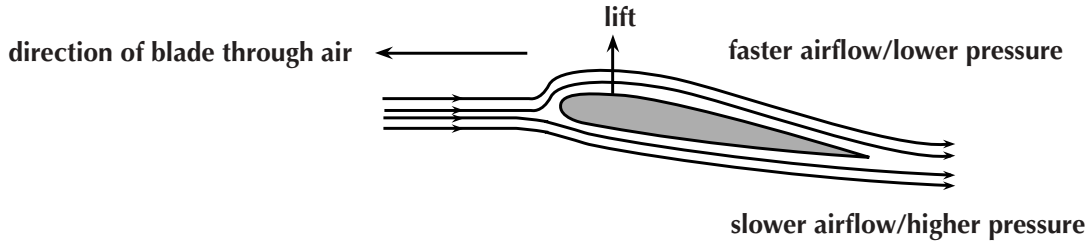
Rotor motor

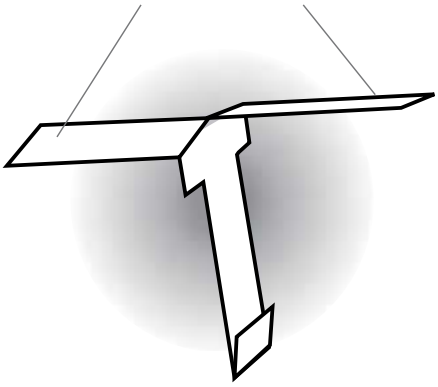


cross section of aircraft wing, or a rotor blade

Background

Air must move across the surface of a wing to produce lift. To fly, birds and insects use a flapping motion to move the air over and around the wing surface. The wings of airplanes are attached to the fuselage in a fixed position. Lift is generated by moving the entire wing and body through the air. *Helicopters* are *rotary wing aircraft*; they rotate the wing surface through the air to produce lift.

Lift is produced by the pressure differences caused by the shape of rotating blades; this is the same way lift is produced by aircraft wings. The rapidly moving air over the top of the blade creates low pressure; the air beneath the blade is moving slower, so it creates higher pressure (see "Paper Bag Mask" pages 26-27, Bernoulli's principle, for more information). High pressure under the rotor blades creates lift which causes the aircraft to rise.



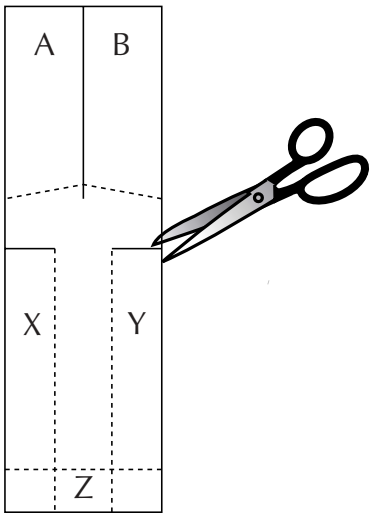
Since the paper models have no motor, they only have one source of lift. As the paper models fall they will spin, imitating the rotation of the rotor blades of a helicopter. Because there is no thrust to produce upward movement, the helicopter will not fly upward, but the spin will reduce the rate of fall by producing lift, resisting the force of gravity.

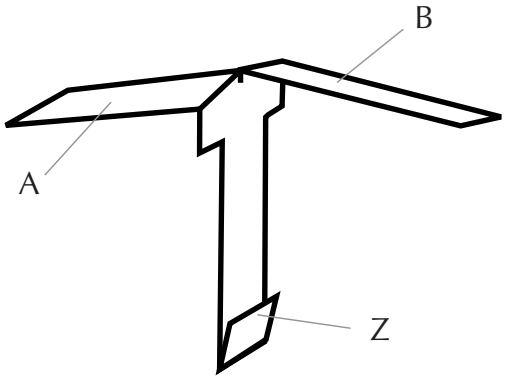
Materials

Plain white paper
Graph paper
Student Page with template and graph
Scissors
Measuring tape
Pencil or marker
3 m length of lightweight paper ribbon (or a strip of audiotape or videotape)

