Ohio's Career Development Program

Issue 1
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Middle School

Exploring Space

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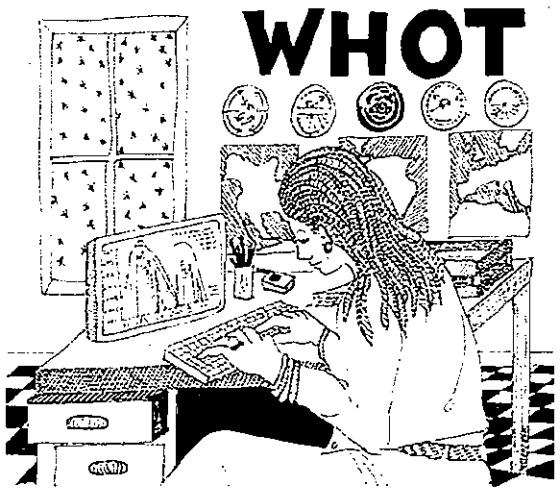

For additional activities, visit our website at www.ohiociad.com

Featuring Ohio's Academic Content Standards:
Space, One Step at a Time – Balloons: *Science*: Earth Sciences, Grades 6-8, B, C
Physical Sciences, Grades 6-8 A, B
Technology, Grades 6-8 A, B,
Scientific Inquiry, Grades 6-8 A
Scientific Ways of Knowing, Grades 6-8 C
Whether There Will Be Weather: *Science*: Earth and Space Science, Grades 6-8, C
Physical Sciences, Grades 6-8 A,
Science and Technology, Grades 6-8 A, B,
Scientific Inquiry, Grades 6-8 A, B,
Scientific Ways of Knowing, Grades 6-8 C
Traveling Beyond Earth: *Science:* Science and Technology, Grades 6-8 A, B
Scientific Inquiry, Grades 6-8 C
Humans Beyond Earth: *Science:* Earth and Space, Grades 6-8, A, B
Science and Technology, Grades 6-8 A, B
Scientific Inquiry, Grades 6-8 A, B
Scientific Ways of Knowing C

Humans Beyond Earth

Since the first humans looked up at the night sky and contemplated the stars, man has been interested in finding out more about space. Maybe you've tried lying in your backyard at night to see so-called shooting stars, really particles of rock that glow as they enter and burn up in our atmosphere. Many scientists who study space do it because they hope to learn more about our part in the universe, and how the earth came to be. Others are intrigued by the idea of exploring to see what's out there. There are thousands of career choices involved with all aspects of space exploration, and many more thousands of things to discover about space. Try out some of the following ideas and experiments to determine what part of space exploration excites you the most. The possibilities are endless as space itself!

1. Try out some of the hundreds of experiments and ideas in the book, How the Universe Works, a Reader's Digest book by Heather Couper and Nigel Henbest, copyright 1994. Here you can find out about galaxies, the color of stars, space laboratories, how the moon got its craters, how planets and other objects in space move, assemble a model of a planetary probe, make a constellations model, determine how stars age and how far apart they are, and many other ideas.

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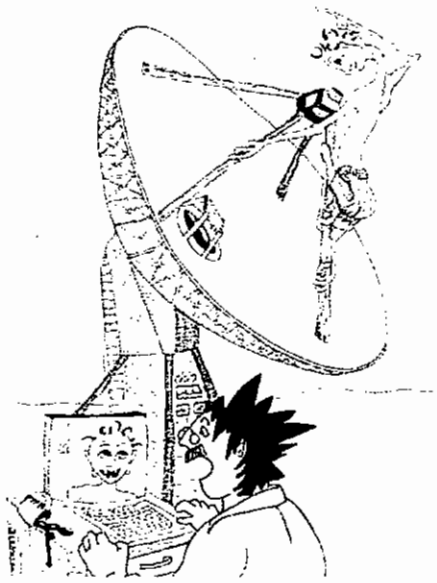
2. Visit an observatory or planetarium to find out more about careers related to space and how stars and planets move. Planetariums have shows you can experience to see how the night sky looks, and how objects change from season to season. Check out this website for planetariums offering shows: http://www.wro.org/ano/planet.htm

3. Research SETI, the group called Search for Extraterrestrial Intelligence, to find out what they are studying to see if there is life in the universe beyond planet earth. Their website is: http://www.seti.org/



