Name: _____

CASE

Activity 3.3.4 Atomizing Air

Purpose

Have you ever flown in an airplane? How does the airplane lift off the ground? What are the properties of air that lift it up?

Bernoulli's Principle is the basis of how objects fly. The pressure of the air beneath a wing lifts an airplane when the air flows faster over the top of the wing than it does on the bottom of the wing. The air pressure on the top of the wing decreases as the airflow speeds up. With a higher pressure beneath the wing, the air lifts the airplane off the ground. Bernoulli's Principle states as the speed of a fluid increases, the pressure within the fluid decreases. Many machines use this principle to function. Figure 1 shows a picture of an airplane wing. The air beneath the wing has a lesser distance to travel than the air that flows over the wing. Therefore, the air flowing over the top moves faster, reducing the pressure on top and causing the wing to lift.

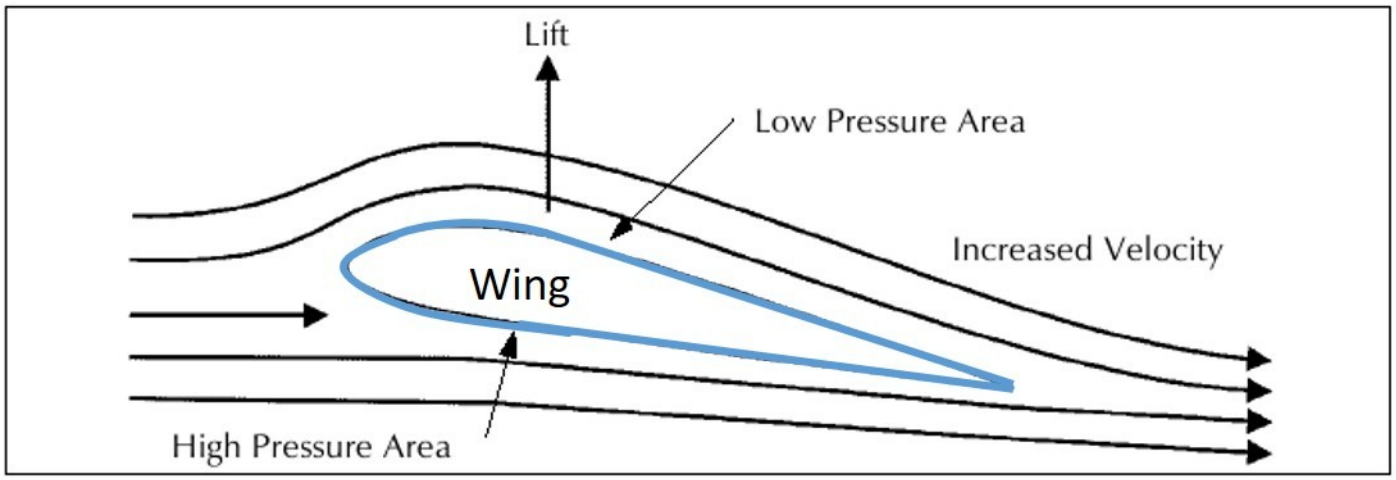

Figure 1. Airplane Wing

A spray bottle is an example of an atomizer that uses Bernoulli's Principle. An atomizer takes liquid from a bowl and distributes it as a vapor into the air. The vapor consists of suspended liquid molecules. Gasoline is a material that must be atomized before it can be used. An engine component called a carburetor atomizes gasoline. The carburetor vaporizes the fuel and distributes it into the engine to ignite and produce power.

Where can you observe Bernoulli's Principle? How can you vaporize a liquid using Bernoulli's Principle?

Materials

Per pair of students:

Frisbee
100′ tape measure
2 plastic flags
Ruler
2 straws
3″x3″ paper
Scotch tape
Foam cup
Water

Per student:

Pencil *Agriscience Notebook*
Safety glasses

Procedure

Work with your partner to demonstrate Bernoulli's Principle and then construct an atomizer that converts water into a vapor.

Part One – Taking Flight

Obtain a Frisbee from your teacher.

Draw the top, side, and bottom views of the Frisbee in the space provided on *Activity 3.3.4 Student Worksheet*.

Use a ruler to record the dimensions of the Frisbee in Table 1 on the student worksheet.

Go outside to an open area as instructed by your teacher.

Place a flag in the ground.

Throw the Frisbee with the curved side up while standing by the flag.

Record observations of how the Frisbee flew in Table 2 on the student worksheet.

Place the second flag in the ground where the Frisbee lands.

Measure the distance using a 100′ tape measure and record the distance in Table 2.

Remove the flag where the Frisbee landed.

Repeat Steps 6 – 9 throwing the Frisbee with the curved side down.

Measure the distance using a 100′ tape measure and record the distance in Table 2.

Answer Part One analysis questions on the student worksheet.

Part Two – Blow the Roof Off

1. Set a foam cup on the table to simulate a barn with no roof.
2. Place a 3″x3″ piece of paper on top of the cup covering the opening. The paper will represent the roof of the barn.
3. Tape one side of the paper to the cup using a piece of scotch tape. The roof is now fastened to the barn.

Blow over the top of the paper with the taped side facing you to simulate a wind storm.

Answer Part Two analysis questions on the student worksheet.

Part Three – Atomizer

1. Put your safety glasses on.

Fill a foam cup half-full of water.

Place a straw in the water so the top of the straw is approximately 3cm above the lip of the cup.

Have your partner hold the straw vertically in the cup

Place a second straw next to the top edge and perpendicular to the straw that is in the cup. Half of the opening of the perpendicular straw should be against the vertical straw and the other half should be above the opening of the vertical straw as seen in Figure 2.

Blow through the second straw so air flows directly over the vertical straw.

Answer the Part Three analysis questions on the student worksheet.

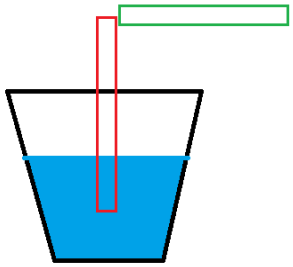

Figure 2. Atomizer

Conclusion

1. What is the relationship between the speed the fluid is moving and the pressure that is within the fluid?

2. Which side of the Frisbee has a faster air speed? Why?

3. Explain how you would design an atomizer to get vaporized fuel into an engine (sketch your design below)?

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Activity 3.3.4 Student Worksheet

Drawing of Frisbee

Table 1. *Frisbee Observations*

	Measurement (Inches)
Diameter	**9 inches**
Thickness of Lip or Rim	**7/8**
Height	**1 and 1/4**

Table 2. *Flight Observations*

Side	Distance Flown	Flight Observations
Curved Side Up	65.5	It can fly straight and farther
Curved Side Down	38.7	It can't go straight and does't go that far

Part One Analysis Questions

Compare the distances and the ability for the Frisbee to fly with the curved side up and the curved side down.
It's easier to throw the disc side up that side down, and it go farther

Use your measurements and observations to explain how Bernoulli's Principle allows a Frisbee to take flight.
the air in the bottom has a higher air pressure than the top part so it fly easier

Part Two Analysis Questions

What happens to the roof of the simulated barn?
It doesn't move and make a sound

Use Bernoulli's Principle to explain how a roof is blown off a building in a storm.
the pressure in the top is higher than the bottom

What could you do to prevent the wind from damaging the roof?
Tape the other parts of the glass

Part Three Analysis Questions

What happens to the water in the cup?
It goes up in the strews

How could you increase the amount of water in the vapor?

Make the strew shorter