

# Air and Aerodynamics

## Overview

Students explore the characteristics of air and the interaction between moving air and solids. They learn that air is a compressible fluid, that it is composed of many gases, and that moving air can support solid materials in sustained flight. By studying birds and airplanes, they learn a variety of adaptations and designs that make flight possible and that provide for propulsion and control.

## General Learner Expectations

*Students will:*

**6–5 Describe properties of air and the interactions of air with objects in flight.**

## Specific Learner Expectations

*Students will:*

1. Provide evidence that air takes up space and exerts pressure, and identify examples of these properties in everyday applications.
2. Provide evidence that air is a fluid and is capable of being compressed, and identify examples of these properties in everyday applications.
3. Describe and demonstrate instances in which air movement across a surface results in lift— Bernoulli's principle.
4. Recognize that in order for devices or living things to fly, they must have sufficient lift to overcome the downward force of gravity.
5. Identify adaptations that enable birds and insects to fly.
6. Describe the means of propulsion for flying animals and for aircraft.
7. Recognize that streamlining reduces drag, and predict the effects of specific design changes on the drag of a model aircraft or aircraft components.
8. Recognize that air is composed of different gases, and identify evidence for different gases. Example evidence might include: effects on flames, the "using up" of a particular gas by burning or rusting, animal needs for air exchange.

## Overview

Students apply their knowledge of aerodynamics to design, build and test a variety of flying devices. In constructing models, students develop a basic design, then build it, test it, and solve the problems that inevitably arise. Through teamwork they learn that planning, communication, cooperation and flexibility are important to the overall result, even though parts of a task can be worked on individually. In the process, students learn about the parts of an aircraft, their role in controlled flight and the differences between aircraft and spacecraft.

## General Learner Expectations

*Students will:*

**6–6 Construct devices that move through air, and identify adaptations for controlling flight.**

## Specific Learner Expectations

*Students will:*

1. Conduct tests of a model parachute design, and identify design changes to improve the effectiveness of the design.
2. Describe the design of a hot-air balloon and the principles by which its rising and falling are controlled.
3. Conduct tests of glider designs; and modify a design so that a glider will go further, stay up longer or fly in a desired way; e.g., fly in a loop, turn to the right.
4. Recognize the importance of stability and control to aircraft flight; and design, construct and test control surfaces.
5. Apply appropriate vocabulary in referring to control surfaces and major components of an aircraft. This vocabulary should include: wing, fuselage, vertical and horizontal stabilizers, elevators, ailerons, rudder.
6. Construct and test propellers and other devices for propelling a model aircraft.
7. Describe differences in design between aircraft and spacecraft, and identify reasons for the design differences.

**Note:** Model aircraft or rockets may be constructed and used as part of this topic. It is recommended that these models be simple devices of the student's construction, not prefabricated models. Propulsion of rockets by chemical fuels is neither required nor recommended, due to safety considerations.