4. Check out this cool NASA Website for experiments and information on stars and space: http://spaceplace.nasa.gov/en/kids/cool_subjects.shtml. (links for stars and space)

5. Determine what materials, equipment, and supplies you personally would want to take with you on a space flight by listing all the materials and recording all the supplies, materials, food, and water you use in one day. Figure out how much space all of that stuff would fill in a spacecraft. It might be fun to actually assemble all of those materials in one place to see how much space they really fill. If you were going to travel in space for a week, how much space would be required? Find out how far away the nearest planet in our solar system is to earth, and determine how long it would take to get there. How big a pile of supplies would you require for that trip? What could you do to reduce the amount of space needed for supplies for such a trip? What workers would need to be employed to make sure you had what was needed for this trip? Find out what kinds of workers are employed by NASA and other groups interested in space exploration.

Ohio Academic Content Standards
Science: Earth and Space, Grades 6-8, A, B;
Science and Technology, Grades 6-8 A, B:
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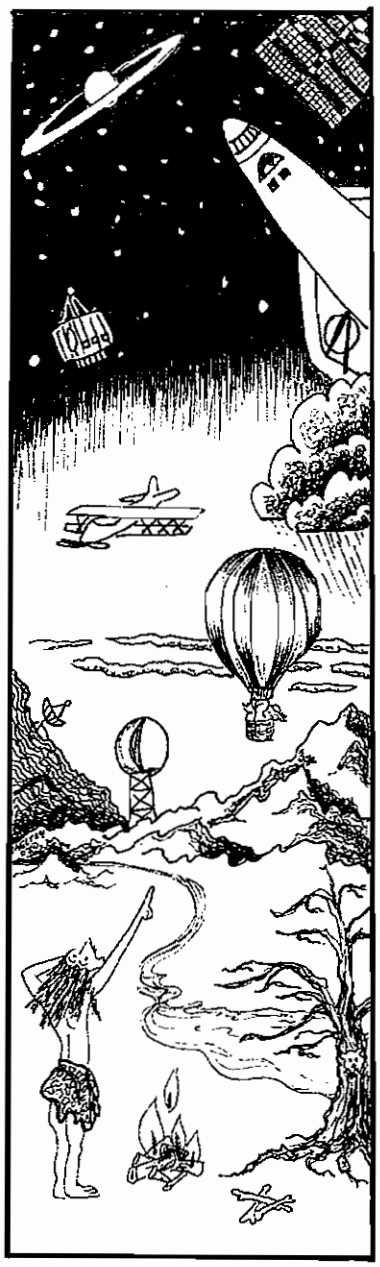
Career Information

Space, One Step at a Time - Balloons



For thousands of years, humans have looked up at the sky and wondered what space consists of and why objects move in space the way they do. Only recently in human history have we been able to explore space and find out more about what's out there, at the extreme outer reaches of our atmosphere and beyond. We humans have made the trip into space in small steps.

One of those early steps was traveling by hot-air balloon. You can still take rides in hot-air balloons today, and many festivals and fairs have hot-air balloon events and offer rides. Early explorers, though, used them to find out what the atmosphere was like, and discovered the earth looked a lot different from above.

A hot-air balloon is basically a pocket full of air that's warmer than the air around it. Warmer air particles move fast and spread out more than the air around the balloon, making the air inside less dense. Because it's less dense, the balloon floats! To see expanding air in action, blow up a balloon and tie the end.

Then stick the balloon into a pan of hot (NOT boiling) water. To observe the opposite effect, put the balloon in a pan of ice. Record your observations in the chart on the next page.

Balloon in Hot Water	Balloon in Ice
Observations:	Observations:

Now make your own smaller-scale version of a flying hot-air balloon by following the directions below and on the next pages:

Mini-Hot Air Balloon

Materials

6 sheets tissue paper
Aluminum foil
1 box birthday candles
Matches
Scissors
White glue
Tape
Marker
Ruler

