



 **Reading the Weather** 

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 **Reading the Weather**   
**Curriculum Unit Overview****Summary**

The weather report is important to many people. Almost everyone wants to know: “What will the weather be like today? Cold and wet? Warm and sunny?” Farmers, sailors, pilots, firefighters, lifeguards, and letter carriers all keep a close eye on the weather because their work depends on it. Farmers depend on the weather to make a living. Sailors and pilots must know if storms are on the way. Poets are inspired by sunsets and sea breezes. We all know songs about sunshine and rain.

Weather is part of our lives. It affects the way we dress, the food we eat, and the type of house we live in. Weather can change a school day to a “stay-home” day and determine when and where we go on vacation. Temperatures are very important in deciding where to go on holiday. In the USA for instance, many people go to Florida in the winter because it is much warmer than New York or Washington. There’s no doubt about it—the weather has lot to do with how we live!

This curriculum unit is designed for students in first through fourth grade classrooms. Its objective is to teach and reinforce the 4<sup>th</sup> Grade Ohio Science Proficiency Learning Outcome:

Strand III: Earth and Space Science

#13 – Make predictions about the weather from observed conditions and weather maps.

In addition, this curriculum unit is designed to make a connection with our TIES work experience with Civil Air Patrol at Wright Patterson Air Force base. We worked for the CAP Great Lakes Regional Director in charge of promoting aerospace education in public and private educational institutions across six states. She is available to help those who request her assistance in their school or community. America leads the world in this “aerospace” endeavor and it is a mission of the Civil Air Patrol to get the available educational resources into the hands of teachers and into the knowledge base of America’s student population.

The aviation industry is one of the largest consumers of weather information. Pilots and air transportation are dependent upon information about weather in order to make flying safe and comfortable. When planning a flight, the pilot firsts contacts a flight service station for weather information. The flight service station receives weather reports from the United States Weather Bureau. Weather forecasting depends upon the observation of such facts as temperature, winds, cloud formation, atmospheric pressure, and moisture in the air.

This curriculum unit could span the length of a quarter, semester, or an entire school year. This unit can continue as long as the teacher feels it is beneficial or worthwhile.

## Big Picture

Kids love to think about what they will be when they grow up. This activity will get them thinking about how the weather might affect their future jobs and how weather affects each of us everyday.

Hook activity: Weather on the Job

Subject: Social Studies

Materials: brown paper grocery bags or a large piece of butcher paper, scissors, marker, glue, empty bottle, drawing paper, crayons, tape

Procedure:

1. Ask: "What do farmers, sailors, pilots, firefighters, lifeguards, and letter carriers all have in common? Say: "They all keep a close eye on the weather because their work depends on it."
2. Say: "You might be surprised by all that you already know about the weather. After all, you've been living with it all your life!" Make a list of all the words the students can think of that describe the weather and what it does.
3. Divide the students into six teams. Pass out crayons and drawing paper. Have each team choose a weather condition from the list to illustrate. For example, everybody in team one could draw windy day pictures, while those in team two could draw their versions of a rainy day.
4. While the teams are drawing pictures, make a weather game board using a large piece of butcher paper or several brown paper grocery bags taped together. Cut out a large circle and divide the circle into six equal segments using a yardstick and a marker. Then draw a smaller circle in the middle of the game board.
5. Ask the students in team one to paste their drawings into one of the segments. Team two can paste their pictures in another segment and so on until the game board is filled. Label each segment with the weather term the drawings show. Then set the empty bottle in the small circle so that it's in the center of the game board.
6. Ask students to close their eyes and imagine what job they want to do when they grow up. Have students brainstorm different types of occupations and write their suggestions on strips of paper. Place the strips in a hat (i.e., construction worker hard hat).
7. Have students sit around the circle game board. Select 4-5 students to pick jobs out of the hat and read them to the rest of the group. Next select a student to spin the bottle to see what kind of weather they will have on the job today. When the bottle stops ask questions that will get the students thinking about and discussing how the weather affects everyone (i.e., What special clothes will you wear today?; Will it be a nice day to be a \_\_\_\_\_? Why or why not? Will the weather help you do your job or will it make it harder? Explain.). Repeat several times.
8. After the game, gather students together. Ask: "Did you wear a jacket, coat, or sweater today? Why or why not?" Say: "The weather affects the clothes you wear everyday. Should you wear shorts or long pants? Lots of things you do depend on the weather too!. Let's make a list of things affected by the weather (i.e., playing baseball, picnic cancelled, school called off because of snow, etc.). Should you ride your bike or curl up on the sofa and read a good book? It also affects how you feel. A rainy day might make you quiet and thoughtful. A sunny day might make you happy and excited."

**Preparation for the Unit**

Work with grade-level colleagues to:

- Identify a timeline for the curriculum unit and coordinate learning activities
- Visit weather websites online and mark favorites for classroom use
- Locate and gather weather resource materials (i.e., books, posters, maps, etc.)
- Locate and gather learning activity materials
- Schedule guest speakers
- Determine fieldtrip possibilities and schedule (i.e., museum, weather center, or meteorological station)

**Overview**

The following table is a summary of the unit including brief summaries of each Authentic Learning Task (ALT). This table provides an overview of the tasks in the unit sections and shows how the activities in the different teaching areas relate to each other.

