Ages 7-9

Aerodynamics – The Science of Air

PROJECT DESCRIPTION

In this session students will assemble, design, and or make an airplane while learning the fundamentals of aerodynamics, the science of flight.

OBJECTIVES

- Explore the concepts of aerodynamics and aviation
- Discover the fun and fascination of science
- Understand the four competing forces of flight; Gravity, lift, thrust, and drag.
- Design and assemble an airplane that fly far and straight based on their understanding of gravity, lift, thrust, and drag.

ENGAGE

Start with a bang! “We are going to make airplanes today, the student that builds the airplane that flies the farthest wins” (give prizes if you have something). Now that you have their attention.

- Talk about airplanes; ask questions about family fights, travel, museums, history, etc. Based your discussion on your student population’s cultural, demographics, and relevancy of what you think surrounds their experience with airplanes. If you are in an underprivileged area where kids have never traveled beyond their neighborhood, talking about family trips may not resonate.

Next, review the foundation of aerodynamics. Talking points:

- The power of air. Although air is invisible, it’s all around us and weighs quite a bit. Air that fills your bedroom weights about 100 pounds. This weight of air is what creates air pressure. We don’t feel air pressure because it is the same inside and outside our bodies. Therefore, when a plane flies, it’s a balancing act.

Click here to show video: (https://youtu.be/eSF6ghOxekM)

MATERIALS

- KNT Airplane Templates

PRE-REQUISITES

- TEACHER: Watch the video before workshop
- Review science notes.
- Make a paper airplane

- STUDENTS: Basic art skills,

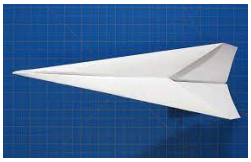
  i.e. use of scissors, cutting inside of lines, etc.

TECHNOLOGY REQUIRED

Computers with high speed Internet, smart board or projector to show videos.

PROJECT BUILD

- **Paper Airplane**



KNT DESIGN PROCESS

PROJECT/PROBLEM – Review project, read through instructions.

PREPARE/ PLAN- Lay out all out your materials that are required to make your project as listed in each step.

INSTRUCTIONAL SEQUENCE

Just before starting the build activity, demonstrate your sample plane in 3-5 quick seconds.

- As you position to throw the plane, describe “thrust”.
- As the plane take off, describe lift!
- As the plane begin to descend, announce drag!
- As it hit the ground, announce gravity!

STEP 1: Based on learner's skill level, assign the type of airplane they will make

STEP 2: Assemble airplane according to instructions.

STEP 3: Upon completion, move class to outdoor area.

STEP 4: Find a suitable open area to test airplanes!

Encourage your students to start with a smooth, steady throwing motion, and then gradually have they increased their throw (or thrust).

Paper airplanes with the larger amounts of wing area (more lift) should stay aloft longer. While sleeker designs with swept wings (less drag) should fly faster.

ADAPTATIONS

If time allows:

- Fly Planes indoors if large area is available. i.e. gym
- Flying contest, measure distance; Analyze Which airplanes flew the farthest distance and why? Which airplanes flew the fastest and why?
- Redesign planes if time permits
- Start flying again!

SCIENCE NOTES:

Explain Gravity, Thrust, Lift, and Drag:

Gravity is what causes any object you throw into the air to come back to the ground; Earth has a magnetic force that pulls things to the ground, therefore, gravity works against an object. The lighter your paper is, the less it will need to fight against gravity pulling it to the ground.

Thrust is the force that causes an object to move forward through the air. Your arm thrust behind your plane. So, it’s important how you aim and throw.

Drag is the force that slows the airplane down. Drag is produced when air flowing over the plane causes friction. When the plane is flying, it must push oncoming air out of the way. As this air is pushed around the plane, it bumps into other air molecules.

Lift and thrust help to keep a plane flying. Gravity and drag work against it. We can't do anything to change gravity, but we can try to minimize drag and increase thrust.

BUILD IT – Follow instructions

TEST IT – Use your project for its intended use. Compare the appearance of your project to the sample. Does it look the same? Similar? Better? Or lacking the same appeal?

TWEAK IT – Change the project in the areas that should be improved

TN CC Standards for 4th Grade Science:

- 4.PS1.B - Develop models to describe the motion of objects, including the effects of gravity, friction, and air resistance.
- 4.PS1.C - Develop models to describe the flow of energy in a system, including the transfer of energy by conduction, convection, and radiation.
- 4.ESS1.C - Investigate and understand the relationship between the Earth's atmosphere and the weather.
- Specifically, the following standards address the concepts of aerodynamics:
- 4.PS1.B.2 - Plan and conduct an investigation to determine the effect of air resistance on the motion of an object.
- 4.PS1.C.4 - Explain how the transfer of energy by conduction, convection, and radiation can be used to explain the heating and cooling of Earth's atmosphere.
- 4.ESS1.C.3 - Explain how the atmosphere affects the Earth's temperature and weather.

These standards require students to understand the basic principles of aerodynamics, such as the effects of air resistance and the transfer of energy by conduction, convection, and radiation. They also require students to be able to design and conduct experiments to investigate these concepts.

By mastering these standards, students will develop a deeper understanding of the science of air and how it affects the Earth's atmosphere and weather. This knowledge will help them to make informed decisions about how to use and conserve energy.

