Consider what you want to change in this second airplane. Remember, it's ONE variable you should change. If you change multiple variables at once, you won't be able to pinpoint the solution..
16. See your teacher for supplies to make a new airplane.

17. Repeat steps 1-4 from the previous page.

Flight	**Time** (s)	**Distance** (m)	**Speed** (m/s)	**Notes about Flights**
Trial 1				
Trial 2				
Trial 3				
Average				

18.Based on this data, did your improvements work? Explain. What improvements do you still need to make, if any?

5. What ONE variable are you going to change for Airplane #3? _____

Airplane #3

6. OK, third time's a charm. Think you know what to fix this time? See your teacher for supplies.
7. Repeat steps 1-4 from the previous page.

Flight	**Time** (s)	**Distance** (m)	**Speed** (m/s)	**Notes about Flights**
Trial 1				
Trial 2				
Trial 3				
Average				

Conclusion

8. What does it take to make the **Perfect Paper Airplane**? (say that ten times fast)

9. Imagine a paper airplane thrown at 24 m/s. Five seconds later, it slows down to 4 m/s. What is this plane's acceleration?

Lab: Science Friction

Part 1: Types of Friction - *Which of the 3 types of friction, static, sliding, and rolling, is the largest force and which is the smallest force?*

Pre-Lab: Define the 3 types of friction (page 121).

- **Static:** _____
- **Sliding:** _____
- **Rolling:** _____

Form a Hypothesis

- Which type of friction is the largest, or causes the most friction? _____ Explain _____
- Which type of friction is the smallest, or causes the least friction? _____ Explain _____

Procedures

1. Calibrate the spring scale by setting it to 0. To do this, pull the metal tab at the top of the scale.
2. Cut a piece of string, and tie it in a loop that fits in the textbook, as shown. Hook the string to the spring scale.
3. Practice the next three steps several times before you collect data.
4. To measure the **static** friction between the book and the table, pull the spring scale very slowly. Record the largest force on the scale *before* the book starts to move.
5. After the book begins to move, you can determine the **sliding** friction. Record the force required to keep the book sliding at a slow, constant speed.
6. To calculate the **rolling** friction, place two or three markers under the book to act as rollers. Make sure the rollers are evenly spaced. Place another roller in front of the book so that the book will roll onto it. Pull the spring scale slowly. Measure the force needed to keep the book rolling at a constant speed.

Type of Friction	Force ( )
Static	
Sliding	
Rolling	

Analysis

1. Which type of friction was the **largest**? _____
2. Which type of friction was the **smallest**? _____
3. Do the results support your hypothesis? Explain why or why not & provide a possible explanation for why you obtained the given results.

Part 2: Sliding Friction & Surfaces – *How do different surfaces affect sliding friction?*

Hypothesis: Of the surfaces listed, which will produce the greatest frictional force? _____
Which will produce the smallest force? _____

Procedures

1. Use a book cover or a ring binder to make a ramp.
2. Make the slope steep enough so that a metal washer will just slide all the way to the bottom.
3. Find the angle of the slope by placing a protractor perpendicular to the angle of the slope. Use the picture & record the final angle in the data table.
4. Tape or hold one of the surfaces onto the binder & find the angle at which the same metal washer will slide to the bottom.
5. Repeat steps 2-4, but with a rubber stopped instead of the washer.

Surfaces
Aluminum Foil
Binder Paper
Bubble Wrap
Cloth
Construction Paper
Plastic Wrap
Sand Paper
Wax Paper

Surfaces	Slope Angle – Metal Washer	Slope Angle – Rubber Stopper
Aluminum Foil		
Binder Paper		
Bubble Wrap		
Cloth		
Construction Paper		
Plastic Wrap		
Sand Paper		
Wax Paper		

Analysis

1. Of the surfaces, which one required the **smallest** angle of slope for the ring to slide to the bottom of the ramp? _____ What makes that surface different from the others?

2. Of the surfaces, which one required the **largest** angle of slope for the ring to slide to the bottom of the ramp? _____ What makes that surface different from the others?

3. How did the slope angles change between the metal washer & the rubber stopper?

4. Are your results accurate or inaccurate? Explain.