 **Reading the Weather**   
**Curriculum Unit Summary**

<b>Science</b>	<b>Language Arts</b>	<b>Technology &amp; Aerospace Technology</b>
<p><b>ALT 1 – Build a Weather Station</b> The students will learn that weather is the condition of the air. The students will create weather instruments with everyday materials. The students will use these home-made weather instruments to collect and measure weather data on air temperature, air pressure, air movement, and air moisture (precipitation).</p>	<p><b>ALT 2 – Keep Your Eyes on the Skies</b> The students will go outdoors and observe cloud formations in the sky. The students will learn about three main cloud types and how they affect our weather. The students will create a Cloud Chart to help them read the clouds!</p>	<p><b>ALT 4 – High-Tech Weather Tracking</b> The students will learn that meteorologists use high-tech tools (i.e., weather satellites, radar stations, weather balloons with radiosondes, computers) to help them keep up with modern-day weather tracking. The students will make and launch a hot air balloon and parachutes.</p>
<p><b>ALT 6 – A Road Map for the Weather</b> The students will observe and read weather maps that appear on TV during a forecast, on the internet, and in the newspaper. The students will listen to the next-day forecast and draw a weather map to illustrate tomorrow's weather.</p>	<p><b>ALT 3 – Keep a Weather Log</b> Students will record daily weather observations, illustrations, and comments in a log. The students will identify and analyze weather patterns that emerge. The students will predict future weather by writing a forecast for the next day's weather in their logs and will compare their predictions to the actual weather.</p>	<p><b>ALT 5 – Weather Aircraft</b> The students will learn that special weather aircraft fly right into tropical storms and hurricanes to gather critical information regarding the storm's strength and direction. The students will make paper airplanes and have a paper airplane contest.</p>

**Transfer Activity**

Cooperative learning groups will report the weather through a variety of mediums.

## **Section One: Science**

### **ALT One: Build a Weather Station**

#### **Summary**

The students will learn that weather is the condition of the air. The students will create weather instruments with everyday materials. The students will use these homemade weather instruments to collect and measure weather data on air temperature, air pressure, air movement, and air moisture (precipitation).

#### **Competencies**

The students will be able to:

1. Describe the factors affecting weather: air temperature, air pressure, air movement, and air moisture.
2. Create weather instruments with everyday materials.
3. State the name of a weather instrument and its use.
4. Use weather instruments to collect and measure weather data on air temperature, air pressure, air movement, and air moisture (precipitation).

#### **Time**

Several class periods

#### **Materials**

1. The Kids' Book of Weather Forecasting by Mark Breen & Kathleen Friestad
2. Weather Watch by Julian Rowe and Molly Perham
3. Simple Weather Experiments With Everyday Materials by Muriel Mandell
4. Bowl with water
5. Drinking glass
6. Paper towel
7. Balloon
8. Balance
9. Cup
10. Index Card
11. Large Classroom Demonstration Thermometer
12. Student Thermometers
13. Materials for Barometer: balloons, empty cans, rubber cans, drinking straws, tape, scissors, and cardboard

14. Materials for Weather Vane: paper cups, pencils, cardboard, straight pins, marker, compass, and modeling clay
15. Materials for Rain Gauge: 2-liter plastic soda bottles, scissors, and rulers

## Instructions

1. Show students a bowl of water. Hold up a glass with a piece of paper towel. Crumple the paper towel into a ball and stuff it into the bottom of the glass. Hold the glass upside down. Say: “I am going to put this glass straight down into the water. What do you think will happen to the piece of paper? Let’s see if you are right.” Push the glass straight down into the water. Pull the glass straight up. Have a student take the paper out. Ask: “Is the paper wet or dry? Why didn’t the paper get wet?” Say: “The paper stayed dry because there is air inside the glass. The air kept the water out of the glass. Even though we can’t see it, air takes up space. In fact, air is everywhere. The entire Earth is surrounded by a blanket of air.”
2. Ask the class to describe today’s weather. As they give their descriptions, write the words they use on the board (i.e., hot, sticky, feels like rain, very little breeze). Say: “Whenever you describe the weather, you are describing the air around you! The condition of the air changes according to temperature (For instance, today is hot.), moisture (It is sticky outside. It feels like rain.), movement (There is a very little breeze.), and pressure. We will be learning about all of these properties of the air as we study the weather.”
3. Teach students about each condition of the air and how to measure it with weather instruments.

### Air Temperature

- If available, display a large classroom demonstration thermometer. Tell students that temperature is how hot or cold something is. Review that a thermometer is a device that measures temperature. Discuss how a thermometer works. Ask: “What happens to the colored line when a thermometer is placed in a cold or warm location? During the winter, would the line be up or down? During the summer, would the line be up or down?” Explain to students that the liquid stored at the bottom of the thermometer expands in warm weather and rises. The level the liquid reaches on the thermometer shows the temperature. Show students how to read temperature in degrees.
- Allow student partners to practice measuring the air temperature with thermometers. Encourage students to measure the temperature of the air in the sun and in the shade. Say: “Where else might you find thermometers? What jobs need them?”

### Air Pressure

- Blow up a balloon and tie it. Say: “We all know that air takes up space and is always around us even though we can’t see it. But does air have weight?” If the students say it does, ask them how they could prove it. Then place the blown up balloon on one

end of a balance and a deflated balloon on the other end. Show students that air has weight. Say: “In fact, you might not think of air as having any weight, but it does.”

