

WEATHER DETECTIVES

An Interactive Exploration of the Weather

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The nationwide movement for high standards has not only determined what students should learn, but also has mandated that students demonstrate what they know. WEATHER DETECTIVES is a standards-based unit addressing numerous National Science Standards and English Language Arts. The content and skills taught are targets of most state frameworks for earth science. There are many opportunities to assess student understanding by using the activities and rubrics provided. The cooperation and group decision-making required in WEATHER DETECTIVES address Applied Learning Standards. The following National Science Standards are addressed in this unit:

Earth and Space Standards

Understands the atmospheric processes and the water cycle

Level II (Grades 3–5)

- Knows that water exists in different forms (e.g., in clouds as tiny water droplets; in rain, snow, and hail) and changes from one form to another through various processes (e.g., freezing, condensation, precipitation, evaporation)
- Knows that the sun provides the light and heat necessary to maintain the temperature of the Earth
- Knows that air is a substance that surrounds us, takes up space, and moves around us as wind

Level III (Grades 6–8)

- Knows the composition and structure of the Earth's atmosphere (e.g., temperatures of different layers of the atmosphere, circulation of air masses)
- Knows the processes involved in the water cycle (e.g., evaporation, condensation, and precipitation) and their effects on climate patterns
- Knows how the tilt of the Earth's axis affects seasons and weather patterns
- Knows ways in which clouds effect the weather and climate

Nature of Science

Understands the Nature of Scientific Knowledge

Level II (Grades 3–5)

- Knows that the same scientific investigation may give slightly different results when it is carried out by different persons, or at different times or places, the general evidence collected from the investigation should be replicable by others
- Knows that good scientific explanations are based on evidence (observations) and scientific knowledge
- Knows that scientists review and question other scientists' work

Level III (Grades 6–8)

- Knows an experiment must be repeated several times to yield consistent results before results are accepted as correct

STANDARDS

Nature of Science

Understands the Nature of Scientific Inquiry

Level II (Grades 3–5)

- Knows that scientific investigations involve asking and answering a question and comparing the answer to what scientists already know about the world
- Plans and conducts simple investigations (e.g., formulates testable question, makes systematic observations, develops logical conclusions.)
- Uses appropriate tools and simple equipment (e.g. thermometers, magnifiers, microscopes, calculators, graduated cylinders) to gather scientific data and extend the senses

Level III (Grades 6–8)

- Uses appropriate tools (including hardware and software) and techniques to gather, analyze and interpret scientific data
- Establishes relationship based on evidence and logical arguments (e.g., provides cause and effect).

National Standards for the English Language Arts

Standard 4: Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate with different audiences for a variety of purposes.

Standard 5: Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

Standard 6: Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print text.

Standard 7: Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purposes and audience.

Standard 8: Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

Standard 11: Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.

Standard 12: Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

California Applied Learning Standards

Standard 1: Students will understand how to solve problems through a project design process. Students will design a product, service, or system to meet an identified need.

Standard 2: Students will understand how to solve problems through planning and organization.

Standard 6: Students will understand how to apply communication skills and techniques. Students will demonstrate ability to communicate orally and in writing.

Standard 7: Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources to communicate their discoveries in ways that suit their purpose and audience.

Standard 8: Students will understand the importance of teamwork. Students will work in teams to achieve objectives.

STANDARDS

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Your students become scientists in order to solve a weather mystery. They work to determine what happened to carefully researched weather documents stolen from McGee's Weather Company. During the first week of the simulation, as students learn basic information about the weather, they also receive information about the five key suspects in the case. Students then combine their newly learned weather knowledge with additional information so they can begin narrowing down the suspect list.

As a result of this simulation, students become better prepared to conduct and understand scientific investigations. Students learn to observe, draw conclusions from factual information, and carefully write their conclusions in a science journal—just as scientists do. Specifically, your students will gain the following:

Knowledge

- Why there are different climates
- The impact of clouds on the weather
- The impact of the water cycle on the weather
- Facts about extreme weather conditions
- The importance of a science journal as a place to record all information gained during scientific observations and investigations

Skills

- Identifying and observing the elements of weather
- Conducting experiments and investigations
- Working as a team with members of a group, and ultimately, with the entire class
- Accurately collecting and recording scientific data, observations, and questions in a journal
- Applying knowledge gained to eliminate suspects in a case and solve a scientific mystery

Feelings and Attitudes

- Recognition of the value of teamwork in reaching personal and group goals
- Appreciation of the learning that took place by keeping and reflecting on the science journal
- Enhanced interest in the weather
- Increased confidence in reading weather maps and predicting the weather
- Confidence in communicating with others an understanding of weather

PURPOSE

OVERVIEW

OVERVIEW

WEATHER DETECTIVES exposes your students to a scientific mystery. Mention to a class of students that they are about to begin solving a mystery and you will be met with enthusiasm and excitement! Most students are fascinated by mysteries because they are able to take pieces of information and see how they fit together as they attempt to solve a problem. Unfortunately, some students have the impression that all mysteries are connected with murder and suffering because that is what they have been exposed to on television and in movies. WEATHER DETECTIVES will help students realize that mysteries are worked on and solved daily in many different disciplines including science, history, archeology, health, and education.

WEATHER DETECTIVES begins with a request for student help in discovering who stole carefully researched weather documents from McGee’s Weather Company. During Weeks 1 and 2 your students work as real scientists to solve the mystery, completing daily investigations, building model weather measurement instruments, and accumulating suspect information and clues. During Week 3 students demonstrate their understanding of weather systems by developing their own weather reports using all the information they have learned. Depending on your schedule, students share these weather report presentations with parents or other classes. Assign or distribute the optional extensions to further expand student understanding.

