

Toys and Flight: A 5E Model Lesson

Recommended for Grades 2-5

To facilitate these lessons, please see Handout A (Toys and Inventions) and Handout B (Helicopter Template) located as free downloadable and printable PDF documents at <http://nwocenter.org/handson.htm>



Hands-on STEM + History Activity

Engage

Big Idea # 1 — Gravity pulls things toward the earth.

Teacher

- 1) Take a wadded up piece of paper, hold it up, and let it drop.
- 2) Ask students: Can you describe what happened to the paper?
- 3) Write on board: gravity, velocity, speed
- 4) Take the same wadded up paper and a smooth sheet of paper, hold them both up, with the smooth sheet parallel to the ground. Ask the students to predict what will happen, which will hit the ground first. Let them drop.
- 5) Ask students: What happened? Possible answer - The smooth paper fell slower or at a lower velocity because of **air**. Define velocity and speed. Speed describes only how fast an object is moving, whereas velocity gives both the speed and direction of the object's motion.
- 6) Ask students: How do you think the air affects the paper? Possible answer: The air pushes on the paper in the opposite direction from which it is traveling.
- 7) Write on board: air resistance
- 8) Show students a rotor copter with one paper clip attached. What do they predict will happen when you let go of the helicopter? Demonstrate it.
- 9) Ask students: What happened? Possible answer - The helicopter fell toward the earth because of gravity and was slowed by air resistance or drag – especially because of the rotors on the top. Drag can be a useful force for slowing things down. A compact object experiences less drag and falls faster than an object of the same mass that is spread out.



Big Idea # 2 — Science and technology have changed daily life.

In 1903, two brothers named Orville and Wilber Wright built a flyer in the back room of their bicycle shop in Dayton, Ohio. On December 17, 1903, Orville Wright made the first machine powered flight in the world at Kitty Hawk, North Carolina. Their most famous flight with the very first airplane lasted only 12 seconds and covered only 120 feet. The Wright Brothers defined

the elements of a flying machine as: wings to provide lift, a power source for propulsion, and a system of control. They spent years developing different plane models. At the end of their careers, they had achieved what most men and women had only dreamed of doing, they flew!

Teacher

1) Have students read the story, *Toys and Inventions* (*Handout A* - <http://nwocenter.org/handson.htm>), about the Wright Brothers and think about the rotor copter.

2) Questions for students to consider:

- a) Why do you think Milton Wright gave his sons a rotor toy?
- b) How did playing with a toy teach Orville and Wilbur Wright about flight?

Explore

Big Idea # 3 — (a) Forces change the motion of an object and (b) Any change in speed or direction of an object requires a force and is affected by the mass* of the object and the amount of force applied & (c) Design and conduct a scientific investigation — How could you change the helicopter design to change the speed with which it falls?

What you'll need:

Stopwatches, Copter template (*Handout B* <http://nwocenter.org/handson.htm>), scissors, paperclips, tape measure.

Teacher

1) Remind the students that these are called “variables”. Possible changes they might suggest include:

- Size of the helicopter shaft
- Size of the helicopter rotors
- Weight of the helicopter
- Material used to make the helicopters
- Where we added the paper clips to the helicopter

2) Once the students have come up with several possible variables, explain which variables you have materials to test—adding weight (paperclips), size of helicopter, size of rotors, use stopwatches to time the flight of the helicopter from its “drop” to its landing. Students should be reminded to also measure the distance between the drop and the landing before you start.

3) Divide the students into groups of 3 or 4. In their groups they will decide which variable they want to test. Along with choosing the variable, they need to decide what they will measure, which should be time.

- Once they have their hypothesis, provide the materials to test.
- Show them how they will fold their helicopter—cut on solid lines, fold on dotted lines. (Pass out pre-printed paper helicopters. They can make changes in folding and cutting depending on the variables they choose.)

- Remind students to do multiple trials and record their data.

Explain



Big Idea #4 – Science Inquiry Ideas: (1) Develop descriptions, models, explanations and predictions; (2) Communicate about observations, investigations and explanations; and (3) Review and ask questions about the observations and explanations of others.

Teacher

1) Ask students to report out: Which variable did you test? What were your results? Why do you think that happened?

What's the Science?

Gravity pulls the helicopter down. The rotors of the copter are an *airfoil*. They catch the slower-moving air below them, which provides lift and drag for the helicopter. When air pushes upward on the slanted rotor blades, some of that thrust becomes a sideways, or horizontal, push. The rotors cause the helicopter to turn because the air pushes on each rotor separately. Those two opposing thrusts or pushes work together to cause the toy to spin. The weight of one paper clip helps the helicopter to maintain balance allowing it to fall slower. Additional weight allows gravity to pull it faster to the earth.

Adapted from The Science of Flight Lesson Plan

<http://www.ihmc.us/community/Voluntology/Activities/Helicopters/index.php>

Extend



Big Idea #5 — (a) Time can be shown graphically on timelines; (b) Multiple-tier timelines can be used to show relationships among events and places; and (c) Science and technology have changed daily life.

What you'll need:

11 x 14 pieces of paper for the timeline, rulers, markers or pencils

* Photocopied photographs and other primary source documents for differentiated activity.

Teacher

1) Orville and Wilbur Wright grew up at the end of the 19th and beginning of the 20th century. Here are some important dates in their lives. Can you create a timeline and place those events in the correct order on your timeline with these other important events in history?

1926 – The U.S. forms the Army Air Corps

1865 – The Civil War ends

1892 – The Wrights open the Wright Cycle Company selling and manufacturing bicycles.

1867 – Wilbur is born

January 1948 – Orville dies of a heart attack

1903 – First successful aircraft flight at Kitty Hawk

1878 – Milton Wright gives his sons a rotor toy

1884 -1889 – Wilbur and Orville attend high school in Dayton, OH

1918 – America enters World War I, the first war utilizing airplanes

November 1948 - The Wright's 1903 airplane is placed on display in the Smithsonian Institution

1896 – Otto Lilienthal crashed while attempting to fly a glider

1912 – Wilbur dies of typhoid fever

1941 – World War II begins. America forms

1871 – Orville is born

★ Differentiation for higher grade levels and levels of student understanding.

Find books, photos and graphics from primary sources (online) that bear witness to the events above and photocopy these for students to place in appropriate places on their timelines.

Big Ideas - Primary and secondary sources can be used to create historical narratives. Primary sources such as artifacts, maps and photographs can be used to show change over time.

Examples:

The Wright Bros. by Elizabeth MacLeod

- Publisher: Kids Can Press (February 1, 2008)
- ISBN-10: 1554530539

My Brother's Flying Machine by Jane Yolen

- Publisher: Little, Brown Young Readers; 1 edition (April 1, 2003)
- ISBN-10: 0316971596

Evaluate



Big Idea # 6 — Many technological innovations that originated in Ohio benefited the United States.

Teacher

1) Have students create a journal entry to answer the following questions:

- a.) What principles of flight can we learn from rotor toys? Draw a picture of your experiment and explain how it flies.
- b.) How did toys and playing help Wright Brothers invent the airplane?
- c.) How do you think playing can lead to scientific inventions and provide ideas to solve technological problems?
- d.) How did the Wright Brothers invention from Ohio benefit people in other places?