- Fill a cup to the top with water. Put an index card over the top of the cup and hold it firmly. Still holding the card, turn the cup upside down. Ask students to predict what will happen if you let go of the card. Let go of the card. (Do this over a sink.) Have students observe what happens and discuss the results. Ask: “Why didn’t the water pour out?” Lead the discussion to conclude that the water and the card were being pushed up by air under it. The pressure of the air was greater than the force of the water. Say: “This is an example of air pressure.”
- Say: “Did you know that about one ton of air is pushing against us all the time, even though we can’t really feel it. With all this pressure pushing against us, why aren’t we crushed? It’s because pressure inside our bodies equals the pressure from the atmosphere.”
- Say: “Air pressure is how hard air pushes on anything it touches. A barometer is used to measure air pressure. A barometer is one of the most important tools meteorologists use to predict changes in the weather.” Show students a barometer, if possible.
- Have students make their own homemade barometers using everyday materials. (Refer to Weather Watch by Julian Rowe and Molly Perham p. 27 for easy-to-follow instructions.)
- Teach students how to read their homemade barometers. Tell students to point their thumbs in the direction that the barometer (and the air pressure) is changing. If the barometer is going up, give the weather a “thumbs up.” When the barometric pressure is high, skies are fair, and it’s a great day to be outside. If the pressure is falling, the weather gets a “thumbs down,” meaning wet or stormy weather is on the way. If the pressure is “steady,” as forecasters say, then no change in the weather is predicted.

### Movement

- Instruct students to pick up a piece of paper and fan themselves. Ask: “What do you feel on your face?” Say: “Air that moves is called wind. Some days are so still it seems that no air is moving at all. Don’t be fooled, though. Air is always there, even when you don’t notice it.”
- Ask: “What makes wind?” Say: “When air is warmed by the sun, it rises up. Heavier cold air rushes in to take its place. When that air is warmed by the sun, it rises, too. This happens over and over. We feel this movement of the air as wind.”
- Ask: “Which way does the wind blow?” Say: “A weather vane (i.e., wind vane) can help you answer this question. A weather vane turns with the wind. It points in the direction from which the wind blows. Winds are described by the direction from

which they blow. Southerly winds blow from the south.” Have students make their own homemade wind vanes using everyday materials. (Refer to Weather Watch by Julian Rowe p. 25 for easy-to-follow instructions) Teach students how to read their homemade wind vanes.

- Introduce students to the Beaufort Scale. Students can carefully watch the things that the wind moves outside and use the scale to judge the speed of the wind. Give each student his or her own Beaufort Scale and allow students time to practice using the scale outdoors. Students can keep their Beaufort Scale in their weather logs. (Refer to Simple Weather Experiments With Everyday Materials by Muriel Mandell p. 108 for a copy of the Beaufort Scale.) Students could also make a Beaufort Scale spinner using everyday materials. (Refer to The Kids’ Book of Weather Forecasting by Mark Breen & Kathleen Friestad p. 55 for easy-to-follow instructions.)

#### Moisture (Precipitation)

- Ask: “What happens to a water puddle on the sidewalk after it rains?” Say: “Yes, the water in the puddle evaporates into the air. Water is always in the air we breathe. Any kind of water falling from the sky—rain, snow, drizzle, hail—is called precipitation. A rain gauge is used to measure the amount of precipitation that has fallen from the clouds.”
  - Have students make a rain gauge to measure rainfall. (Refer to Weather Watcher by Julian Rowe and Molly Perham p. 13 for easy-to-follow instructions.) Teach students how to measure the amount of rain collected in their rain gauges.
4. Organize students into cooperative groups. Challenge them to set up their own weather stations using weather instruments, including the ones they have made. Encourage cooperative problem solving. Help each group find a safe, open, flat, and convenient place for their weather station. Ask each group to make a sign for their weather station. They should name it and list the people in their group.

### **Evaluation/Assessment of Student’s Competency**

Evaluation will be based on the student’s ability to make weather instruments and cooperatively work with a group to set up a working weather station.

### **Closure**

Say: “Reading the clouds is just as important as reading your weather instruments everyday. Meteorologists keep a very close eye on clouds: their size, shape, and where they hang out in the sky tell forecasters what weather those clouds with bring. Our next lesson will teach you how to “read” the clouds.”

## Section One: Science

### ALT Six: Road Map for the Weather

#### Summary

The students will observe and read weather maps that appear on TV during a forecast, on the Internet, and in the newspaper. The students will listen to the next-day forecast and draw a weather map to illustrate tomorrow's weather.

#### Competencies

The students will be able to:

1. Design weather symbols for a weather map key.
2. Draw and illustrate a weather map to show tomorrow's weather in the United States.

#### Time

1-2 hours

#### Materials

1. Video Clips of TV Weather Forecasts
2. Multiple Copies of a Newspaper (Weather Section)
3. Computers with Internet (Showing Weather Maps or Satellite Images)
4. Large Classroom USA Map
5. Laminated Weather Symbols
6. Blank USA Map Worksheet (one for each student)
7. Markers

#### Instructions

1. Discuss why weather is different in different places. Ask: "How can we find out the weather in North America?"
2. Say: "Weather maps are based on information collected by hundreds of local weather stations. You'll be amazed at all the weather information you already know how to interpret once you understand the symbols! Special symbols and codes on weather maps explain the type of weather a location is having. The symbols are used because they take

up a lot less space than words.” Ask: “What symbols could we use to report and record the weather on a map?”