This unit will excite and challenge students as they actively increase their understanding of the weather. Since weather influences many aspects of our lives—from what we wear to what we are able to do, students have a natural interest in learning about the weather. Students are motivated as they uncover clues and gain information about weather just as a detective (and scientist) does.

Differentiated Instruction

Like all Interact units, WEATHER DETECTIVES provides differentiated instruction through its various learning opportunities. Students learn and experience the knowledge, skills, and attitudes through all domains of language (reading, writing, speaking, and listening). Adjust the level of difficulty as best fits your students. Assist special needs students in selecting activities that utilize their strengths and allow them to succeed. Work together with the Resource Specialist teacher, Gifted and Talented teacher, or other specialist to coordinate instruction.

1. Before You Begin

Carefully and thoroughly read this Teacher Guide and the Student Guide before beginning. Doing so will help you plan your time and adjust the unit to meet your students' needs and your teaching objectives.

Throughout the Teacher Guide Interact employs certain editorial conventions to identify materials.

- In preparing materials, *class set* means *one per student*.
- All transparency masters and student handouts are listed by name using ALL CAPITAL LETTERS.
- Teacher reference pages are named in **Bold**.
- Student-created materials are named with plain text, beginning with capital letters (e.g., the Science Journal).
- Special events are named using *Italics* (e.g., *Weather Report*).

2. Timing Options

Carefully decide how to use this unit within your curriculum. Study the **Unit Time Chart** (pages 18–19).

- One *Day* on the **Unit Time Chart** equals one hour.
- Weeks 1 and 2 introduce the minimum knowledge content for the unit and allow students to solve the mystery.
- Week 3 provides an opportunity for students to put the skills they learned in this simulation to practical use and demonstrate their mastery of the content. Student teams prepare and present their own *Weather Reports* using correct vocabulary, graphic images, and weather concepts.
- Introduce the optional **Extension** activities during or following Week 3.
- If your schedule is very limited, you may omit the application of knowledge opportunities presented in Week 3 as well as the Extensions.

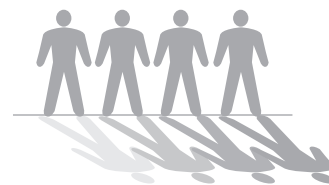
3. Grouping Students

Students accomplish much of their work in cooperative groups. Divide your class into five heterogeneous teams.

- Craft your teams so that each has a good mix of ability, gender, and ethnicity. Keep in mind that each team must work together smoothly and creatively.
- Teach, monitor, and reinforce social skills throughout WEATHER DETECTIVES using the provided Weather Detective Team Rubric (found on WEATHER DETECTIVES ROLES AND RUBRIC, page 86).



10+ hours



Cooperative Groups
Five Weather Detective Teams

SETUP DIRECTIONS

4. Assigning Weather Detectives Team Roles

Within each Weather Detective Team, students assume a particular role. Assign each student one of the roles (Day 2) or allow students to select their roles.

- **Senior Scientist**—The Senior Scientist is the team leader responsible for seeing that all members are working cooperatively and completing each activity. This member is responsible for managing the Team Folder.
- **Experiment Expert**—The Experiment Expert is responsible for overseeing all experiments and labs. This member leads the team through the SCIENTIFIC METHOD, reads and follows the Procedure on all experiment and lab handouts, and leads the team discussion of results and possible conclusions.
- **Profile Detective**—The Profile Detective is responsible for overseeing the team's profiling of suspects. This member collects and reads all SUSPECT CLUES, leads the team in solving the clues, and monitors suspects on the SUSPECT LIST.
- **Weather Reporter**—The Weather Reporter is responsible for getting daily temperature readings and making daily weather observations. Additionally, this member watches or reads the local weather report.
- **Materials Manager**—The Materials Manager collects and returns all materials to the designated areas. This member ensures that the team has what they need to complete the day's work.

5. Classroom Environment

Create a weather-rich environment in your classroom.

a. Resources

Collect weather maps, books about weather, and newspaper articles pertaining to the weather. Make these items available to your students during their free time.

b. Bulletin Board

If possible, devote one bulletin board in the classroom to the study of weather. Include color copies of published weather reports and forecasts.

c. Videotape Televised Weather Reports

It would be most helpful if there were more than one weather report to view, possibly even weather reports from different television stations. This will especially help your students during Week 3, when they are developing their own *Weather Reports*.

SETUP DIRECTIONS

d. **Homework**

The daily short homework assignments will adapt easily to the homework system already in use in your classroom.

e. **Spreadsheets**

If you have access to computers, use a data base spreadsheet to keep track of weather conditions over time.

6. **Teacher Reference Pages**

Prepare these prior to Day 1.

- **Glossary** — *use at your discretion*
- **Today's Weather Guideline** — *transparency*
- **Suspect Profiles** (five) — *one of each to display on a bulletin board (consider enlarging and/or coloring to pique student interest)*
- **Weather Questions #1-#9** — *transparency (or write one question on the board each day beginning on Day 2)*
- **Weather Map Symbols** (12) — *one of each to display on a bulletin board or pocket chart (consider enlarging and/or coloring to pique student interest)*

7. **Reproducible Masters**

Student pages are listed in the order used. Copy in the quantity indicated in *Italics*.