Activity

1. Cut along the solid lines of the template.



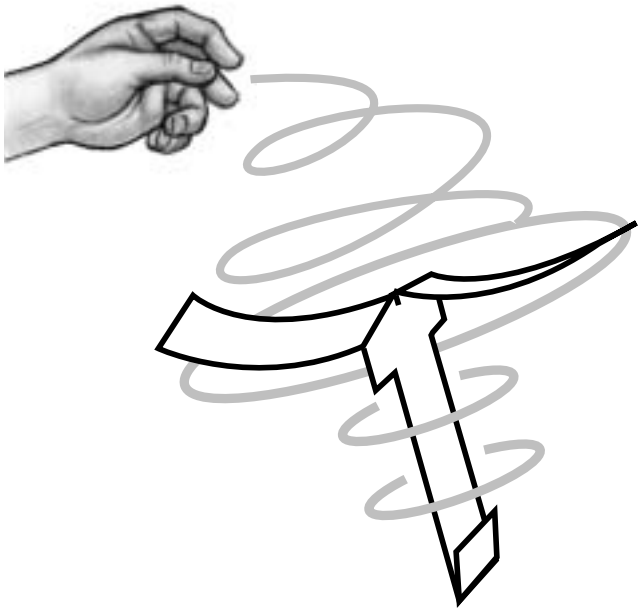


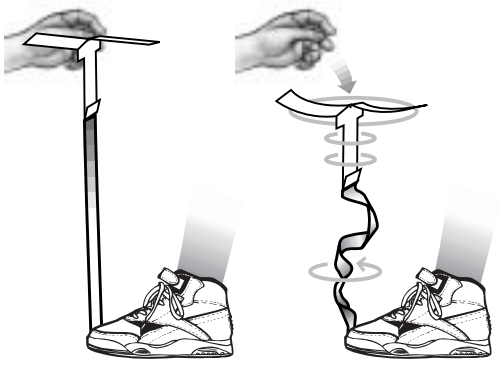
2. Fold along the dotted lines. The propeller blades should be folded in opposite directions. X and Y fold toward the center, and Z is folded up to give the body rigidity, and lower the *center of gravity.*

3. Stand up and drop the rotor motor.

4. Drop an unfolded piece of paper and the rotor motor. Which one falls faster? *The paper falls faster because it is not continuously generating lift. The spinning rotor motor reduces the rate of fall by producing lift, resisting the force of gravity.*

5. Have the students predict what will happen when they wad up the paper and drop it. *It will drop faster than the sheet of paper and the rotor motor. The sheet of paper falls slower mainly because its larger surface area offers more resistance to the air than the compact, wadded paper.*

