The Scientist's Apprentice

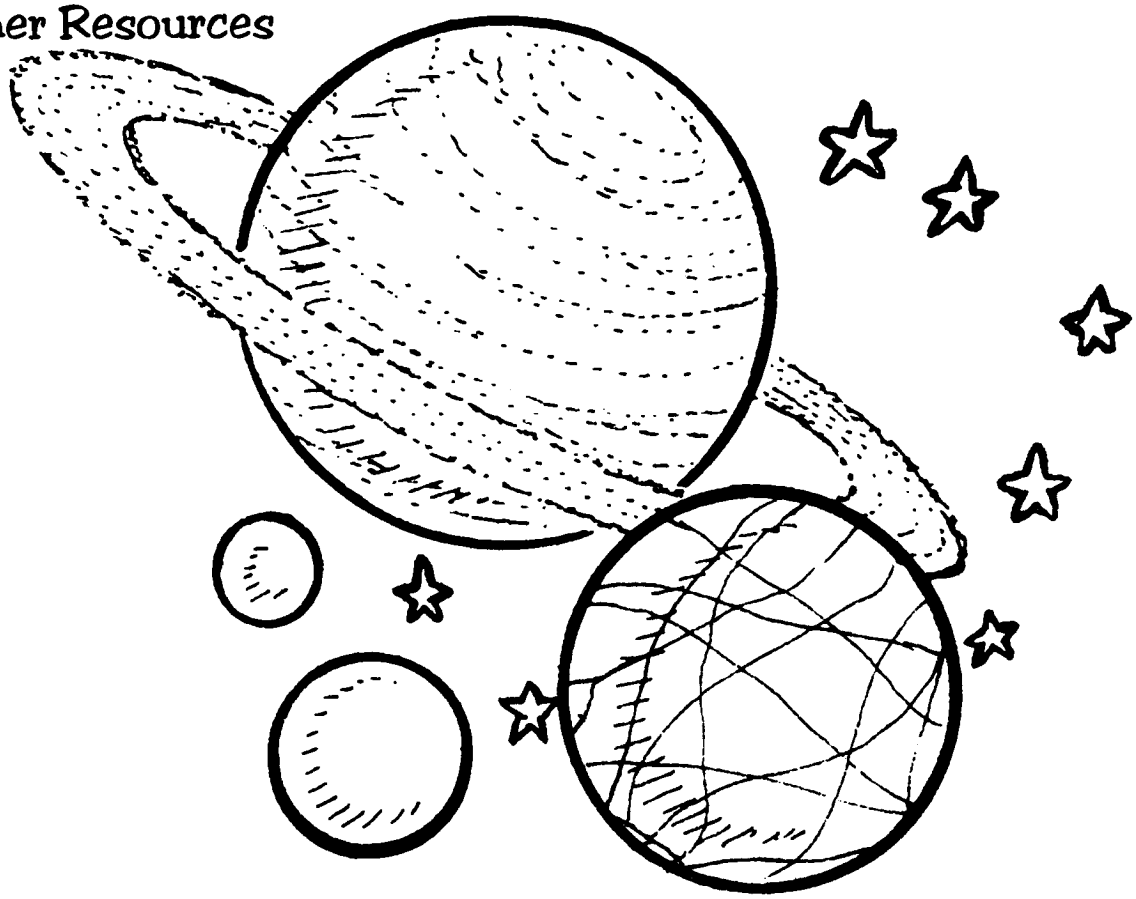
A complete one-year science curriculum for elementary grades

by Hilary Welliver

Unit One

Astronomy

- First Steps to Space
- Our Place in Space
- The Solar System
- The Moon
- Star Light, Star Bright
- Teacher Resources



AVIATION: A BRIEF HISTORY

Man has dreamed of flying for thousands of years. Mercury, the messenger of the ancient Roman gods, flew on winged feet. In the myth of Daedalus and Icarus, an incarcerated father and son escaped their island prison by creating wax wings which they used to fly away. Icarus, the son, plummeted into the sea when his wings melted from the sun's heat.

Of course, these were only fantasies. Not until the 1700's did man create a successful airborne vessel capable of carrying a person, the hot air balloon. It was about this time that Sir George Cayley designed the first airplane with a modern form. His work with gliders inspired other inventors to carry on his work.

Then on December 17, 1903, Wilbur and Orville Wright successfully piloted a powered aircraft at Kitty Hawk, North Carolina. They sustained flight for twelve seconds.

Use the information in this chapter to create a timeline. Add events as your research and exploration uncovers them. Here are just a few dates to get you started:

1911	First cross-country (USA) flight. It took 49 days.
1923	First non-stop flight across the USA.
1927	First solo transatlantic flight performed by Charles A. Lindbergh, in his plane, the "Spirit of St. Louis."
1932	Amelia Earhart, first woman to perform a solo transatlantic flight.