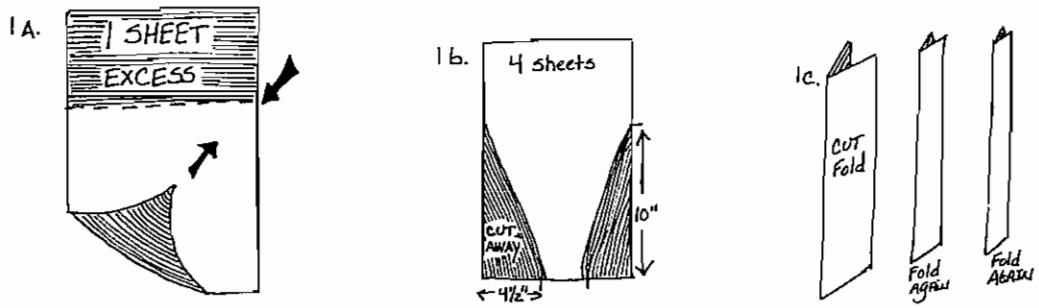
1. Cut pieces for the balloon as follows.

a) Top: Fold one corner and side of one sheet of tissue to line up with opposite side, making a triangle. Cut off extra paper beyond triangle, unfold.

b) Sides: On one of short sides of 1 sheet of tissue, measure in 4 ½ inches from each corner and 10 inches up each side. Mark measurements, draw line with ruler to connect, and cut off triangles. The remaining edge is the bottom side of the balloon. Repeat with three more sheets of tissue.

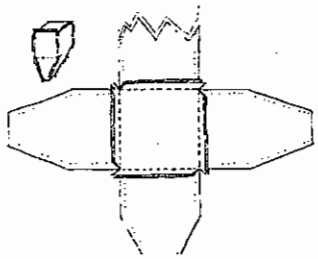
c) Base: Fold last sheet of tissue in half lengthwise, cut along fold. Fold each piece in half lengthwise again, tape together to make one long strip, with folds on one edge.

(The drawings on the next page will help with Step 1.)



2. Assembly: DO NOT use too much glue! A thin line of glue is all that's needed.

a) Run a thin line of glue along one edge of the square top. Overlap with uncut end of one side, press to seal. Repeat with remaining sides.



b) Line up two adjoining side edges, lay flat on table. Run thin line of glue along bottom edge, cover with top and press to seal. Repeat with other three side seams, carefully turning balloon as you go.

c) Tape the base to the bottom edge of the assembled balloon with the fold on the untaped side, making sure to reinforce the side seams with extra tape as needed. This makes the opening for filling the balloon. Keep taping till you reach your starting point. Cut off any extra tissue, and tape ends of base together.

3. Liftoff!

a) Assemble the heat source by removing the candles from the box, holding them tightly while wrapping the bases with tape to hold them together. Be sure bases are all even, so the candles can stand up. Tear off a piece of aluminum foil to put under candles.

b) Outside, on a windless day, set the heat source on the foil away from any flammable materials. Light the candles with the matches, tilting them to be sure all are lit, then stand them on the foil.

c) Quickly and carefully, fluff the balloon so the opening can catch the rising hot air, and hold top corners of balloon to keep base a few inches above flame. Be sure not to get it too close, or your balloon will catch fire! As the balloon fills, you will feel it tugging, trying to float upward. After the candles have burned a few minutes, and the balloon if well-filled, try letting it go – if it floats, you've made it! Be sure to blow out your candles when you're finished.

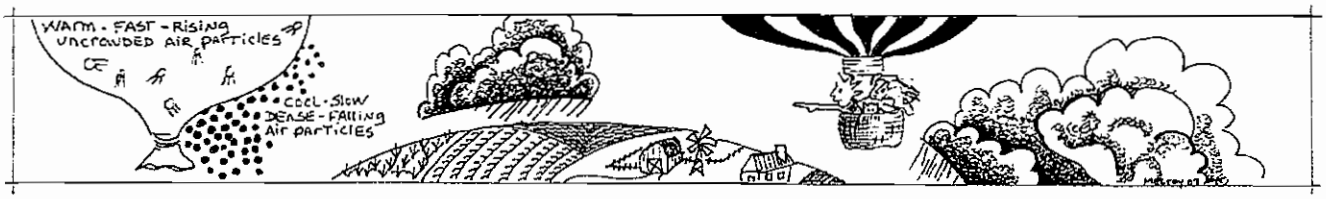
Hot-Air Balloon Flights

Flight Variables	Flight #1	Flight #2	Flight #3
Shape/size of balloon			
String length			
Weather Conditions			
Height traveled			
Distance traveled			
Time Traveled			
Add your own variable:			

Questions for Further Research and Extension Activities:

1. Does one type of balloon material work better than another? Try lightweight Mylar (the metalized plastic found in many potato chip or corn chip bags), small paper lunch bags, or plastic trash bags as balloon material. Record your data on a chart modeled after the one in the experiment.