3. weather forecast for the day with the actual weather. Ask: “Is the forecast for the day accurate?” Note special cities that are specifically mentioned and point them out on large classroom USA map. Have students compare the temperatures in Ohio to the rest of the United States. Ask: “Which cities in Ohio had the highest and the lowest temperatures for the previous day? Which regions in the United States had the highest and lowest temperatures the previous day?” Discuss what the symbols on the newspaper weather map means and ask questions to check student understanding.
4. Have students listen to the next-day forecast and make notes in their Weather Logs. Then, have them draw a weather map to illustrate tomorrow’s weather.

### **Evaluation/Assessment of Student’s Competency**

Evaluation will be based on the student’s ability to design weather symbols for a weather map key and create a weather map to show tomorrow’s weather in the United States.

### **Closure**

Say: “Thousand’s of people all over the world help gather the weather information that is needed to make predictions. Weather data pours into the National Meteorological Center in Washington D.C., around the clock, coming from weather stations on ships, on planes, on balloons, on airport decks, on university campuses, and other places all over the world. Every 12 hours this information is fed into giant computers and transformed in accurate, up-to-date weather maps. A meteorologist takes all the data and uses his or her skills and experience to come up with a reliable weather forecast. In our next lesson, you will get the chance to report the weather too!

## Section Two: Language Arts

### ALT Two: Keep Your Eyes on the Skies

#### Summary

The students will go outdoors and observe cloud formations in the sky. The students will learn about three main cloud types and how they affect our weather. The students will create a Cloud Chart to help them read the clouds!

#### Competencies

Students will

1. Identify clouds by their shape and how high they are in the sky.
2. Create a Cloud Chart to illustrate the three main types of cloud formations and their elevations in the sky.

#### Time

3 hours

#### Materials

1. Glass jar
2. Hot water
3. Plastic wrap
4. Rubber band
5. Ice cubes
6. Sketch paper & pencils
7. The Cloud Book by Tomie dePaola
8. Construction paper
9. Markers

10. Cotton balls
11. Paint
12. Sponges
13. Art materials

## Instructions

1. Start out by telling students that people have been watching the skies and studying the clouds for centuries. Clouds occasionally help us forecast the weather to come.
2. Tell students that clouds are made up of tiny water droplets and ice crystals floating in the air. Fill a glass jar  $\frac{3}{4}$  full with hot water. Cover the jar opening with clear plastic wrap and place a rubber band around the opening to secure it. Put ice cubes on top of the plastic wrap. Water vapor will condense where the warm and cold air meet. Show students the cloud that forms in the jar.
3. Say: “Clouds form when water in the air, called vapor, cools and turns into droplets. When the droplets group together they become so heavy that they fall as rain.” (If time permits, teach or review the water cycle.)
4. Take students outdoors to observe and sketch the clouds for about 10 minutes. Bring the class back inside and have an open discussion about what they saw. Make a list as they talk. Encourage students to cut out and add their cloud sketches to the list created. Later, have the class return to this list and decide on what types of clouds were seen.
5. Read The Cloud Book by Tomie dePaola to the class. With students, look at the pictures and discuss the types of clouds, how they look, and how they relate to the weather conditions. Explain to students that clouds are grouped by the way they look and according to where they form in the atmosphere. Teach students that there are three main types of clouds but many variations of these three occur.
  - Cumulus Clouds – Cumulus clouds look like piled-up heaps of cotton. A nice fluffy white cumulus will not give any rain but the darker the cloud becomes, the greater the likelihood of rain. (Cumulonimbus clouds consist of ice crystals high up in the sky. They are dark thunderclouds, which bring heavy rain and lightning.)
  - Stratus Clouds – Stratus clouds are low-sky clouds that look like layered sheets. They cover the whole sky and often completely block direct views of the sun. They may be light grey in color, very thin and unlikely to bring rain on their own. But thicker and darker stratus may bring light rain, light snow, or drizzle.
  - Cirrus Clouds – Cirrus clouds are high-sky clouds that are very thin and feathery in appearance. They are often called mares’ tails because they resemble a horse’s tail blowing in the breeze. They are the first sign of an approaching warm front and can mean rain or snow is on the way.

6. Have students create a Cloud Chart (a labeled diagram) to illustrate the three main types of clouds and their elevations in the sky. Provide students with construction paper, paint, sponges, cotton balls, art supplies, etc. Pass out construction paper that is at least 17 inches in length to each student. Have students draw a straight line down the right side of their paper. Ask students to place dots on the line at one-inch intervals, starting from the bottom. Write the following scale on the board: 1 inch =  $\frac{1}{2}$  mile. Next to the first dot from the bottom, have each student write  $\frac{1}{2}$  mile. Then on the next dot, directly above, the students should write 1 mile, then 1  $\frac{1}{2}$  miles, and so on going up the chart. Tell students to add layered stratus clouds at a  $\frac{1}{2}$  mile up from the ground, heaps of cumulus clouds starting at 1 mile from the ground, and thin, feathery cirrus clouds 8 miles high in the sky. Students should label their clouds and add houses, trees, and people to the ground level. They should add a title "The Cloud Chart" too!

### **Evaluation/Assessment of Student's Competency**

Evaluation will be based on the student's ability to create a labeled Cloud Chart that identifies the 3 main types of clouds and their elevations in the sky.