Day 1

- TODAY'S WEATHER — *transparency*
- MY SCIENCE JOURNAL COVER — *class set*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *class set + transparency + extras as needed*
- TOMORROW'S WEATHER PREDICTION CHART — *one*

Day 2

- WEATHER DETECTIVES ROLES AND RUBRIC — *class set or one per team + one to post*
- SCIENTIFIC METHOD — *class set*
- SCIENCE JOURNAL RUBRIC — *class set and/or transparency + one to post*
- HEAT 'EM UP EXPERIMENT — *one per team*
- TEMPERATURE OF GRASS, SAND, SOIL, AND WATER — *class set + transparency*
- SUSPECT LIST — *one per team*
- WEATHER HOMEWORK #1 — *class set*

Day 3

- MOVING AIR EXPERIMENT 1 — *one per team*
- MOVING AIR EXPERIMENT 2 — *one per team*
- WEATHER HOMEWORK #2 — *class set*



The **Glossary** is intended as a teacher resource. Use this however best meets your needs. Consider incorporating this subject area vocabulary into other lessons (vocabulary, spelling, etc.). If you choose to use the Glossary with students, you may need to reword some of the definitions for your students so that they are more easily understood.

Make a large wall chart of the TOMORROW'S WEATHER PREDICTION CHART.

SETUP DIRECTIONS

Day 4

- TYPES OF CLOUDS — *class set + transparency*
- CLOUD INVESTIGATION — *one per team*
- WEATHER HOMEWORK #3 — *class set*

Day 5

- WATER CYCLE EXPERIMENT — *one per team*
- WEATHER HOMEWORK #4 — *class set*

Day 6

- SAFETY HINTS: Extreme Heat — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Thermometer — *one per team*
- SUSPECT CLUE #1 — *class set*
- WEATHER HOMEWORK #5 — *class set*

Day 7

- SAFETY HINTS: Tornadoes — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Tornado — *one per team*
- SUSPECT CLUE #2 — *class set*
- WEATHER HOMEWORK #6 — *class set*

Day 8

- SAFETY HINTS: Hurricanes — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Weather Vane — *one per team*
- SUSPECT CLUE #3 — *class set*
- WEATHER HOMEWORK #7 — *class set*

Day 9

- SAFETY HINTS: Lightning — *class set*
- SAFETY HINTS: Floods — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Anemometer — *one per team*
- SUSPECT CLUE #4 — *class set*
- WEATHER HOMEWORK #8 — *class set*

Day 10

- SAFETY HINTS: Blizzards — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Rain/Snow Gauge — *one per team*
- SUSPECT CLUE #5 — *class set*
- WEATHER HOMEWORK #9 — *class set*

Day 11

- WEATHER MAP — *class set + transparency*
- WEATHER EXTENSIONS — *as needed (optional)*

Day 12

- WEATHER REPORT: Checklist and Rubric — *class set or one per team + one to post*

Days 13–14

- ORAL PRESENTATION RUBRIC (Content and Presentation) — *class set or one per team + one to post*

Day 15

- WEATHER EXTENSIONS — *as needed (optional)*

8. Science Journals

Each student in the class needs a Science Journal. These journals can be made in a number of ways. Select the option that makes the most sense for your situation and budget.

- a. Use a spiral-bound composition book and have students glue on the duplicable master cover.
- b. Fabricate folders using a large sheet of construction paper (11" x 17"). Fold the construction paper, staple lined paper inside (at least 10 sheets per student), then glue on the duplicable master cover.
- c. Fabricate folders using pocket folders filled with lined paper, with the duplicable master cover glued on the front.

9. Other Materials

Prior to beginning WEATHER DETECTIVES assemble the following materials in the quantities indicated in *Italics*. Also see the Daily Directions and the various experiments and classroom weather station handouts for more information:

- Almanacs/encyclopedias — *several*
- File folder or construction paper (11" x 17") — *one per team (for team folders)*
- Recorded weather forecast — *if possible*
- Sticky notes (3" x 3") — *two pads*
- Thermometer — *one (placed in the shade outside the classroom)*
- Weather maps (current) from a local or national paper (in-color) — *several (one per team or copies of the same map per-team)*

Science Journals

- Spiral-bound composition book — *class set*
—OR—
Construction paper (assorted colors, 11" x 17") — *class set*
Lined paper (8.5" x 11") — *10 sheets per student (minimum)*
Stapler — *one*



You will need a total of two empty 16-oz. bottles and two empty 2-liter bottles per team. Carefully remove all labels.

SETUP DIRECTIONS

Week 1 Experiments

Materials are listed in order of experiments. Quantities are for one experiment. Multiply by the number of teams in your classroom.

Heat 'Em Up

- Colored pencils (four different colors) — *one of each*
- Graph paper — *one*
- Grass — *one-half cup*
- Heat lamp (if it is not sunny) — *one*
- Insulated plastic cups (6-oz. size) — *four*
- One-cup measuring cup — *one*
- Paper towels — *two*
- Sand — *one-half cup*
- Soil — *one-half cup*
- Thermometer — *one*
- Water — *one-half cup*

Moving Air Experiment 1

- Balloon — *one*
- Bowl (1-quart size) — *one*
- Hot tap water — *one cup*
- Plastic bottle (2-liter size, clear) — *one (at room temperature)*
- Thermometer — *one*

Moving Air Experiment 2

- Bowl of warm water (1-quart size) — *one*
- Plastic bottle (2-liter size, clear) — *one (placed in freezer for at least one hour)*
- Quarter coin — *one*
- Thermometer — *one*

Cloud

- Cotton balls — *one per team member*
- Pie pan (8" diameter) — *one*
- Tap water — *one-half cup*

Water Cycle

- Permanent marker — *one*
- Plastic cup (6-oz. size, clear) — *two*
- Plastic wrap or small plastic bag (clear) — *one*
- Rubber band (2" diameter) — *one*
- Thermometer — *one*
- Warm tap water — *one cup*

Week 2 Weather Station Materials

Materials are listed in order of weather station projects created. Quantities are for one team project. Multiply by the number of teams in your classroom.