Airplanes became weapons of war in World Wars I and II. Afterwards, aviators raced to break the sound barrier. Sound travels at 670 miles per hour. In 1947, "Chuck" Yeager reached 700 miles per hour in "Glamorous Glennis," the Bell X-1. Five years later, the X-15 was able to travel six times the speed of sound.

ROCKETRY: WHAT GOES UP, MUST COME DOWN!

Originally, rockets were used primarily as weapons and fireworks. A story is told of a man in ancient China, Wan Hu, who used fireworks to launch his chair (with him in it) into space. Wan Hu was never seen again. In the late 1700's, an Englishman developed incendiary rockets for the British to use against the French.

FIRST STEPS TO SPACE

In the United States, the first rockets were launched during the War of 1812. It was these rockets that inspired Francis Scott Key to pen the phrase "rockets' red glare" which eventually became part of our national anthem.

Dr. Robert H. Goddard launched the first successful liquid-fueled rockets in 1926.

The Soviet Union reached space first, with an artificial satellite called "Sputnik," on October 4, 1957. The United States responded with Explorer, on January 21, 1958. One year after Sputnik, the National Aeronautics and Space Administration (NASA) was established. NASA's mission is "devoted to peaceful purposes for the benefit of all mankind." NASA has launched many different kinds of spacecraft since then.

Project Mercury (1961) developed a one-man spacecraft. Alan B. Shepard, Jr. was the first American in space. Two-man spacecraft were used in the Gemini Program. Three-man spacecraft were used in the Apollo Program. Mercury, Gemini, and Apollo were developed to reach the moon. Neil Armstrong was the first human to walk on the moon on July 20, 1969.

Skylab, the first United States space station, was launched in 1973. It permitted astronauts to work in space for long periods of time. Mir, the Soviet space station, has set many endurance records.

The Space Shuttle features the first re-usable spacecraft. The first crew, on Columbia, were John Young and Robert Crippin.

In the space of less than one hundred years, man has learned not only to fly, but has set foot on the moon!

Bernoulli's Law

What lifts an airplane and keeps it in the air?

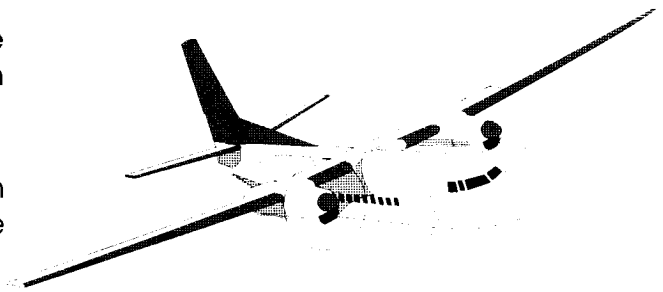
Materials:

Ping pong ball
Blow dryer
Funnel

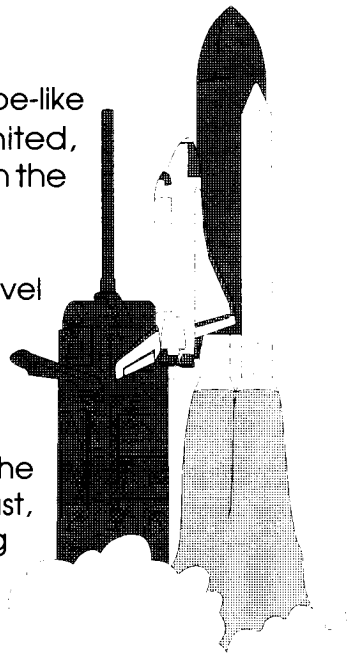
Steps:

- Place ping pong ball inside funnel.
- Now turn the funnel upside-down, holding the ball in with your finger.
- Direct stream of air from blow dryer through the funnel spout and remove your finger from the ball.

The fast-moving air causes a low pressure area above the ball. The relatively higher pressure below pushes up on the ball, holding it in the funnel.



Rocket: n. any of various simple or complex tube-like devices containing combustibles that on being ignited, liberate gases whose action propels the tube through the air.



In order to escape Earth's gravity, a rocket must travel seven miles per second (25,000 miles per hour), which is also known as "escape velocity." This fantastic speed is possible because of such efficient rocket engines.

A rocket burns fuel inside a combustion chamber. The gases produced are directed through the exhaust, providing thrust to propel the rocket forward, according to Newton's Third Law of Motion. This law states that for every action there is an equal and opposite reaction.

Paper Darts

You don't need expensive model rockets to demonstrate how they fly. Try this activity using paper.

Materials:

5x1-inch paper
Pencil
Scissors
Tape
Index card
Drinking straw

Steps:

❖ Wrap the narrow strip of paper lengthwise around a pencil. Tape lightly. Slide it partially off the pencil and cut points into the end of the tube and slip it back on the pencil. Now slide the points to the pencil tip, squeezing them to form a nose cone. Use the pencil tip to provide support as you tape the nose cone into shape.