### **Closure**

Explain to students that each day they will go outdoors and observe the sky. Tell students that they will chart the type of cloud formations they see and the current weather conditions of the day in weather logs that they will be designing.

## **Section Two: Language Arts**

### **ALT Three: Keep a Weather Log**

#### **Summary**

Students will record daily weather observations, illustrations, and comments in a log. The students will identify and analyze weather patterns that emerge. The students will predict future weather by writing a forecast for the next day's weather in their logs and will compare their predictions to the actual weather.

#### **Competencies**

Students will be able to:

1. Observe weather conditions.
2. Record daily weather conditions and readings of weather instruments in a weather log.
3. Predict the weather using their observations and weather instrument recordings.
4. Compare their predictions to professional predictions and actual weather.

#### **Time**

Several class periods

#### **Materials**

1. Student Weather Logs
2. Student weather stations with weather instruments
3. Video clips of TV weather forecasts

**Instructions**

1. Help students make their own personalized weather logs. Have students draw a chart like this one, or have them design one of their own. Younger students may need a chart provided to them.

Page 1

Date	Temperature		↑ Air ↓ Pressure (rising or falling)	Precipitation (centimeters)	Clouds (cirrus, cumulus, or stratus)
	AM	PM			

Page 2

Wind		My Forecast	Newspaper, Radio, or TV Forecast	Actual Weather
Speed	Direction			

2. Review with students how to “read” their weather instruments. Teach students how to record their observations and findings.
3. Provide frequent opportunities for students to observe and record weather conditions and readings on weather instruments during a designated period of time (such as a quarter or semester).
4. Each day have students write down their detailed measurements of the weather. Students should keep track of air temperature, air pressure, wind direction and wind speed, cloud formations, and rainfall. Remind students to date everything, so that they can begin to see patterns emerge.
5. Once students have a week or two of data (scientific information), they can start looking for weather patterns—relationships between a weather condition (wind from the northeast, for example) and the weather event that follows (rain later that day).
6. Help students to use their observations and recordings to predict the weather to come. Have students try writing a forecast for the next day’s weather in their logs. Then have them check to see if they were right the following day. Encourage students to evaluate their work by comparing their predictions to professional predictions and actual weather. Tell students to not feel too bad if their predictions are not always accurate. Explain that weathermen are not always right, either—even with the help of weather satellites, radar, balloon-borne instruments, and super-speed computers to help their surface observations.

**Evaluation/Assessment of Student's Competency**

Evaluation will be based on the student's ability to:

1. Measure and record daily weather observations in his or her weather log.
2. Analyze and reflect upon the weather data collected in writing and pictures.

**Closure**

Say: "Meteorologists have been using weather instruments (i.e., barometer, rain gauge, weather vane, etc.) for hundreds of years to measure and record weather data. Within the last fifty years, meteorologists have used weather balloons, satellites, radar, and computers to improve the accuracy of their forecasts. We will learn more about these high-tech weather tracking machines in our next lesson."

## **Section Three: Technology & Aerospace Education**

### **ALT Four: High-Tech Weather Tracking**

#### **Summary**

The students will learn that meteorologists use high-tech tools (i.e., weather satellites, radar stations, weather balloons with radiosondes, computers) to help them keep up with modern-day weather tracking. The students will make and launch a hot air balloon and parachutes.

#### **Competencies**

Students will be able to:

1. Make a hot air balloon and observe that hot air rises.
2. Follow directions to make a simple paper parachute.
3. Launch and time a parachute's decent.
4. Record collected data.

#### **Time**

Several class periods

#### **Materials**

1. Tissue paper
2. Glue stick
3. String
4. Tape
5. Scissors
6. Blow dryer or hot air popcorn popper
7. Paper lunch bags
8. Small berry baskets
9. Handkerchief
10. 2 Small toys (identical)
11. Paper napkins
12. Small round sticky dot
13. Paper clips
14. Miniature candy bars
15. Popsicle sticks
16. Stopwatches

## Instructions

1. Say: “Even before airplanes were invented scientists wanted to know what was happening in the atmosphere. Once, two men took thermometers, barometers, and other weather instruments high into the air in a big hot-air balloon! They learned a lot about what happens in the atmosphere. But they also learned that it was dangerous for them to go so high up in a balloon. They almost died from the cold and lack of air.”
2. Say: “Weather scientists still use balloons to learn about what goes on in the atmosphere. They send packages of instruments called “radiosondes” into the air, attached to balloons. But people don’t have to go up with them today! The radiosondes send radio signals back to weather scientists on the ground. Thousands of radiosondes are released every year. When their balloons pop, the radiosondes return to the earth on small parachutes. Some are lost. But others land in people’s yards, fields, gardens, or woods. If you find a radiosonde, send it to the address on the package. The instruments may be repaired and used again.”
3. Build and launch a hot air balloon with the class.
  - Gather together six sheets of tissue paper, a glue stick, a piece of string, a piece of tape, and a pair of scissors.
  - Use four full sheets of the tissue paper to build the balloon.
  - Using the glue stick, fasten the long edge of the four sheets of tissue paper together, forming an open box.
  - From the fifth sheet, cut a piece to fit over the top; glue along all edges.
  - Make a loop with the string; tape the loop to the center top of the balloon.
  - Cut several long strips of tissue paper from the remnants of the fifth sheet; attach these streamers at each corner of the balloon. (The sixth sheet will be used to patch any tears in the balloon.) It is important to make sure all seams are joined together, with no “escape holes” for the air.
  - Use the string handle to hold the balloon and heat the air inside the balloon with a blow dryer or hot air popper. Be careful not to touch the tissue paper with the hot blow dryer; this will cause the paper to burn. When the air has been heated enough, the balloon will try to “pull away” from you. Release the balloon and watch it fly up and away!
  - Discuss how a hot air balloon works. Students should use their knowledge from previous weather lessons to conclude that the balloon is able to lift up because hot air rises and is lighter than cooler air.
  - Have students make individual hot air balloons using small paper bags. Students can decorate their hot air balloons with crayons, markers, or paint. Have students punch holes in each of the corners and attach a piece of yarn or string to each hole. Fasten a