Thermometer

- Modeling clay — *enough to make a 1-inch ball*
- Permanent marker — *one*
- Plastic straw (clear) — *one*
- Plastic water bottle (16-oz. size, clear) — *one*
- Red food coloring — *five drops*
- Sauce pan (1-qt. size or 9" pie or square pan) — *one*
- Spoon — *one*
- Store-bought thermometer — *one*
- Water (cold) — *one cup*
- Water (hot) — *one cup*
- Water (room temperature) — *one-half cup*

Tornado

- Duct tape (5" length) — *one*
- Plastic bottles (2-liter size, clear) — *two*
- Red food coloring — *10 drops*
- Water — *1.5 liter*

Optional Extension

- Pail (large) — *one*
- Spoon (wooden) — *one*
- Water — *enough to fill pail three-quarters full*

Weather Vane

- Compass — *one*
- Glue — *one container*
- Masking tape — *one roll*
- Plastic straw (clear) — *one*
- Poster board or cardboard (8" x 8") — *one*
- Ruler — *one*
- Scissors — *one pair*
- Shoe box — *one*
- Thread spool (empty) — *one*
- Weights (such as rocks) — *several (enough to weigh down the shoe box)*



Carefully remove the label from the plastic water bottle.

SETUP DIRECTIONS

Anemometer

- Glue — *one container*
- Masking tape — *one roll*
- Paint (tempera; a different color than the plastic cups) — *small amount*
- Paper or plastic cups (2-oz. to 4-oz. size) — *four*
- Plastic straw (clear) — *one*
- Scissors — *one pair*•Shoe box — *one*
- Thread spool (empty) — *one*
- Weights (such as rocks) — *several (enough to weigh down the shoe box)*
- Wooden craft sticks — *two*

Rain/Snow Gauge

- Duct tape (5" length) — *one*
- Permanent marker — *one*
- Plastic water bottle (16-oz. size, clear) — *one*
- Ruler — *one*

10. Weather Detective Team Folders

Prepare a folder for each team of students using file folders or construction paper. During the simulation, students keep all important information they gather in their team folder.

11. Homework

WEATHER DETECTIVES includes short homework assignments each night. If you have a homework system in your classroom, adapt these assignments to the system you currently use. Students who do not have access to a computer or encyclopedias at home will need some time in class or in the school library to access this information.

12. Special Arrangements

a. Study Trip

If a local television station allows visitors, try to arrange a visit at the end of this unit of study. Students can observe how weather is reported and the information used to make weather forecasts.

b. Guest Speakers

If possible, invite a meteorologist, a weather forecaster, or anyone else associated with the weather to come and speak to your class during or after the unit. **Note:** If students have access to the Internet, they might surf the net for information about weather. Maybe there is a scientist out there willing to talk to your students via the computer.

13. Planning for Culminating Activity

During the third week of the unit each Weather Detective Team is responsible for researching, creating, and presenting a *Weather Report* on their assigned city. *Weather Reports* are presented on Day 15.

Presentations can be held in an all-purpose room, music room, or classroom depending on size. Be sure to schedule the room ahead of time. Send Invitations to parents, grandparents, school personnel, etc. Expect each report to last 2–3 minutes.

14. Extensions

You may decide to have certain (or all) students do an **Extension** on this simulation concurrent with their team *Weather Reports* during Week 3 or following the conclusion of the unit.

- a. Students may work on one of the **Extension** projects described.
- b. Students may also develop their own **Extension** projects.

15. Extending Student Learning

Even after your students finish this weather unit, continue to help them remember what they learned throughout the year.

- a. Have interested students continue to collect weather data after the 3–week weather unit is complete. The more data your students collect, the easier time they will have finding trends in weather.
- b. As storms occur in different areas of the country (and the world), share the information with your class.
- c. Weather conditions can have an effect on many different things: sporting events, travel, crops, etc. As these things come to your attention, share them with the class.
- d. On February 2, take note if the groundhog sees his shadow. Talk to your class about where this belief might have originated.

AUTHENTIC ASSESSMENT

1. What is authentic assessment?

Authentic assessment involves looking at more than a single test to judge a student's ability in an area of study. At the end of a unit of study, a student should be able to show thoughtful understanding of a complex idea. Many teaching methods achieve authentic assessment, some of which have been incorporated into WEATHER DETECTIVES.

- a. Before judging a student's work, it helps to look at his/her progress over a period of time.
- b. A student can demonstrate knowledge and skills orally, in writing, and through photographs, videos, and projects.

2. Achieving Authentic Assessment

Students accomplish a great deal during WEATHER DETECTIVES.

- a. They use and understand the scientific method, and acquire skills and knowledge, which will benefit them throughout their lives.
- b. They write down thoughts, ideas, observations, and experiments in a Science Journal. You may use each student's completed Science Journal as an assessment tool to both determine and to demonstrate to parents the extent of student learning.
- c. You take time in WEATHER DETECTIVES to observe how students work together in their teams.
- d. During the daily debriefing session as well as daily homework assignment, students also give evidence of what they learned during that session and provide you with information on how well they are understanding concepts covered that day. If additional discussion is needed, you have the opportunity to provide that *immediately*.
- e. Of course, having students complete daily science activities to your satisfaction is a type of authentic assessment.
- f. The culminating *Weather Report* provides an additional opportunity to observe students' application of knowledge. Use the rubric provided to assess both teams and individual students (ORAL PRESENTATION RUBRIC; use the Content Rubric to assess the team and the Presentation Rubric to assess individual student presentation skills).
- g. A completed WEATHER EXTENSION project is an ideal tool for authentic assessment.