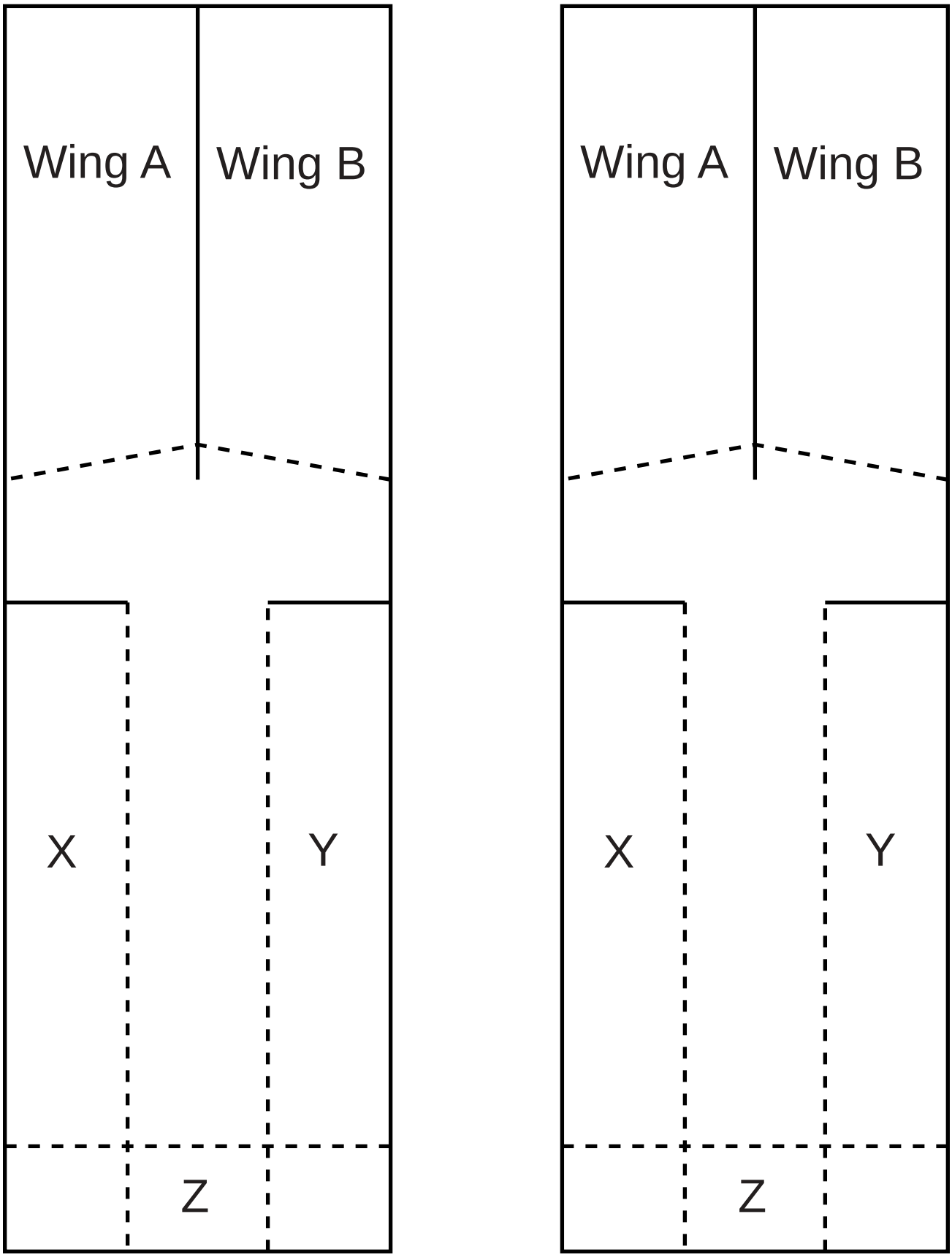


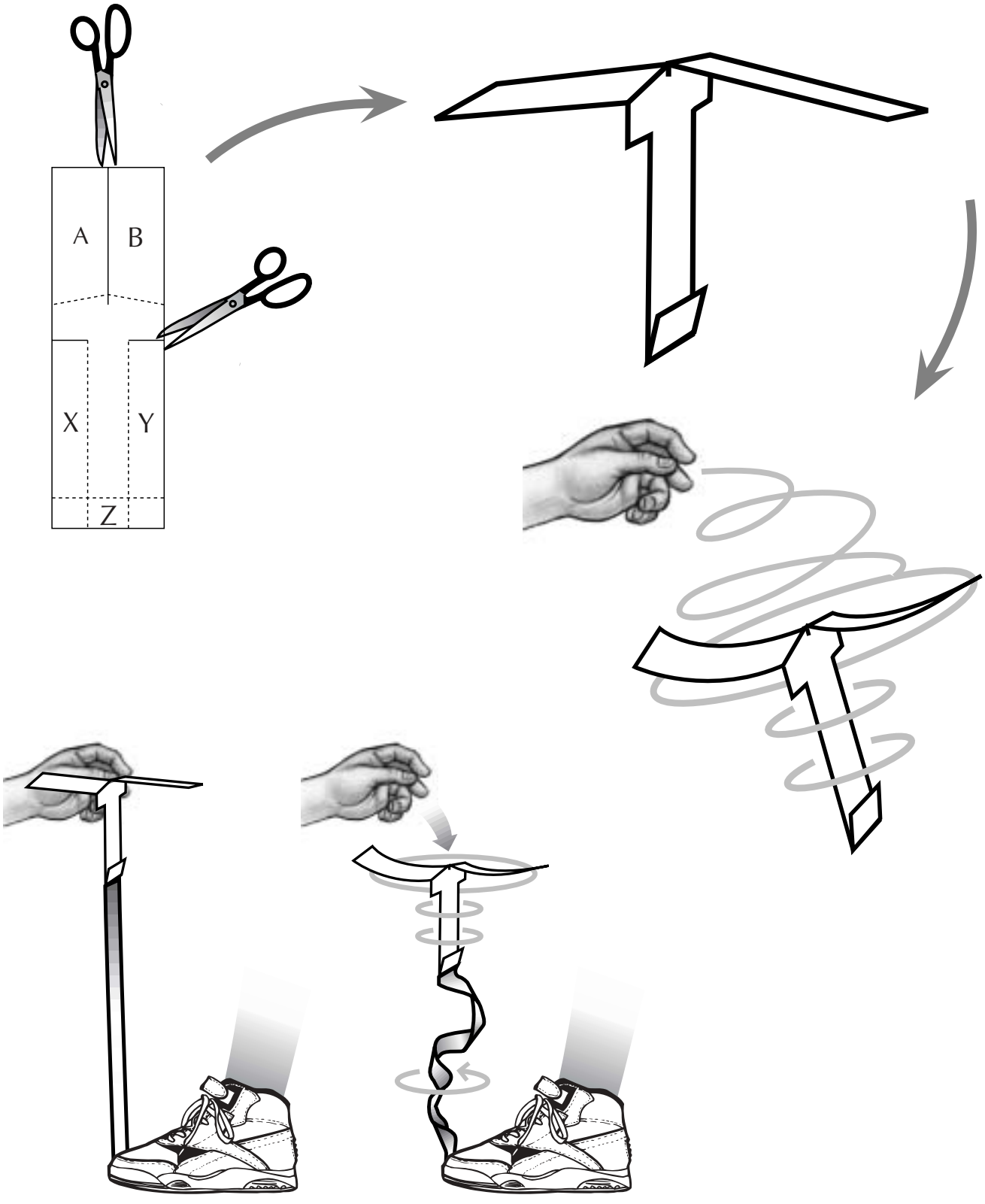


6. Can you accurately count the number of rotations the rotor motor made as it descended? *No—the rotations are fast and that makes accurate counting very hard.*

7. To determine the number of rotations, (1) tape the cassette ribbon to the rotor motor, (2) stand on the loose end, and pull the rotor up so there are no twists in the ribbon, and (3) drop the rotor as usual. How does the cassette ribbon make counting the rotation easier? *Each twist in the ribbon represents one rotation of the rotor motor. Counting the total number of twists equals the total number of rotations.*

Rotor Motor Templates




A
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