

Lesson 1: Discovering Flight

A. Define, Describe, or Identify:

1. Flight
2. Parachute
3. Kite
4. Gunpowder
5. Rocket
6. Legend
7. Helicopter
8. Streamlining
9. Glider
10. Ornithopter

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B. Fill in the Blanks:

1. In the ancient Greek story, Icarus ignored his father's warning and flew too close to the _____. He fell into the _____ and _____.
2. The unfortunate experiment by a man in Spain trying to fly from a tower might be described as an early attempt at a jump by _____.
3. _____ were among the first man-made devices to take flight.
4. The Chinese used their rockets mostly for _____, but also in battle to _____.
5. The ancient Chinese legend of a man who tried to ride his rockets to the moon says he went up in a _____ and perhaps became the _____.
6. Da Vinci's drawing of an "airscrew" looks a lot like a modern _____.
7. Like other scientists, Leonardo da Vinci _____ the world closely. Also like other scientists, he kept _____.
8. Gliders were the first aircraft that had _____.
9. Da Vinci was fascinated with _____, and he experimented with flapping-wing _____.
10. Birds are very powerful for their size. Their large _____ and _____ make them well suited to flight.

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C. Matching:

Match the definition in Column A with the name in Column B. You may use each name only once.

Column A

- _____ 1. He was at the controls for the first controlled, sustained, and powered heavier-than-air flight.
- _____ 2. According to a Greek story, he made wings from bird feathers and beeswax to escape imprisonment.
- _____ 3. A king who, the story goes, imprisoned an early flier on an island.
- _____ 4. He is credited with the first known human attempt to fly.
- _____ 5. This Chinese general used kites to scout his enemy's position and movements by air.
- _____ 6. He reportedly saw Chinese sailors attached to kites as "eyes in the sky," observing enemy actions during battle.
- _____ 7. He conducted the first scientific experiments in aviation.
- _____ 8. An Italian biologist who realized that human muscle power would never enable a person to fly on their own.
- _____ 9. He made an important discovery about the relationship between pressure and fluids (liquids or gases) in motion.
- _____ 10. This Englishman formulated three famous laws of motion.

Column B

- a. Armen Firman
- b. Daedalus
- c. Orville Wright
- d. Minos
- e. Marco Polo
- f. Han Hsin
- g. Leonardo da Vinci
- h. Daniel Bernouilli
- i. Isaac Newton
- j. Alfonso Borelli