Use the rubrics included in this unit to assess the Science Journals (SCIENCE JOURNAL RUBRIC) and cooperative group work (WEATHER DETECTIVES ROLES AND RUBRIC).

- h. Students who do *not meet the standard* on any part of the assessment must be required to redo that section. Sometimes students need a second chance to demonstrate what they know. For written work, consider allowing students to rewrite their work after reviewing with you. Also consider allowing students to provide their responses orally.

3. Final Essay

Ask students to write an essay at the end of the unit (either Week 3 or Week 2, depending on your time). This essay will demonstrate to each student, you, and others that learning has taken place. Consider the following essay prompts:

- Why are there different climates?
- How does the temperature affect air and how does this impact the weather?
- How do different clouds help us understand the weather?
- How does the water cycle impact the weather?
- What were the three most interesting things you learned about weather and why were they so interesting?

- What are the steps of the Scientific Method?
- Why does an experiment need to be repeated several times before results are accepted as correct?

- You are a weather forecaster (meteorologist) and have been asked to speak to a class about your job. What would you tell the students about what you do and why it is important?
- What information is important to include in a weather report and why?
- Write an information report about the weather. Include important factors that effect the weather, instruments that help predict the weather, and information that makes a successful weather report.



Holding students accountable reinforces the importance of quality work.

RESOURCES (1)

Internet Resources

There is a Resource List on the INTERACT Web site. To find the Interact WEATHER DETECTIVES Resources Page, follow these steps:

- Connect to the Internet
- Go to INTERACT’s home page:
www.teachinteract.com
- Type “Weather Detectives” in the search bar.
- Scroll down to “related Web sites.”
- Click on the name of a resource site you would like to visit and it will appear on your screen.
- When you are finished exploring the resource Web site, click the “Back” button on your browser to return to Interact’s Web site.

ORGANIZATIONS

American Meteorological Society
45 Beacon Street
Boston, MA 02108-3693

Cooperative Institute for Research in the Atmosphere
Colorado State University
Fort Collins, Colorado 80523-1375

Institute of Global Environment and Society
IGES / COLA
4041 Powder Mill Road, Suite 302
Calverton, MD 20705-3106 USA
301-595-7000 Phone 301-595-9793 Fax
www@cola.iges.org

Meteorological Society of New Zealand
P. O. Box 6523,
Te Aro,
Wellington, New Zealand

National Oceanic Atmospheric Administration
14th Street and Constitution Avenue NW
Washington DC 20230

The National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230
(703) 292-5111

Royal Meteorological Society
104 Oxford Road,
Reading, Berkshire RG1 7LL, United Kingdom
Tel: 0118 9568500, Fax: 0118 9568571

World Meteorological Organization
7 bis Avenue de la Paix
CP2300 – 1211 Geneva 2 – Switzerland



UNIT TIME CHART

DAY 1	DAY 2	
<ul style="list-style-type: none"> • Introduce mystery • Make Science Journals • Student Guide • TODAY'S WEATHER • MY SCIENCE JOURNAL • WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED • TOMORROW'S WEATHER PREDICTION CHART <p>Teacher Reference</p> <ul style="list-style-type: none"> • Today's Weather Guideline • Suspect Profile: Bob Blizzard 	<ul style="list-style-type: none"> • How temperatures of different materials contribute to different climates • Science Journals • WEATHER DETECTIVES ROLES AND RUBRIC • SCIENTIFIC METHOD • SCIENCE JOURNAL RUBRIC • HEAT 'EM UP EXPERIMENT • TEMPERATURE OF GRASS, SAND, SOIL, AND WATER • SUSPECT LIST • WEATHER HOMEWORK #1 	<p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #1 • Weather Map Symbol (Clear Skies) • Suspect Profile: Juan Sum Light
DAY 3	DAY 4	DAY 5
<ul style="list-style-type: none"> • How the atmosphere affects the weather • MOVING AIR EXPERIMENT 1 • MOVING AIR EXPERIMENT 2 • WEATHER HOMEWORK #2 <p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #2 • Weather Map Symbol (Wind Direction) • Suspect Profile: Joe Breezy 	<ul style="list-style-type: none"> • How cloud cover affects the weather • TYPES OF CLOUDS • CLOUD INVESTIGATION • WEATHER HOMEWORK #3 <p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #3 • Weather Map Symbol (Cloudy) • Suspect Profile: Ima Vapor 	<ul style="list-style-type: none"> • How the water cycle affects the weather • WATER CYCLE EXPERIMENT • WEATHER HOMEWORK #4 <p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #4 • Weather Map Symbol (Rain) • Suspect Profile: Debbie Drizzle
DAY 6	DAY 7	DAY 8
<ul style="list-style-type: none"> • Severe weather study: Drought • Create thermometers • SAFETY HINTS: Extreme Heat • CLASSROOM WEATHER STATION: Make Your Own Thermometer • SUSPECT CLUE #1 • WEATHER HOMEWORK #5 <p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #5 • Weather Map Symbol (Daily Temperature) 	<ul style="list-style-type: none"> • Severe weather study: Tornadoes • Create tornadoes • SAFETY HINTS: Tornadoes • CLASSROOM WEATHER STATION: Make Your Own Tornado • SUSPECT CLUE #2 • WEATHER HOMEWORK #6 <p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #6 • Weather Map Symbols (High and Low Pressure Areas) 	<ul style="list-style-type: none"> • Severe weather study: Hurricanes • Create weather vanes • SAFETY HINTS: Hurricanes • CLASSROOM WEATHER STATION: Make Your Own Weather Vane • SUSPECT CLUE #3 • WEATHER HOMEWORK #7 <p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #7 • Weather Map Symbols (Cold Front and Warm Front)