What I Learned

Answer the following questions:

What is gravity?

A) A force that makes objects fall to the ground.
B) The force that pushes objects away from each other.
C) The force that lifts objects into the air.

Which of the following is an example of lift?

A) A kite soaring in the sky.
B) A rock falling to the ground.
C) A car driving on a road.

What is drag?

A) A force that pulls objects toward each other.
B) A force that slows down objects moving through air or water.
C) A force that makes objects float.

Which of the following best describes how gravity affects objects of different sizes?

A) Gravity affects all objects the same way, regardless of size.
B) Gravity pulls larger objects harder than smaller ones.
C) Gravity pulls smaller objects harder than larger ones.

Which of these activities is most affected by both lift and drag?

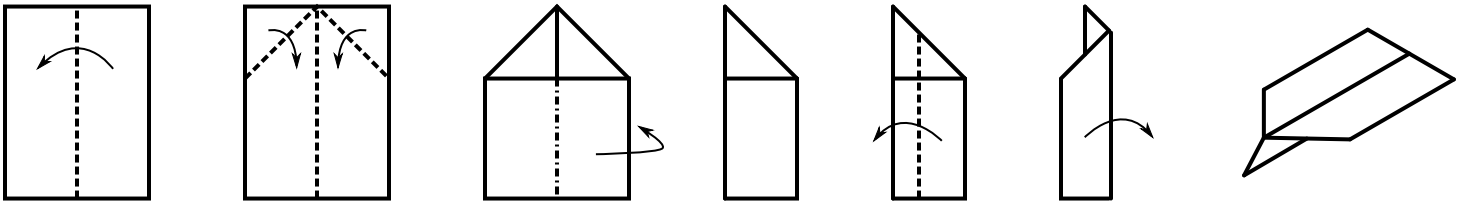
A) Riding a bicycle.
B) Swimming in a pool.
C) Flying a paper airplane.

Answers:
A) A force that makes objects fall to the ground.
A) A kite soaring in the sky.
B) A force that slows down objects moving through air or water.
B) Gravity pulls larger objects harder than smaller ones.
C) Flying a paper airplane.

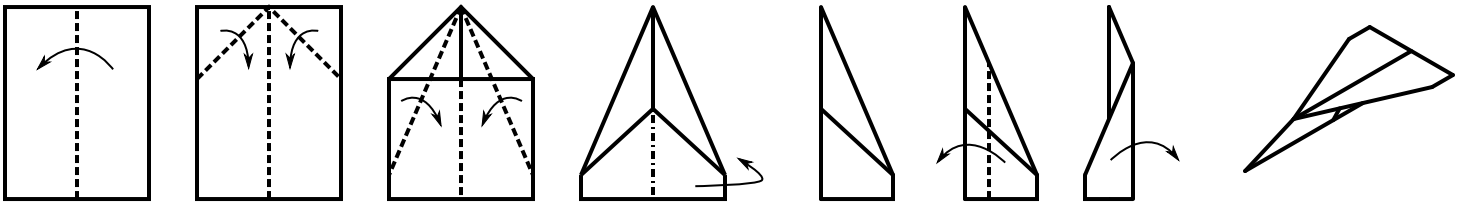
PAPER AIRPLANE TEMPLATES

Use 8.5 x11 Paper and fold as shown.

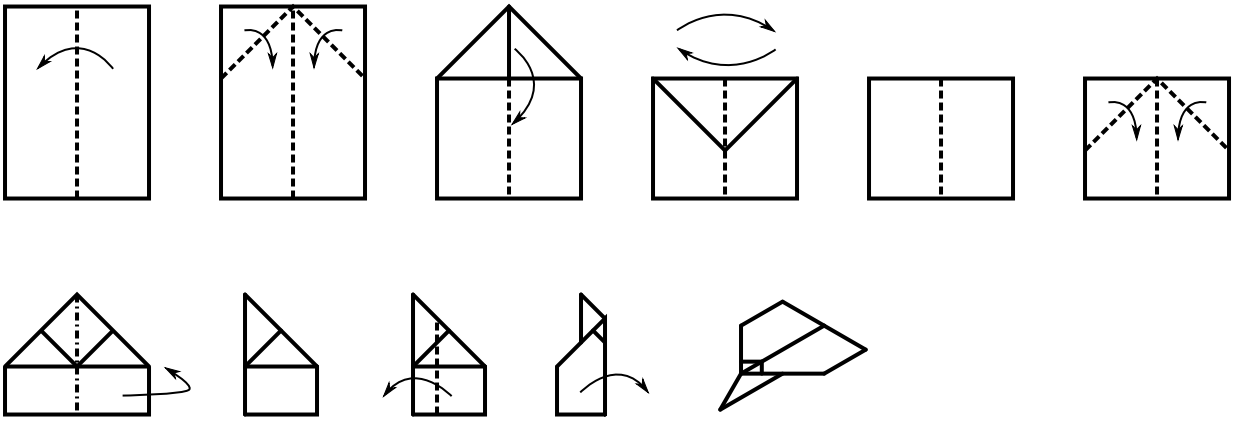
Beginner



Intermediate



Advanced



Stunt plane