



SAMPLE LESSON PLAN

What a Paper Airplane can teach your students

LESSON TOPIC:

Why Do Paper Airplanes Fly?

GRADE LEVEL:

Any - with teacher modifications as needed.

TIME:

30 - 60 minutes

MATERIALS:

8.5 x 11 copy paper
Paper clips

VOCABULARY:

Aerodynamics
Drag
Gravity
Thrust
Lift

OBJECTIVE:

After a lesson on aerodynamics, the students will create and then launch a paper airplane that demonstrates the four forces of aerodynamics (drag, gravity, lift and thrust).

INTRODUCTION OF LESSON:

Questions for students:

1. "We have all seen planes fly. Raise your hand if you have ever flown in a plane?"
- student response -
2. "Have you ever wondered how a plane can fly through the air?"
- student response -

Today we will learn about flight and at the end of the lesson each of you will create your own paper airplane and launch it outside!!!

PREDICTION:

As a class list your predictions on the chalkboard of why an airplane can fly.



PRESENTATION OF KNOWLEDGE AND ACTIVITIES:

Aerodynamics:

Aerodynamics is how easily an airplane moves through the air.

• **Simple in-class aerodynamic demonstration**

- Ask your students to hold one of their hands in front of their body with the palm facing sideways so that the thumb is on top and pinkie is facing the floor (like they're reaching out to shake someone's hand). Have the class swing their hands back and forth. Notice the amount of air pushing against the hand?
- Now ask your students to turn their palm so their hand is horizontal and parallel to the floor. Then ask them to swing their hands back and forth like they're slicing it through the air. They should still be able to feel the air, but now their hands are able to move more smoothly than when the hand is positioned the other way.

Drag & Gravity:

Drag is when air resists the forward motion of the plane.

- There are many factors that affect the amount of drag. The shape of the paper airplane is one of them. In order to reduce drag and allow the plane to fly as far as possible, you want a plane that creates as little drag as possible. So it moves through the air just like the students hands did when their palms were parallel to the floor.

Gravity is the force that will be pulling a paper airplane to the ground.

- In order to make a paper airplane fly as far as possible and help fight against gravity, they must keep their plane as light as possible.

• **Simple in-class gravity demonstration**

- Slip a paper clip on the edge of a sheet of paper and see how quickly the sheet falls to the floor. Now remove the paper clip and watch how long it takes the paper to float back and forth before finally landing on the floor. The lighter your paper is, the less it will need to fight against gravity pulling it to the ground.

Thrust & Lift:

Thrust is the forward motion of a plane.

- For full size airplanes, the engine is what generates the thrust. For paper airplanes, thrust is created by the forward launch of the thrower's arm.

To overcome gravity and the weight of a paper airplane pulling it to the ground, all airplanes create an opposing force called lift.

- Lift is created when the air below the airplane wing is pushing up harder than the air above it is pushing down. The wings are doing the lifting, not the engines or thrust. The wings of a plane are usually curved slightly so that the air can move more quickly over the top of the wing than the air moves below the wing. This creates an upward push on the wing which generates lift.



APPLICATION OF KNOWLEDGE ACTIVITY:

- **Simple outdoor thrust/lift demonstration**

- It's time to have your students fold paper airplanes! Use the template provided or let them create their own designs. Once each student's plane is ready, go outside and find a suitable open area. Encourage your students to start with a smooth, steady throwing motion, then gradually have them increase 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 and farther.

CLASS DISCUSSION AND QUESTIONING:

1. Which airplanes flew the farthest distance and why?

2. Which airplanes flew the fastest and why?

*Think about your predictions at the beginning

CONCLUSION:

The motion of the plane through the air depends on the balancing of forces. The aircraft can cruise at constant velocity, if the forces are balanced. If the forces are unbalanced, the plane will accelerate in the direction of the greatest force.

The paper airplane template we suggest using is the basic Dart. See the included template on the next page.

Think about one new thing that you learned in today's lesson.

- Tell your partner
- Tell your parents tonight
- Write a journal entry

ADDITIONAL READING MATERIALS:

Blackburn, Ken & Lammers, Jeff. The World Record Paper Airplane Book. New York: Workman Publishing, 2006