UNIT TIME CHART



DAY 9		DAY 10
<ul style="list-style-type: none"> • Severe weather study: Thunderstorms, lightning, and flooding • Create anemometers • SAFETY HINTS: Lightning • SAFETY HINTS: Floods • CLASSROOM WEATHER STATION — Make Your Own Anemometer • SUSPECT CLUE #4 • WEATHER HOMEWORK #8 		<p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #8 • Weather Map Symbols (Thunderstorms, Showers, Snow)
		<ul style="list-style-type: none"> • Severe weather study: Blizzards • Create rain/snow gauges • SAFETY HINTS: Blizzards • CLASSROOM WEATHER STATION: Make Your Own Rain/Snow Gauge • SUSPECT CLUE #5 • WEATHER HOMEWORK #9 <p>Teacher Reference</p> <ul style="list-style-type: none"> • Weather Question #9
DAY 11	DAYS 12–14	DAY 15
<ul style="list-style-type: none"> • Study a weather map • Review weather map symbols • Create a weather report using facts from a televised weather report • Look at optional extension opportunities • WEATHER MAP • WEATHER EXTENSIONS (optional) 	<ul style="list-style-type: none"> • Create a <i>Weather Report</i> for a certain area of the country • Practice group presentation of <i>Weather Report</i> • WEATHER REPORT: Checklist and Rubric • ORAL PRESENTATION RUBRIC (Content and Presentation) 	<ul style="list-style-type: none"> • Deliver <i>Weather Report</i> to the class • Look at optional extension opportunities • WEATHER EXTENSIONS (optional)

DAILY DIRECTIONS

DAY 1



Make a large wall chart of the TOMORROW'S WEATHER PREDICTION CHART.



This paper will act as the first page of their Science Journals so if you are using a composition book be sure to distribute those now and have students use the first page.

Day 1

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *transparency*
- MY SCIENCE JOURNAL COVER — *class set*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *class set + transparency*
- TOMORROW'S WEATHER PREDICTION CHART — *one*
- Pencils — *class set*
- Sticky notes (3" x 3") — *class set*
- Thermometer — *one (placed in the shade outside the classroom)*

Science Journals

- Spiral-bound composition book — *class set*
- OR—
- Construction paper (assorted colors, 11" x 17") — *class set*
- Lined paper (8.5" x 11") — *10 sheets per student (minimum)*
- Stapler — *one*

Teacher Reference

- **Today's Weather Guideline** — *transparency*
- **Suspect Profile: Bob Blizzard** — *one (to read; then post)*

Preparation

1. In the morning before class, read the weather report in the paper or watch a weather forecast on the news for your area.
 - a. Note information about high/low temperature, humidity, wind, the forecast for the week and any other information of interest.
 - b. On the day you start this simulation, make note of what the clouds look like outside.
2. Place a thermometer outside in a shady spot. Later, when you take your class outside to observe the weather, students will look at the thermometer to determine the current temperature today.
3. Before class starts, pull shades down over your classroom windows and close doors that lead outside. This will give you a more accurate assessment of student's observation skills.

Procedure

1. Instruct students to take out paper and record today's date at the top as you put the transparency entitled **Today's Weather Guideline** on the overhead projector. Tell the students that they should draw a line down the middle of the page and write what they **remember** on the left side of the page.

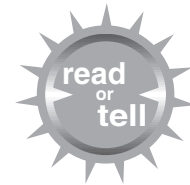
2. After students have finished writing what they remember, have them share these with one another. Point out similarities and differences in what students remember.
3. Open the shades or allow the students to go outside to look at the clouds, observe the wind, and look at the thermometer that you placed outside to determine the exact temperature.
4. Share the weather report that you watched or read this morning. Fill in details about the humidity level, the predicted high and low temperature for today, and any other weather information included in the weather report you watched.
5. Have the class fill in the right side of their paper with accurate information about the clouds, temperature, wind conditions, and humidity (and any other weather information they completed on the left side of the page).
6. Illuminate TODAY'S WEATHER graph. Using the information just learned, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions on another piece of paper.
7. Read or tell:

“The point of the exercise we just did is to help you realize that observations are an important part of a detective’s job—even when that detective is a scientist. Scientists make observations regularly. They must carefully write down exactly what they see and conclude in any experiment they do. It is important to be as accurate as possible when making observations so that this information can lead to reliable conclusions. In the next few weeks when you are asked to make scientific observations, you will have advanced warning to carefully observe and make notes in a science journal. This journal will help keep us organized. As we make observations or do experiments, we will carefully write down what we see and any conclusions we might make. We will keep all of our notes in this science journal.

As you might have guessed, we are going to become science detectives as we learn about weather for the next few weeks.”



This paper will act as the second page of their Science Journals. Students monitor the weather each day for 15 days. Allow 1–2 pages (front and back) for this activity.



DAILY DIRECTIONS

DAY 1

8. Distribute MY SCIENCE JOURNAL COVER and science journal materials to each student. Help students make their journals. The paper students used for the Today's Weather Guideline activity is the first page of their Science Journal. The paper used for graphing Today's Weather is the second page of their Science Journal. **Note:** Students will need a second page for graphing Today's Weather throughout the simulation so this acts as page three of their Science Journal. Be sure to have students include these pages. When making the Science Journals use *one* of the following methods:
 - a. MY SCIENCE JOURNAL COVER glued on a composition notebook
 - b. the cover sheet glued on top of a folded 11" x 17" sheet of colored construction paper
 - c. a section of a three-ring binder notebook with MY SCIENCE JOURNAL COVER glued and colored on a cover sheet of regular paper

9. Distribute WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED.
 - a. Tell students to write anything they know about weather in the "What I Know" column.
 - Elicit one example from a student in the class and, using the overhead transparency, demonstrate how to briefly notate the information. This will help students get started on this activity.
 - When students are finished filling in the first column, have them share some of the information they already know with one another.
 - b. As a shared class activity, have students volunteer questions they have about weather.
 - Write these questions in the "Questions I Have" column on the overhead chart and have students copy the questions on their own papers.
 - c. Tell students that they will be adding to this chart as they work through this simulation.
 - As they learn about weather in the next few weeks, they will note what they learn in the "What I Learned" column.
 - When new questions about weather come up in the simulation, they will add to the "Questions I Have" column.
 - d. When this activity is completed for the day, have students place this paper in their Science Journals.