❖ Remove the tube from the pencil. Gently blow in the open end and check for leaks. Seal leaks with tape.

❖ Determine the tube's center of gravity by balancing it on your index finger. Add tape to appropriate ends to make the center of gravity as close to the middle as possible. Draw a line on the tube to mark the center of gravity.

❖ Slip a straw into the tube's opening. Point the tube in a safe direction and blow. The tube will fly off and wobble as it goes. The wobble is around the center of gravity mark.

❖ Cut out two small sets of fins and tape them near the open end of the tube. Now insert the straw into the tube again and blow. Notice that the dart has a smoother flight and has less wobble.

Questions:

1. Explain how the air you blew pushed the paper dart.
2. How did the fins help stabilize the wobble? (Note: this actually happened to the first rockets.)
3. What changes could you make to the paper to increase speed or distance?

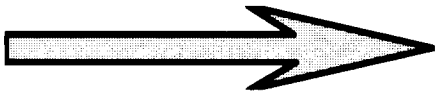
Secret Codes

All aircraft have identification numbers which begin with a letter identifying the country of registry. In the United States, this letter is N followed by a registration number.

An important tool in communicating in the air is the phonetic alphabet chart. This internationally agreed upon chart aids pilots and others in understanding one another.

Here is an activity in which you can make up your own aircraft ID numbers. Instead of a registration number, use the phonetic alphabet chart to develop a secret code based on your name and birthday. Here is an example using Neil Armstrong, born August 5, 1930 - "N0805 November Alpha." What might your code be? Use *this chart to design your own secret* codes!

N = USA
08 = August
05 = Fifth
November = Neil
Alpha = Armstrong



A	Alpha	N	November
B	Bravo	O	Oscar
C	Charlie	P	Papa
D	Delta	Q	Quebec
E	Echo	R	Romeo
F	Foxtrot	S	Sierra
G	Golf	T	Tango
H	Hotel	U	Uniform
I	India	V	Victor
J	Juliet	W	Whiskey
K	Kilo	X	X-ray
L	Lima	Y	Yankee
M	Mike	Z	Zulu

Aeronautics ABC

On a sheet of notebook paper, make a column lettered from A to Z. Visit the library to compose an ABC list of artifacts, people, or terminology that relates to space, flight, or the history of aviation and aeronautics. Or, list words on index cards, pull a card, and have the student demonstrate library skills by finding information about that word.

A	astronaut	N	NASA
B	bi-plane	O	orbit
C	cockpit	P	propeller
D	Discovery	Q	quasars
E	Earhart, Amelia	R	rocket
F	fuselage	S	space shuttle
G	Gemini	T	thrust
H	hot air balloon	U	uniforms
I	Icarus	V	Voyager
J	jet plane	W	Wright brothers
K	Kitty Hawk, NC	X	X-1; X-15
L	Lindbergh, Charles	Y	Yeager, "Chuck"
M	Moon	Z	zero gravity

Is the Earth Really Round?

For centuries astronomers debated whether the earth was a flat disk or a round ball suspended in space. Many arguments were presented supporting both views. The earth's real shape was discovered about 2,500 years ago by Greek scientists. Their theory was proven when Ferdinand Magellan's expedition successfully sailed all the way around the world. Without traveling into space, how can you show the earth is round?

Don't Fall Off!!

Materials:

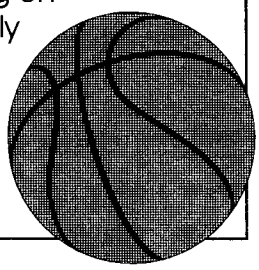
Table
Basketball
Paper
Scissors
Toothpick
Tape

Steps:

❖ If you have the opportunity, observe a ship traveling toward the horizon. If the earth were flat, the ship would appear to grow smaller in the distance, but it would never disappear. However, if you watch closely, you'll observe that the bottom parts of a ship gradually vanish, hidden by the earth's curvature, until just the top stands above the horizon. (Or substitute a car traveling over a flat, straight, road.)

❖ Make two flags out of the paper, tape and toothpicks. Viewing from the edge of the table, move the flag along the surface, away from you. What do you see? What happens to the flag?

❖ Now place the other flag on top of the basketball, slowly moving the flag away from you as it follows the curvature of the ball. Can you see the entire flag as it passes back over the ball?



Super Soaring Shuttle!

Materials:

4 pins
Scissors
Glue
2 foam trays - saved from the produce section.
Pattern
Indelible marker

Steps:

❖ Trace pattern onto foam trays using an indelible marker. Cut out pieces.
❖ Score the center of the body along line to provide slit in which to fit fin. Line score with glue and insert fin.
❖ Working up from bottom of body, anchor fin in place with a pin. Insert up to three pins in nose for ballast. The final product really flies!

Chart Your Results:

Flight Number:	*Flight Distance (in Feet)*	*Number of pins*	*Other Variables*