2. How do weather conditions change the flight of your balloon? Does it fly better in cool or warm air? Why do you think this happens? Who would balloonists contact to be sure of good weather conditions? Check out this link for answers on how balloons work: http://imagine.gsfc.nasa.gov/docs/ask_astro/answers/970106a.html



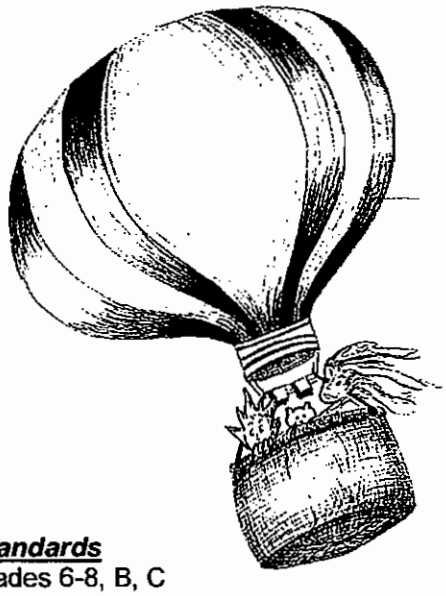
3. Research hot air balloons to determine what the real balloons are made of. How large are they? How long does it take to fill a real balloon before a flight? What workers are needed to design, construct, and prepare a balloon for flight? Try this link or others for information: http://www.hot-airballoons.com/

4. How is a hot air balloon steered? What does a balloonist need to know before he or she can fly safely? See previous links, or do a search on Google.

5. What kind of weather conditions would make flying a hot-air balloon unsafe, and why? How can balloons be used in predicting the weather? Who makes use of such weather-predicting balloons? The National Oceanic and Atmospheric Administration's (NOAA) website has some information: http://astrophysics.gsfc.nasa.gov/balloon/. This website also includes information on how NASA uses balloons for the space program.

6. What differences, if any, are there between hot-air balloons and helium-filled balloons? Can they fly in different conditions? How and where are helium balloons used? What kinds of jobs would make use of helium balloons?

7. Research early balloonists to find out what discoveries they made about the earth's atmosphere, and share your findings with your class.



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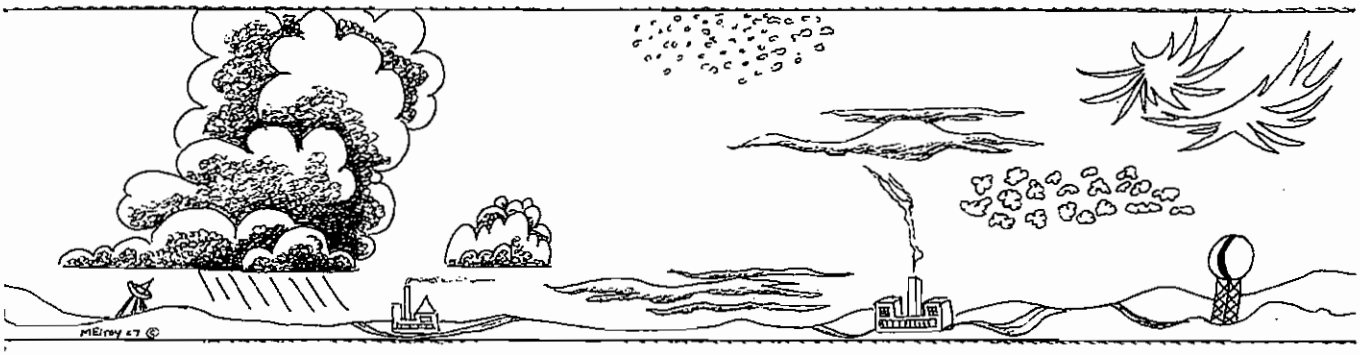
Whether There Will Be Weather

In the book, The Phantom Tollbooth, by Norton Juster, a boy driving a toy car in a fantastic world meets a Whether Man. When asked about the name, the Man says, "It's more important to know whether there will be weather than what the weather will be."