10. Distribute the Student Guides. Instruct students to read the letter from Michael McGee on page 1. Read or tell:

“Our class has been asked to help with this science mystery. To help us become better informed about the weather we will work each day on building up our knowledge about weather. Each day, after we successfully complete each weather activity, we will receive information to help us solve this mystery. During this first week, we will answer a weather question each day. Then, once the activity for the day is complete, we will receive information about a suspect in the case.”
11. Display TOMORROW’S WEATHER PREDICTION CHART pointing out the different options available. Have each member of the class predict what they think the weather will be like tomorrow.
 - a. Instruct students to write “Tomorrow’s Weather Prediction” at the top of the fourth page in their Science Journals. On this page they should write today’s date, their weather prediction, and their rationale for their prediction. They need to leave some space for writing the actual weather tomorrow. Note: have students reserve two pages for this activity throughout the unit (pages 4–5 of their Science Journals).
 - b. Distribute sticky notes. Instruct students to write their names and predictions on the sticky note and place them on the Tomorrow’s Weather Prediction Graph.
 - c. Ask students to calculate the percent of students who predict each weather type. For instance, if 10 out of 30 students predict sunshine tomorrow 33 percent of the class believes it will be sunny.

Note: Some students may predict more than one type of weather. For example, they might predict both sun and clouds for a day that they believe will be partly sunny and partly cloudy. In this case, direct students to choose the type of weather they believe will mostly occur tomorrow.
12. Tell the students that since they agreed to help Michael McGee, they will get information about the first suspect in this case. Show the class **Suspect Profile: Bob Blizzard** and read his profile. Post the profile on a bulletin board in the classroom.



Make a large wall chart of the TOMORROW’S WEATHER PREDICTION CHART.

DAILY DIRECTIONS

DAY 2

Day 2

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WEATHER DETECTIVES ROLES AND RUBRIC — *class set or one per team + one to post*
- SCIENTIFIC METHOD — *class set*
- SCIENCE JOURNAL RUBRIC — *class set and/or transparency + one to post*
- HEAT 'EM UP EXPERIMENT — *one per team*
- TEMPERATURE OF GRASS, SAND, SOIL, AND WATER — *class set + transparency*
- SUSPECT LIST — *one per team*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #1 — *class set*
- Science Journals — *created on Day 1*
- File folder or construction paper (11" x 17") — *one per team (for team folders)*
- Sticky notes — *class set or reuse from previous day*

Heat 'Em Up Experiment Materials

- Colored pencils (four different colors) — *one of each*
- Graph paper — *one*
- Grass — *one-half cup*
- Heat lamp (if it is not sunny) — *one*
- Insulated plastic cups (6-oz. size) — *four*
- One-cup measuring cup — *one*
- Paper towels — *two*
- Sand — *one-half cup*
- Soil — *one-half cup*
- Thermometer — *one*
- Water — *one-half cup*

Teacher Reference

- **Weather Question #1** — *transparency or written on the board*
- **Weather Map Symbol** (Clear Skies) — *one (to display on bulletin board)*
- **Suspect Profile: Juan Sum Light** — *one (to read; then post)*

NOTE: Today's experiment requires that students take the temperature of different materials every 10 minutes. Either tell students when 10 minutes has passed (every 10 minutes for the hour) or allow one of the students in the team to take on this task. As students are waiting for the 10-minute intervals to pass, you will have them do other weather activities. (See **Procedure steps #13–18** below.)



The **Materials** listed are enough for one experiment. Multiply by the number of teams in your class.

The grass should be **only** grass with no soil attached to the grass.

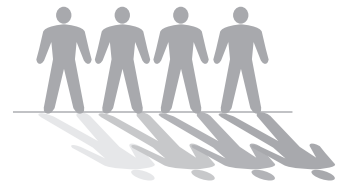
NOTE: If you have trouble tracking down all of the different substances used in this experiment (grass, sand, and soil), you can modify the experiment using only water and soil (or sand).

Procedure

1. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).
2. Write **Weather Question #1** on the board or display it on the overhead transparency. Ask students if they have any idea why there are different climates. Elicit any responses or predictions the students may have.
3. Tell your students that they are going to conduct an experiment that will help them understand why there are different climates.
4. Divide your class into five teams (see **Setup Directions #3, Grouping Students** for more information). Distribute WEATHER DETECTIVES ROLES AND RUBRIC. Read and discuss the various roles within each Weather Detective Team. Assign roles or allow students to select. Be sure students are clear on your expectations for cooperative group work.
5. Distribute or have the Materials Managers collect a file folder or construction paper (11" x 17") to each team to make a team folder. Instruct teams to write their names (or the name of the team) on the front of the folder. Direct students to store within this folder all important information they gather during the simulation.
6. Distribute and read SCIENTIFIC METHOD. Inform students that they are going to participate in an experiment demonstrating how various materials "heat up."
7. Distribute the HEAT 'EM UP EXPERIMENT and the TEMPERATURE OF GRASS, SAND, SOIL, AND WATER. Go through the experiment together so students understand what they are expected to do. Remind teams that the Experiment Expert will lead the experiment.
8. Before beginning the experiment, review the steps of the SCIENTIFIC METHOD and relate them to the experiment you are about to conduct in class.