plastic berry basket to the balloon using the string ends. Display the hot air balloons in the classroom by suspending them from the classroom ceiling.

4. Discuss parachutes.
  - Gather together a handkerchief, string, scissors, and two identical small toys.
  - Measure and tie four strings of equal length to the corners of a handkerchief.
  - Gather the string ends together and attach a small toy. Demonstrate what happens when two objects (one with a parachute and one without) are falling. In one hand, hold a small toy (with parachute attached), and in the other hand, hold a small toy (without a parachute). Ask: “Which toy will take longer to reach the floor and why?” Listen to several predictions and then drop the small toys simultaneously. Students will observe that the small toy without a parachute falls to the ground much faster than the one with the parachute.
  - Lead students into a discussion about parachutes. Ask: “What is a parachute? What does a parachute look like? How are parachutes used? What would happen to a person or an object, like a radiosonde, if a parachute was not used during a fall?” Record class observations on chart paper.
5. Have each student make their very own paper parachute in class.
  - Put one paper napkin, four pieces of string 20 inches in length, five small sticky dots (round Avery labels), one paper clip, and a miniature candy bar into a plastic baggie. Make one bag for each student in the classroom. Have tape accessible for all students to use.
  - First, have students open their napkins flat in front of them.
  - Second, have students securely attach their strings to the napkin corners using the sticky dots provided.
  - Third, students should fold up their napkins as they were originally folded. The strings should be gathered together at this point.
  - Next, have students slide their paper clips into the center of their candy bar wrappers and secure with tape.
  - Finally, students should take all four strings and slip them through their paper clip ends and attach. They can tie a knot or use the fifth small dot to secure the strings together.
6. Have each student drop his or her parachute gently and observe it as it floats to the ground. Ask: “Why does it fall? What force is acting upon it? Why does it float rather than drop straight down?” Discuss these questions with the class. Record class observations on chart paper.

7. Say: “A parachute slows an object’s fall from a great height. A parachute is affected by two forces: gravity pulling it down toward the center of the Earth and air resisting that movement. Don’t forget that air pushes in all directions. Ultimately, the pull of gravity is greater than air resistance so the parachute is slowed but not stopped. Older parachutes had a round canopy, but now they are more like arches or boxes. Newer parachutes have fabric compartments called cells in which the air can be trapped. Modern parachutes can be steered by pulling on guide lines. Whereas older parachutes were made of silk, today most parachutes are made of nylon because it is stronger and cheaper.”

8. Lesson Extensions:

- Have students attach toys of different weights to their parachutes. Ask: “How does a change in mass affect time of descent?” They should drop their parachutes from the same height and observe. Have them time and record how long it takes for each parachute to reach the ground. Have them record the results and discuss what happens when more mass is added to the paper napkin parachutes.

For example:

**Parachute Drop Data Sheet**

Name of Toy	Weight (ounces)	Time of Descent (seconds)

- Have students work in small groups to construct square parachutes of various sizes (i.e., 10” square, 11” square, 12” square and 13” square). Have students predict and record the number of seconds they think it will take the different sized parachutes to fall to the ground. Have students take turns dropping the parachutes, observing the drops, and timing and recording their observations on a data sheet. Students could use the data obtained to create a bar graph so that comparisons could be made. (Note: Students should conclude that the larger the parachute canopy, the slower it will drop because it catches more air; therefore slowing the rate of descent.

For example:

**Parachute Drop Data Sheet**

Parachute Size (inches)	Predicted Time (seconds)	Actual Time (seconds)	Difference (seconds)
10”			

<b>11"</b>			
<b>12"</b>			
<b>13"</b>			

- Have students cut a hole in the top center of their parachutes, drop, and time. Ask: “What happens to rate of descent?” Then have them cut a hole in one side of another parachute—what happens?
- Have students experiment with different materials (i.e., plastic, tissue paper, fabric) for the parachute canopy. Ask: “How does this change affect time of descent?”
- Have students construct and test parachutes of different shapes (i.e., circle, ellipse, pentagon). Ask: “How does this change affect time of descent?”
- Have student teams try to create a parachute that will provide the greatest amount of drag and stay aloft the longest time after being dropped from the same height and location.

### **Evaluation/Assessment of Student’s Competency**

Evaluation will be based on the student’s ability to follow directions, measure, and record data.