D. Crossword Puzzle:

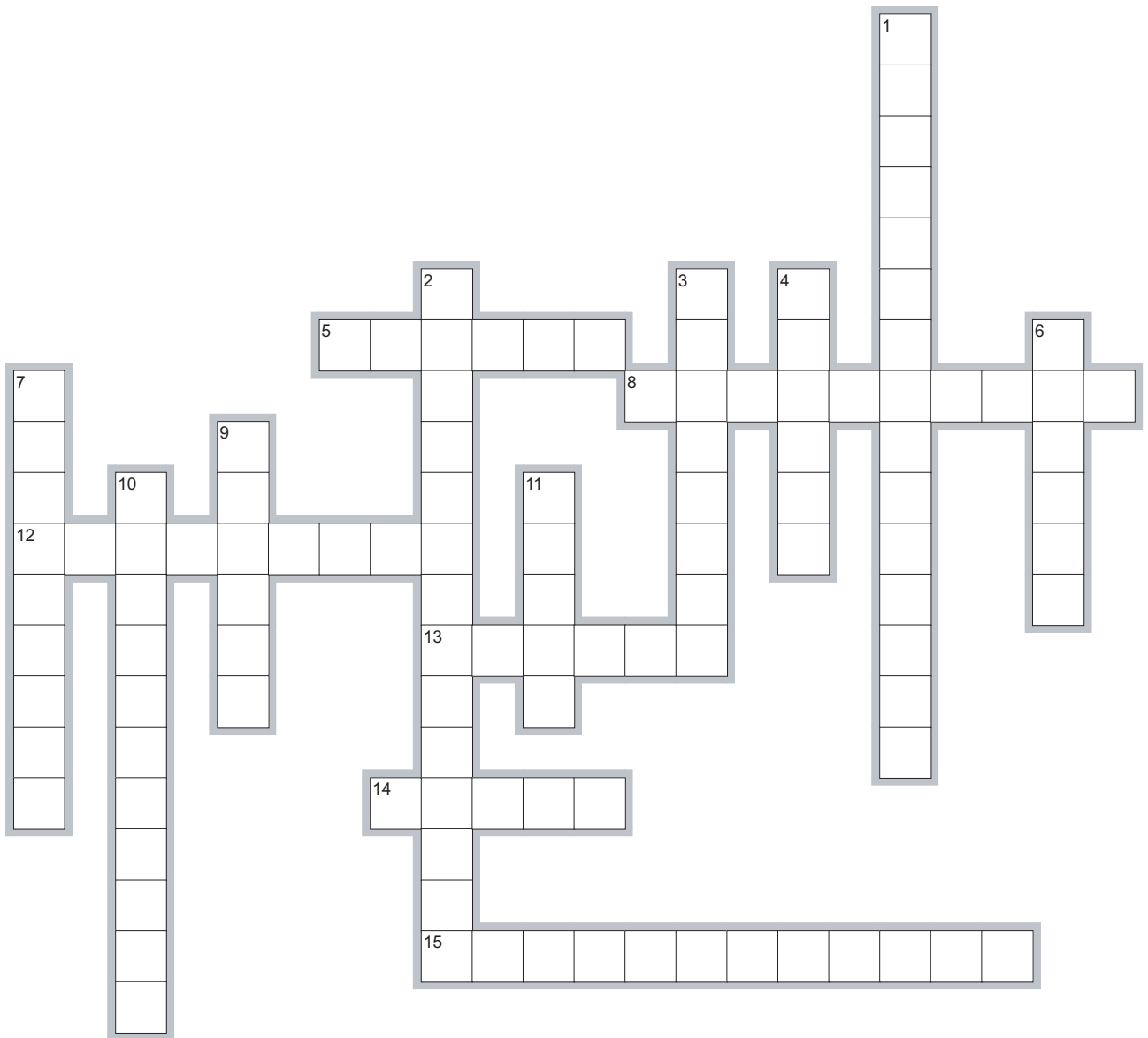
Across

- 5. A light aircraft without an engine.
- 8. It gets its lift from spinning blades.
- 12. A device to slow free fall from an aircraft or other high point.
- 13. He was the son of Daedalus.
- 14. They carried flying spies in battle in China.
- 15. Leonardo da Vinci understood this key concept of aviation.

Down

- 1. A Renaissance man who experimented with flight.
- 2. The *Wright Flyer's* first flight happened here.
- 3. He and his son tried to fly away from Crete.
- 4. Humans have dreamed of taking _____ for thousands of years.
- 6. The story of Wan Hoo's attempt to fly to the moon can't be verified; it's only a _____.
- 7. An explosive powder used to use shoot projectiles from guns.
- 9. A Chinese invention used in battle to scare off the enemy.
- 10. A kind of aircraft that gets support and forward motion from flapping wings.
- 11. When he jumped from a tower in Cordoba, Spain, Armen Firman hoped his _____ would open wide like a bat's wings.

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E. True/False:

Put a **T** in the blank if the sentence is true and an **F** if it is false.

- _____ 1. Wilbur Wright made the first controlled, sustained, and powered heavier-than-air flight.
- _____ 2. The Chinese invented kites around 1000 BC but they were too small and flimsy to be of much practical use except as toys.
- _____ 3. Legend credits a Chinese named Wan Hoo with an attempt to fly to the moon, using 47 rockets fastened to a chair.
- _____ 4. The Chinese designed the first known helicopter.
- _____ 5. The publication of Leonardo's notebooks advanced aviation during the Renaissance.
- _____ 6. Birds are able to fly in part because they are very powerful for their size.
- _____ 7. A bird's flight is similar to an airplane's in some ways but different in others.
- _____ 8. The phenomenon known as Bernoullian lift helps aircraft wings move upward.
- _____ 9. Sir Isaac Newton formulated his three laws of motion after many experiments with early hang gliders.
- _____ 10. Only when people stopped trying to fly as birds do did the way open for the Wright brothers' success on the North Carolina dunes.

