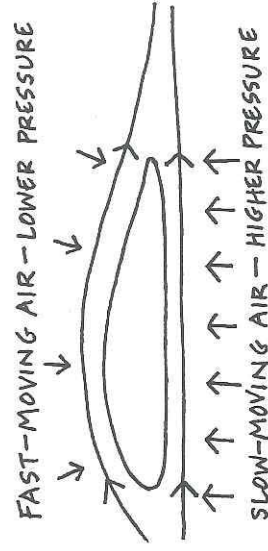


5

The Role of Lift in Overcoming Gravity

Science Background Information for Teachers

Bernoulli's Principle (discussed in the previous lesson) also applies to flight. The difference in pressures as air moves around an aircraft's wings creates lift. Lift is the upward force caused by differences in air pressure. All wings, be they aircraft or animal, have a curved surface on top and a flatter surface on the bottom. The curved surface on top of a wing forces air to travel faster, causing lower pressure. The flat surface on the bottom of the wing forces air to move slower, causing higher pressure. A smaller force is exerted on top of the wing, while a greater force is exerted below the wing. As a result, the wings are pushed upward.



Placing flaps on the leading and trailing edge of a wing, as in jet aircraft, increases the curve of the wing and, therefore, increases lift.

Materials

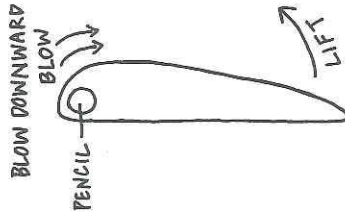
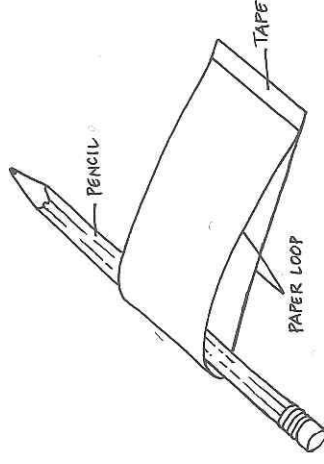
- pictures and/or models of various aircraft
- chart paper
- markers
- pencils
- scissors
- four different types of paper (such as newspaper, Manila tag, Bristol board, tissue paper), cut into 5 cm x 15 cm strips
- clear tape or masking tape

Activity

Display the pictures and/or models of various aircraft. Have the students closely examine the planes. Ask:

- What do you think enables a plane to fly?
- What makes the plane move forward?
- What makes the plane stay in the air?
- How are the wings shaped on the planes?
- How is the top of the wing shaped?
- How is the bottom of the wing shaped?
- How do you think air moves over and under the wing?

Explain that the shape of the wing on a plane plays an important role in keeping the plane in the air. Have the students construct a wing using their strip of paper, a pencil, and tape.



Have students hold the ends of the pencil so the wing hangs freely, then position the pencil just below their bottom lip. Now have the students blow downward over the top of the wing and observe that the wing lifts.

Ask:

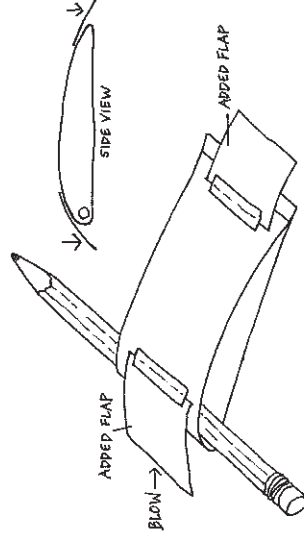
- Based on what you have learned about Bernoulli's Principle, why do you think the wing lifts?

Explain that the upward force caused by the air pressure differences is called *lift*. The fast-moving air over the wing causes an area of low pressure. The air under the wing is moving slower, therefore, the pressure is higher. This high pressure area exerts force, which lifts the wing. Record the term *lift* on the chart paper. Encourage the students to explain the concept of lift in their own words. Use their explanations to create a definition for this term, and record it on the chart paper. Include a diagram with the definition.

Have the students look again at the pictures or models of airplanes. Look specifically at the shape of the wings. Explain that the curved top of the wing causes air to move faster than the air moving past the flat bottom of the wing. Now focus on the wing flaps. Ask:

- What do you think is the purpose of flaps on the wings?

Have the students make flaps by cutting out small pieces of paper and taping them to the front and back of the wing.



Once the flaps are attached, have the students blow over the wings again. Elicit observations from the class and make comparisons about how the wings lift with and without flaps.

Note: Putting flaps on a wing makes the wing more curved, creating a greater lift.

Divide the class into working groups. Provide each group with several different types of paper. Give each group a copy of the activity sheet, and explain that their primary goal is to find the type of paper that is most suitable for making a wing.

Provide plenty of time for the groups to conduct their investigations. When the activity is complete, have each group present its findings to the class.

Activity Sheet

Directions to students:

Use the activity sheet as a guide for determining which type of paper makes the best wing (2.5.1).

Extension

Have each group make a double bar graph to communicate the findings of their wing test. Each pair of bars will represent a wing without a flap and a wing with flaps. Each double bar will represent the type of paper used to make the wing.

Note: Ensure that the bars representing the wing without flaps and the wing with flaps are placed directly beside each other. Make sure to leave a space between each double bar representing the type of paper used.

Assessment Suggestion

Observe the students as they investigate and test wings. Focus specifically on the students' ability to follow directions, construct wings, test the wings, record results, and draw conclusions. Use the anecdotal record sheet on page 12 to record results.

Date: _____

Name: _____

Wing Testing

1. Construct four wings using four different types of paper and tape.
2. Hang one wing from the pencil. Test the wing by blowing over it and observing the lift.
3. Rate the wing according to how you think it performed in your lift test. For example:

1	did not lift at all
5	lifted somewhat
10	lifted very well

4. Now make flaps for the wing, using the same paper. Attach the flaps and test the wing again. Rate the wing.
5. Repeat the test for each wing.

Note: Blow with the same amount of force and for the same length of time for all the wings. This will make it easier to compare and rate the wings.

Wing #1	Paper Type:
Lift without flaps:	1 2 3 4 5 6 7 8 9 10
Lift with flaps:	1 2 3 4 5 6 7 8 9 10
Observations:	_____

Wing #2

Paper Type: _____

Lift without flaps: 1 2 3 4 5 6 7 8 9 10

Lift with flaps: 1 2 3 4 5 6 7 8 9 10

Observations: _____

Wing #3

Paper Type: _____

Lift without flaps: 1 2 3 4 5 6 7 8 9 10

Lift with flaps: 1 2 3 4 5 6 7 8 9 10

Observations: _____

Wing #4

Paper Type: _____

Lift without flaps: 1 2 3 4 5 6 7 8 9 10

Lift with flaps: 1 2 3 4 5 6 7 8 9 10

Observations: _____

Conclusions

1. Did the wings lift easier with flaps than without flaps? Explain, using the results from your investigation.

2. What type of paper makes the best wings? Explain, using the results of your investigation.

3. Feel each wing in your hand. Rate the wings from the lightest to the heaviest.

Lightest: _____

Heaviest: _____

4. How did the thickness of the paper used affect the performance of each wing?