### **Closure**

1. Explain to students that in addition to weather balloons, meteorologists use a variety of high-tech tools, like satellites, radar, and computers to improve the accuracy of their forecasts. These high-tech tools help weather scientists collect information about weather conditions all over the world and developing storms.
2. Say: “Doppler radar helps meteorologists predict when the next severe storm will occur. Doppler radar sends out radio waves at the speed of light. These waves bounce off moisture in the air and reflect back to a radar antenna. The radar receiver picks up the radio waves and changes them into dots and blips of light that show up on a fluorescent screen. When the weather forecaster on TV shows you the “radar picture,” he or she is showing you those radar pulses. From the ground, weather watchers track the parent thunderstorms of tornadoes with radar. One of the “tricks” to be a good meteorologist is learning how to “read” and interpret the radar.
3. Say: “In addition, weather satellites above the Earth take pictures of the earth. Satellites show how the clouds are moving. They also follow the movement of the storms from high up in space. Satellite pictures are very important in spotting and tracking dangerous storms like hurricanes. When weather scientists see a hurricane forming, they warn people who might be in its path.”
4. Say: “But scientists often need more detailed information to make accurate predictions about a storm’s path and intensity. Scientists can depend on special weather aircraft to help find this information. In the next lesson, you will learn that hurricane hunters fly

special weather aircraft near or into a storm to gather information about wind speed, rain, and temperature.”

## Section Three: Technology & Aerospace Education

### ALT Five: Weather Aircraft

#### Summary

The students will learn that special airplanes fly right into tropical storms and hurricanes to gather critical information regarding a storm's strength and direction. The students will fold paper airplanes and have a paper airplane contest.

#### Competencies

The students will be able to:

1. Learn about how the forces lift, gravity, thrust, and drag work on an airplane in flight.
2. Design, create, and fly paper airplanes in a paper airplane-flying contest.

#### Time

2 hours

#### Materials

1. Storm Chaser: Into the Eye of a Hurricane by Brian Taggart
2. Fabulous Paper Airplanes by E. Richard Churchill
3. Paper Toys That Fly, Soar, Zoom & Whistle by E. Richard Churchill
4. The Paper Airplane Book by Byron Barton
5. Science Fun With Toy Boats and Planes by Rose Wyler
6. Paper
7. Tape
8. Paper clips

#### Instructions

1. Explain to students that some meteorologists fly special airplanes into and around tropical storms and hurricanes. Violent winds bounce the planes around. These special airplanes carry weather instruments and record weather data at various heights in the sky. Explain to students that radar and computers on board give the forecasters valuable information about the strength and direction of the storm.
2. Read and discuss Storm Chaser: Into the Eye of a Hurricane by Brian Taggart. This book profiles the life of Brian Taggart, a pilot for the National Oceanic and Atmospheric Administration, whose job involves flying directly into dangerous storms.

3. Ask: “Have you ever flown in a real airplane? Have you ever flown a paper airplane?”  
Say: “Sometimes it twists and loops through the air and then comes to rest, soft as a feather. Other times a paper airplane climbs straight up, flips over, and dives headfirst into the ground.”
4. Show students sample paper airplanes. Have a volunteer throw one paper airplane. Ask students to explain how they think the airplane flies. Ask: “What keeps the airplane in the air? How can you make a paper airplane go on a long flight? Does flying a paper airplane on a windy day help it to stay aloft? What can you learn about real airplanes by making and flying paper airplanes?”
5. Take two sheets of paper and crumple one into a ball. Hold the crumpled paper ball in one hand and the flat sheet of paper in the other hand high above your head. Tell students that you are going to drop both pieces of paper at the exact same time. Ask students to predict which piece of paper will hit the ground first and why. Drop them both. Ask: “What force pulled them both downward? Which paper fell to the ground first? What kept the flat sheet from falling quickly?” Say: “The flat sheet of paper falling downward pushed against the air in its path. The air pushed back up against the paper and slowed its fall. A crumpled piece of paper has a smaller surface pushing against the air. The air doesn’t push back as strongly as with the flat sheet, and the ball of paper falls faster.”
6. Say: “The spread-out wings of a paper airplane keep it from falling quickly down to the ground. We say the wings give a plane lift. Because you want a paper airplane to move forward, you throw it. Usually the harder you throw it, the farther it will fly. The forward movement of an airplane is called thrust. Thrust helps to give an airplane lift. The paper airplane lifts because the flowing air creates an area of decreased pressure. The airplane is pulled into that area. As thrust works to make it move forward, drag works to slow a plane down. The atmosphere pushes against the airplane as it moves forward, creating drag. At the same time, lift works to make a plane go up, gravity tries to make it fall down. These four forces are always working on paper airplanes just like they work on real airplanes. An airplane flies when the combined forces of lift and thrust are greater than the forces of drag and gravity.”
7. Set out a variety of books about paper airplane making. Challenge students to create a paper airplane that will fly the greatest distance. Let students explore various ways to fold paper airplanes. Allow students to test fly various models. Have a paper airplane contest or conduct your own air races. Have students measure the distance their paper airplane flies. The data collected could be graphed and analyzed!

### **Evaluation/Assessment of Student’s Competency**

Evaluation will be based on the student’s ability to follow directions, measure, and record data.

### **Closure**

Say: “Computers take all the information from weather stations, satellites, and weather balloons and convert it into weather maps. In our next lesson, you will learn how to read weather maps and you will get the chance to create some of your own!”

## Transfer Activity

### “And Tomorrow’s Weather Will be . . .”

#### Summary

The students will report the weather through a variety of mediums.

