Exploring Aviation Science

For grades 6-8
ETA 120 mins

SYNOPSIS:

To develop young students interest in aviation science and teach students the principles of air and flight.

NEXT GENERATION SCIENCE STANDARDS

MS-ETS1-3.	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4.	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
MS-PS2-2.	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [*Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.*]

OBJECTIVES:

By the end of this experiment, students will be able to:

- Understand what it means for a plane to have THURST.
- Understand the force of GRAVITY.
- Understand what it means to have LIFT in terms of a plane.
- Understand what DRAG is and how if effects an airplane.
- Principles of AIR.

INTRODUCTION

Through physical experimentation, students will learn about the principles of air and the properties of objects and materials as they explore the basics behind the four forces of flight. Students will be divided into groups and discover the effects of gravity on a tennis ball, the thrust provided by an inflated balloon, the drag created by friction and the lift produced by their own hands in a stream of air.

CAREER CONNECTION

- ***Pilot***
  DUTIES: To be able to understand how to appropriately manage and fly an aircraft.
  EDUCATION: flight education and aviation knowledge.
- ***Aeronautical Engineer***
  DUTIES: The role is focused on improving flight safety, fuel efficiency, speed and weight, as well as reducing system costs and using advancing technologies to meet customer needs. Increasingly, the role addresses the environmental impact of air travel.
  EDUCATION: At least a bachelor's degree in engineering.
- ***Aerospace Engineer***
  DUTIES: Aerospace engineers design components of spacecraft, aircraft, satellites, missiles, and other types of aerospace products.
  EDUCATION: At least a bachelor's degree in engineering.

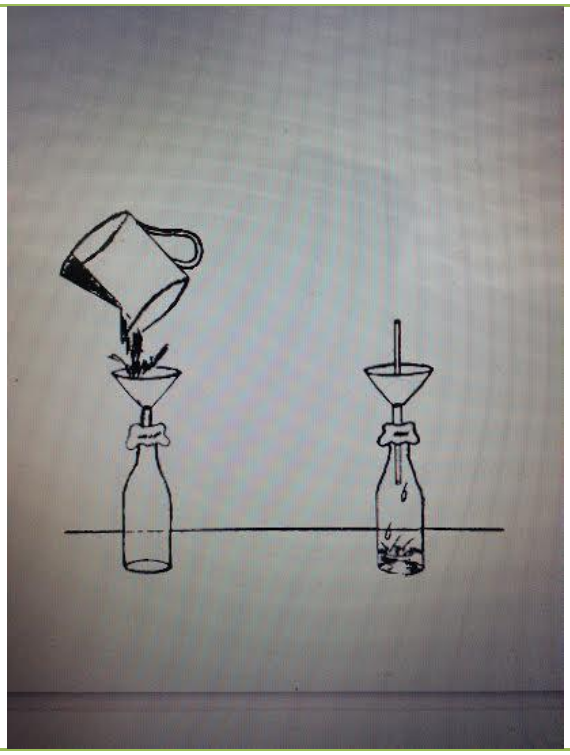
MATERIALS LIST #1

Materials

- Soda pop bottle
- Small funnel
- Soda straw
- Modeling clay or Masking tape
- Cupful of water

GOAL OF LAB #1

Seal the funnel tightly into the neck of the bottle with the tape or clay. Pour a **cup** of water into the funnel **quickly**. The water stays in the funnel because the air in the bottle cannot get out. Pass the straw through the funnel into the bottle. Suck out a mouthful of air. Some of the water goes down into the bottle, taking the place of the air sucked out.



PROCEDURE IN DETAIL #1

1. The students should pair up into groups of two or three.
2. Place funnel inside of soda bottle.
3. Seal the two together with either the masking tape or modeling clay.
4. Once secure quickly pour a cup of water into the funnel.
5. Write down observations and describe what you see to continue.
6. Next stick the straw though the funnel passes the water and into the bottle and see what happens once you suck air out of the bottle.
7. Write down any observations
8. Lastly give a brief explanation on what you did and what you saw.