F. Optional Activity: Build and Fly a Kite

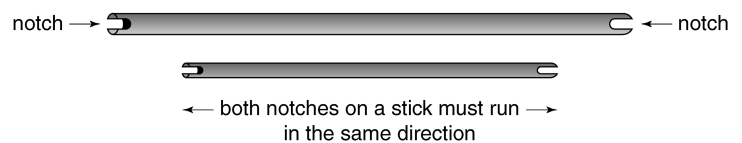
American inventor and statesman Benjamin Franklin used a kite in his scientific experiments. Follow the instructions below to build a kite like his. Then take it outside and see if you can fly and maneuver it!

Materials:

- One 24-inch wooden dowel or lightweight, straight wooden stick
- One 20-inch wooden dowel or lightweight, straight wooden stick (Hint: If you have a longer stick, get an adult to help you cut it to the right length.)
- A large piece of paper (at least 26 inches square) or a heavy-duty trash bag
- Tape
- Lightweight string, twine, or fishing line
- Craft knife (Make sure there's an adult around to supervise when you use this tool.)
- Ruler
- Pencil, pen, or marker
- Scissors
- Ribbon
- Pin, needle, or other tool with a sharp point.

Procedure:

1. With the craft knife, carve a notch into each end of each stick. Both notches must run in the same direction and be parallel to the ground.



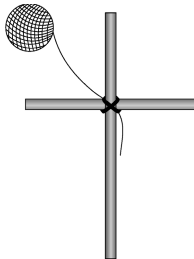
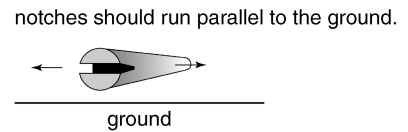
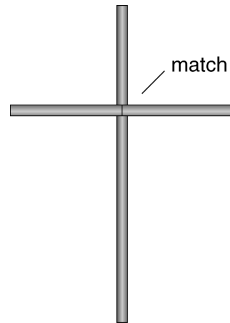
2. Take the longer stick. Using a ruler, mark a spot six inches, or one-fourth of the way, from one end of the stick.

3. Take the shorter stick. With the ruler, mark off a spot 10 inches, or halfway, into the stick.



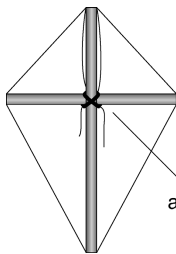
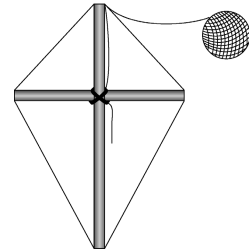
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4. Place the shorter stick crosswise over the longer one, matching up the marks you just made. When the sticks are lying down, all the notches should be parallel to the ground.



5. Take the string and wrap it tightly around the center of your sticks, binding them together. You will be making an X shape with the string. Double-check that the notches remain parallel to the ground.

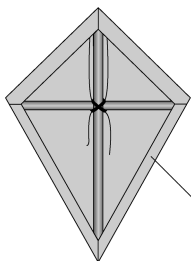
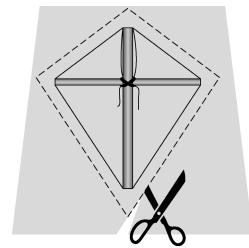
6. Thread the string through all the notches, creating a diamond shape. Wrap the string around twice, making sure it is tight. This is the frame of your kite.



knot the string
around the center
of your kite

7. Pull the end of the string back toward the center of your kite. Make sure the frame is still tight. Wrap the string tightly around both sticks (mimicking the X shape you made earlier with the string) and tie it off with a knot.