#### Competencies

The students will be able to:

1. Work cooperatively with a group to prepare a weather report.
2. Prepare a weather report to share with others.

#### Time

Several class periods

#### Materials

1. Weather Forecasting by Gail Gibbins
2. Bulletin board
3. Butcher Paper
4. Markers
5. US/Ohio Maps
6. Posterboard
7. Assorted art materials
8. Paper
9. Sample weather report script
10. Video recorder & blank video tapes
11. Tape recorder & blank cassette tapes
12. Videotaped TV weather reports

#### Instructions

1. Read Weather Forecasting by Gail Gibbins to class.
2. Assist groups to use their weather records, observations, and predictions to prepare visual aids (i.e., weather map) and scripts for weather reports. Have students read and listen to professional weather reports in newspapers, on radio, and on TV so that they get a feel for the content of these reports. (An excellent resource in The Weather Channel.) Encourage students to bring in newspaper pages, audio, and/or videotaped recordings of weather reports. Be sure that the students notice that most reports consist of two parts: a) reporting the current and just-past weather and b) forecasting the weather to come.

3. Arrange for a variety of mediums by which the children may share their reports:
  - a large display area such as a bulletin board
  - a pretend radio or TV broadcast
  - a space in the class or school newspaper
  - broadcast report to the school on the public address system or television network
4. Let each group choose the medium which it will use to share its weather report. Ensure that each team has an opportunity to share and that each team member participates in the preparation of the report.
5. Provide students with a sample weather report script like the one below.

Today was a \_\_\_\_\_ day in \_\_\_\_\_.

(Description of weather) (location)

The temperature was \_\_\_\_\_ in the morning and \_\_\_\_\_ in the afternoon.

The air pressure was \_\_\_\_\_.

(rising/falling)

There was \_\_\_\_\_ precipitation today.

(no/light/heavy)

\_\_\_\_\_ clouds were in the sky.

(type of clouds)

The weather forecast for tomorrow is \_\_\_\_\_.

6. After the report has been shared, encourage the students to evaluate their work.

**Evaluation/Assessment of Student’s Competency**

Evaluation will be based on the student’s ability to:

1. Work cooperatively with a group.
2. Present a weather report that addresses current/just-past weather and forecasts the weather to come.

**Closure**

Students will view, watch, and/or listen to the weather reports created by their classmates. Write your local newspaper and explain what your class has been doing—enclose photographs! Make special arrangements for your students to “broadcast” weather reports daily to the school on the public address system or television network.

## Appendix

### Books

Eyewitness Explorers: Weather. John Farndon and John Bendall-Brunello, Dorling Kindersley, Inc., 1998

It's Raining Cats and Dogs – All Kinds of Weather, And Why We Have It. Franklyn M. Branley. Houghton Mifflin Co., 1998

National Audubon Society First Field Guide: Weather. Jonathan D. W. Kahl. Scholastic, 1998

Peterson First Guide To Clouds And Weather. John Day, Vincent J. Schaefer, and Roger Tory Peterson. Houghton MifflinCo., 1998

Weather. Paul Lehr, Will Burnett and Herbert Spenser Zim. Golden Press, 1987

The Kid's Book of Weather Forecasting. Mark Breen and Kathleen Friestad. Williamson Publishing, 2000

The Weather Book. Jack Williams. Random House, Inc., 1987

Weather Experiments. Vera R. Webster. Children's Press, 1989

Weather Watch. Julian Rowe and Molly Perham. Children's Press, 1994

Weather Wisdom – Facts and Folklore of Weather Forecasting. AlbertLee. Congdon & Weed, Inc., 1990

### Weather Organizations

National Oceanic and Atmospheric Administration, Silver Spring, MD [www.noaa.gov](http://www.noaa.gov)

U.S. National Weather Service, Silver Spring, MD [www.nws.noaa.gov](http://www.nws.noaa.gov)

National Climatic Data Center, Asheville, NC [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

National Hurricane Center, Miami, FL [www.nhc.noaa.gov](http://www.nhc.noaa.gov)

National Severe Storms Laboratory, Norman, OK [www.nssl.noaa.gov](http://www.nssl.noaa.gov)

The Meteorological Service of Canada, Inquiry Centre, 351 St. Joseph Blvd., Hull Quebec  
K1A 0H3 <http://weather.ec.gc.ca>

### **Weather on the Web**

Earthwatch Weather on Demand – [www.earthwatch.com](http://www.earthwatch.com)

El Nino Theme Page – [www.pmel.noaa.gov](http://www.pmel.noaa.gov)

The Old Farmer's Almanac – [www.almanca.com](http://www.almanca.com)

The Hurricane Hunters – [www.hurricanehunters.com/welcome.htm](http://www.hurricanehunters.com/welcome.htm)

Kids' Weather Page – <http://eyewall.met.psu.edu/kidswx/kids.html>

Kids' Web Weather – [www.kidsvista.com/Sciences/weather.html](http://www.kidsvista.com/Sciences/weather.html)

One Sky, Many Voices – <http://groundhog.sprl.umich.edu>

USA Today – [www.usatoday.com/weather](http://www.usatoday.com/weather)

The Weather Channel – [www.weather.com](http://www.weather.com)

“The Weather Dude” – [www.wxdude.com](http://www.wxdude.com)

Weatheroffice – [www.weatheroffice.com](http://www.weatheroffice.com)