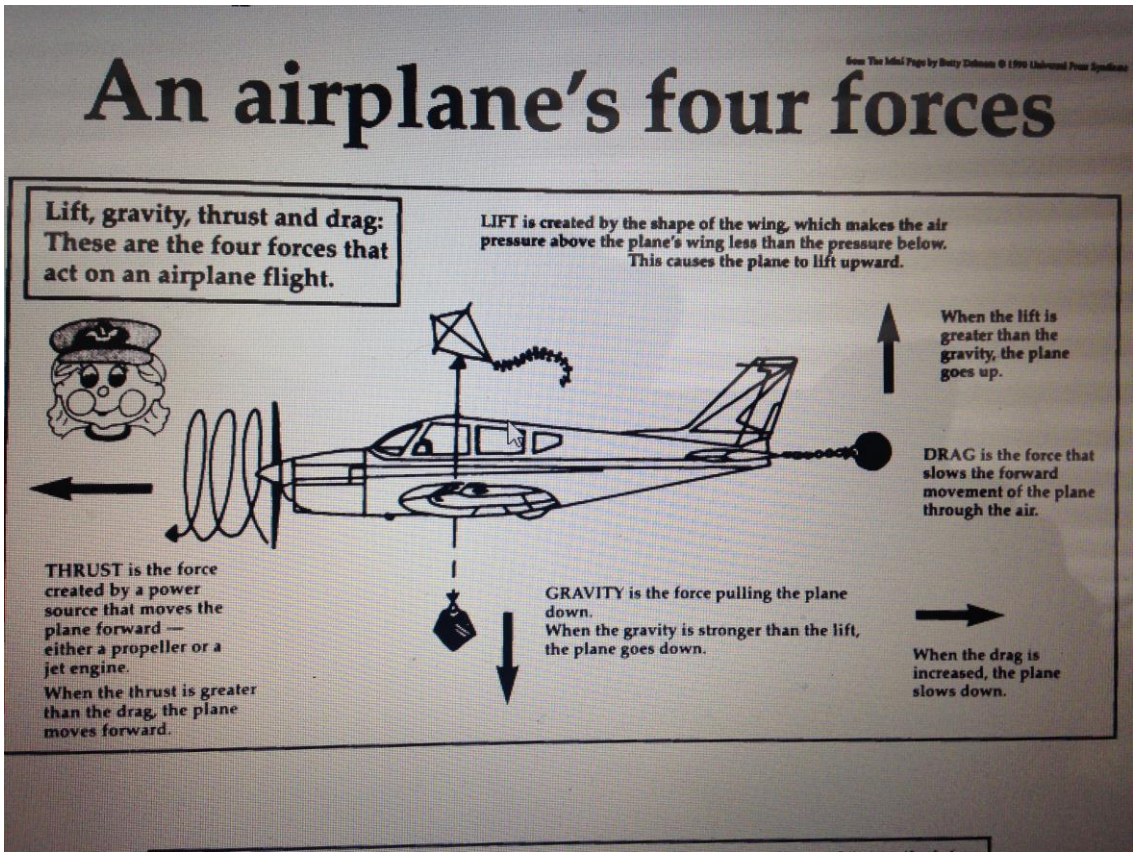
MATERIALS LIST #2

Materials

- Balloons
- Tennis balls
- Box fan
- High friction material (sandpaper)
- Large book
- Paper

GOAL OF LAB #2

The lab will be divided into four different stations, with one station specific to each force. Students will be divided into four groups and each group assigned to a station. After performing the listed tasks at that station, the groups will rotate to the next. Thus giving them a chance to actually see the forces at hand.



PROCEDURE IN DETAIL #2

Station One: Thrust

• Have each student, or designated students, blow up a balloon using either their mouths or a balloon pump. The air inside the balloon is pushing in all directions to get out. Some of the air escapes through the open neck, but the air at the opposite end of the balloon cannot get out, so it pushes the balloon forward.

Station Two: Drag

• Each student should slide the book across a smooth surface such as the table. Next, ask them to slide the book again, but this time over a sandpaper or carpeted surface.

Station Three: Weight

• Ask each student, or designated students, to roll the ball along a flat table and watch what happens as it

reaches the end of the table. Then to roll the ball along a incline and watch what happens.

Station Four: Lift

• Have each student hold one hand flat (palm facing down) against the blowing stream of air with a piece of paper on their palm. Now have them tilt the front of their hands slightly with the piece of paper on their palm and observe. They should feel their hands start to rise. This is due to lift being produced as the air travelling over the top of the hand is moving quicker than the air underneath.

QUESTIONS TO ENGAGE STUDENTS

Why do you think understanding air is important to aeronautics?
Why is lift important?
Can a plane fly without thrust?
How do you think a plane is able to turn and maneuver?
What do you think the relationship between drag and thrust is?
Can you think of any other types of fly aircraft than an airplane?

GOAL OF LAB #3

This lesson introduces students to the art of designing an airplane through paper airplane constructions. The goal is that students will learn important aircraft design considerations and how engineers must iterate their designs to achieve success. Students first follow several basic paper airplane models, after which they will then design their own paper airplane. They will also learn how engineers make models to test ideas and design

PROCEDURE IN DETAIL LAB #3

Please Visit: https://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_airplanes/cub_airplanes_lesson06.xml

Sources:
https://www.aiaa.org/uploadedFiles/Education_and_Careers/STEM_K-12_Outreach/Kids_Place/Airplane_Activities/Aviation%20Science%20Activities%20for%20Elementary%20Grades.pdf

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