8. Cut your paper or plastic bag so that it is slightly larger than the kite frame.



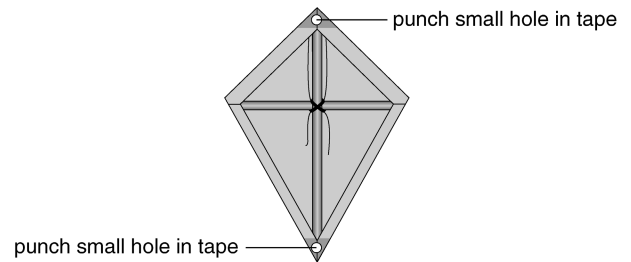
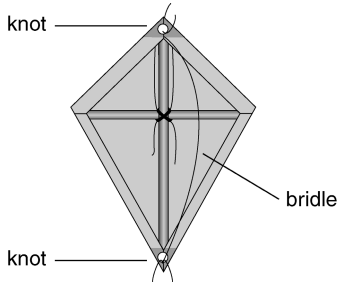
secure folds with
strong tape or glue

9. Fold the paper over the string frame. Tape or glue it down.

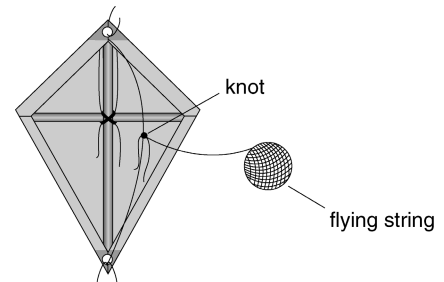
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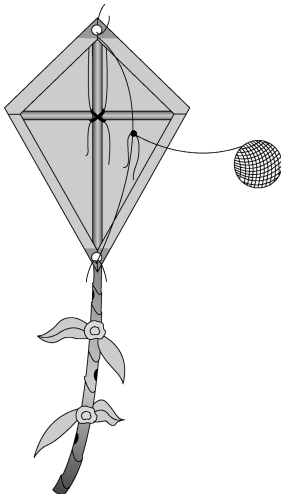
10. Reinforce the top and bottom tips of your kite with tape. Using a pin or needle, punch a tiny hole through each of these reinforced tips.



11. Cut a two-foot piece of string. Knot one end of the string through the top hole and the other end through the bottom hole. This will form the “bridle” of your kite, the part that controls it.



12. Take the rest of the string. Attach one end to the bridle about a third of the way down. This will be your flying string.



13. Either tape or knot a two-yard-long string to the bottom tip of your kite. Then take the ribbon and tie bows around the string. The tail of your kite will add stability when the kite is in flight.

14. Now it's time to fly your kite! On a breezy day, find an open space. Make sure there are no power lines or trees nearby. Let the wind work its magic! (Hint: If your kite jerks or dips, try moving the location of the flying string knot up or down the bridle.)

G. Optional Activity: Is Bernoulli's Principle Worth Two Cents?

The objective of this activity is to create an airfoil out of a piece of file folder and then make it “fly” with a source of high velocity wind. A file folder, shaped like a wing, will fly when the wind of a hair dryer is directed toward it. The force is strong enough even to lift a few pennies!

Materials:

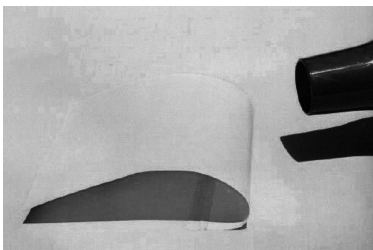
- One or more filing folders cut to about the size of a sheet of paper
- One hair dryer
- Masking or Scotch-type tape
- Two pennies.

Procedure:

1. Tape the file folder piece to the edge of a smooth table.



2. Fold so that it eventually has the shape of an elongated teardrop.



3. Point the hair dryer toward the leading edge and experiment with wind flow.

4. After a few tries, the “wing” will lift right off the table.
5. Next, tape a penny to the underside of the wing.
6. Try the airflow again . . . and if you’ve done it correctly, it will lift two, sometimes three pennies.

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This is a fun thing to experience about Bernoulli's Principle. In the example of our wing, air flows faster over the upper curved surface. As the air going over the upper surface accelerates, the pressure drops. The air on the underside, relative to the upper surface, has a higher pressure. The difference in pressure causes the wing to react by rising toward to the area of lower pressure. If the air is flowing fast enough and the surface of the wing is curved enough, it will fly!

Optional Activity adapted from Millspaugh, Ben P. (n.d). AEX II, Volume I, Activity 12. Maxwell AFB, AL: Civil Air Patrol.

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