People in many different careers, though, depend on knowing as much about what the weather will be as possible. Construction workers, sailors and Great Lakes and ocean shippers, airline pilots, farmers, and many other workers depend on knowing what the daily weather patterns are.

Meteorologists are the people who study these patterns and report on the weather on your television news. They have to understand how winds travel in the atmosphere, how temperature changes, how moisture levels change, what causes clouds and storms to form, and use their knowledge of past weather events to predict future ones. In preparing these predictions to be as accurate as possible, meteorologists make use of weather satellite images, computer data and models, current barometer and thermometer readings, and communicate with other meteorological stations around the world

Most of basic weather prediction deals with differences in three major factors: temperature, air pressure, and humidity. The first, ***temperature***, determines how air particles will move. You probably already know that if air is warm, it rises: just think about hot air balloons, or the steam above a pan of water boiling on the stove. The reason it rises has to do with the speed at which the air particles move -- as they heat, they move faster, spreading out in the atmosphere. This makes them less dense than the surrounding air, and they rise. Rising air more easily carries moisture into the upper atmosphere, where it then cools, losing its heat energy, and condenses back into liquid water. Your class can actually see the process of cloud formation in the classroom by checking out the following website link: http://www.lessonplanspage.com/Sciencecloudslesson.htm



The different types of clouds indicate different conditions in the atmosphere, leading to different weather conditions. Research one of these types of clouds to determine what weather conditions they may predict or indicate: cumulus, stratus, nimbus, cirrus. How are these names combined to show different cloud types and conditions? Share your findings with the class, and create a poster showing all the types of clouds and conditions they indicate.

Play the part of a meteorologist by predicting local weather with cloud and temperature observations. Use your knowledge of cloud formations to identify cloud types, and record daily temperatures for two weeks. Record observations in the chart on the following page, and make daily predictions on tomorrow's weather based on each day's information.

How accurate were your predictions? Why do you think this was?

What information do you think would make your predictions more accurate?

How could you obtain that information?

Research the various instruments meteorologists use, and what those instruments measure. How would using each instrument increase the accuracy of your predictions?

CHART: Weather Predictions Using Clouds

Date	Temperature	Cloud Types Present	Today's Weather	Predictions for Tomorrow's Weather

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The second major factor of weather prediction is ***air pressure***. Air pressure is measured with the use of a barometer. Barometers measure high or low pressure, and these differences are indicated on weather maps by lines called isobars. The distance between isobars tells meteorologists how quickly pressure is changing: the closer isobar lines are, the quicker the change from low to high or high to low pressure. Wind speeds are generally indicated, too, by distances between these lines, and tend to be stronger when lines are closer together. Wind direction is also indicated by observations of air pressure – low pressure creates, in effect, a space in the atmosphere that the surrounding air rushes into. This rush of air is what we call wind. See if you can locate a weather map showing isobars and pressure differences on the Internet. The NOAA, National Oceanic and Atmospheric Administration, website is a good starting point at www.noaa.gov.

Using the NOAA weather map online, or one provided by your teacher, answer the following questions:

Can you determine from this map which direction the winds are blowing? How is that direction indicated?

Can you determine differences in wind speeds by studying isobars? In what types of conditions do the wind speeds appear to be fastest?

How would these conditions affect people working outside on a job? What kinds of jobs or activities might be impacted by strong winds?

Humidity is the third major factor in weather prediction, and one that we usually think of most with weather. Humidity in the air refers to the amount of moisture, or water vapor, in the atmosphere. Why would it be important to find out how high the humidity is on certain jobs? How is humidity different from relative humidity? Which idea is most important to meteorologists for weather predictions, and why?

Extension Activities:

1. Research the history of the National Weather Service. When did it start predicting weather? What technological problems did early predictions have to deal with?

2. How do Doppler radar and satellite images improve our current ability to predict weather conditions? Check out the NOAA weather satellite link for information: http://www.noaanews.noaa.gov/stories/s421.htm.

3. What types of radiation and other information can be seen with these types of technology?. How would that be important to people in different kinds of jobs? How do these technologies work? Who manufactures and uses these ideas today?

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