Note: Two different weather types might be correct. For example, it could be partly sunny and partly cloudy. In this case, predictions for both sun and clouds would be a correct prediction. Students can reuse the prediction sticky notes later today when they predict tomorrow's weather.



Cooperative Groups



Consider having teams examine the variable of "distance from the heat source."

DAILY DIRECTIONS

DAY 2

9. Point out that Step 1 is the *Question*. Explain that the question in a science experiment is what you want to find out. Ask students to state the question for the experiment they are about to perform. Ask students to share their ideas and guide them to state the question simply. (For example: Which material will heat up most quickly?) Instruct students to open their Science Journals to the sixth page (pages 1–5 are used for Today’s Weather and Tomorrow’s Weather Predictions throughout the unit). Students need to write “Heat ‘Em Up Experiment,” date their entry, and then write their question.
10. Next discuss Step 2 of the SCIENTIFIC METHOD, the *Hypothesis*. Explain that the hypothesis is an educated guess to answer the question in Step 1. A hypothesis does not have to be correct (scientists will tell you they frequently are not correct), but it should be a guess based on what you know and have observed. Solicit hypotheses from the class about the experiment. Have students write their hypothesis in their Science Journals.
11. Discuss Step 3 of the SCIENTIFIC METHOD, the *Experiment*. Scientists conduct experiments according to very exact procedures. It is important for scientists to be accurate when listing the procedure followed in their experiments. If they are accurate, they or other scientists will be able to repeat the experiment and get the same results in the future.
12. Tell students that you will discuss the *Data* and *Conclusion* steps of the SCIENTIFIC METHOD after the experiment.
13. Assist students as necessary. Illuminate the transparency of the TEMPERATURE OF GRASS, SAND, SOIL, AND WATER and guide students with taking the temperatures of the various materials and recording their data. Then have students do the experiment on their own. Remind teams that the Materials Manager collects the appropriate materials for the experiment.
14. During the first 10–minute interval of taking temperatures in the experiment, bring out TODAY’S WEATHER used yesterday. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions on the second page of their Science Journals. Teams send their Weather Reporters to check the temperature and report back to the team.



It is best to take the temperature about the same time each day.

15. During the second 10–minute interval, tell the students that they are going to be reading and interpreting weather maps during this simulation, so knowing how to read the different symbols on the map is an important skill to learn. Show students the **Weather Map Symbol (Clear Skies)**. Display the symbol on your weather bulletin board.

16. During the third 10–minute interval, tell the students that they are doing such a good job today gaining knowledge about weather and climate, they will now get information about a second suspect in the case.
 - a. Distribute **SUSPECT LIST** to each team. The Profile Detective is responsible for completing this form.
 - b. Show the class **Suspect Profile: Juan Sum Light** and read his profile. Discuss what Juan Sum Light’s motives might be to commit this crime and compare those to what Bob Blizzard’s motives might be. Post the profile on the bulletin board beside the information on Bob Blizzard.
 - c. Remind Profile Detectives that they need to take notes on both suspect profiles (today’s Juan Sum Light and Bob Blizzard from yesterday). Profile Detectives keep this form in their Science Journals.

17. During the fourth 10–minute interval, have each member of the class predict what they think the weather will be like tomorrow.
 - a. Instruct students to locate the page they titled: “Tomorrow’s Weather Prediction” in their Science Journals. They should write today’s date, their weather prediction, and their rationale for their prediction (on the line under yesterday’s entry). They need to leave some space for writing the actual weather tomorrow.
 - b. If students are making the same weather prediction, they can reuse their previous sticky note. Distribute sticky notes to those students who are making new weather predictions. Students write their names and predictions on the sticky note and place them on the Tomorrow’s Weather Prediction Graph.
 - c. Ask students to calculate the percent of students who predict each weather type. For instance, if 10 out of 30 students predict sunshine tomorrow 33 percent of the class believes it will be sunny.

DAILY DIRECTIONS

DAY 2



As a good follow-up activity to today's experiment, consider having students look at maps and note landforms and their relationships with weather. For example: students can see that deserts can form on the other side of mountains because the moist weather cannot get over the tops.

18. During the fifth 10-minute interval, distribute WEATHER HOMEWORK #1 to the class. Talk to the students about where they might locate the information asked on the homework assignment. If students do not have access to the Internet or encyclopedias at home, allow them time to look for this information in (or after) class. Ask students to try to find the information listed on this page tonight and bring the information with them to class tomorrow.

Answers to WEATHER HOMEWORK #1:

1. Highest temperature ever recorded: 136° Fahrenheit recorded in Al Aziziyah, Libya in Africa. (This occurred on September 13, 1922.)
 2. Highest temperature recorded in North America: 134° Fahrenheit in Death Valley, CA (recorded on July 10, 1913)
 3. Driest place on earth: Arica, Chile in South America. At one point this area went 14 straight years with no rain (from November 1945–May 1957).
 4. Driest place in the United States: Death Valley, CA. It receives less than two inches of rain per year on average.
19. During the sixth 10-minute interval, ask students what this experiment has to do with the Weather Question for today, “Why are there different climates?” If they don’t come to any conclusions themselves, tell them:

“Areas of the earth heat up differently because the tilt of the earth affects the way that rays of sunlight hit its surface. The areas that are closest to the equator (measured in degrees of latitude) are the areas that have the warmest climate. These regions receive direct sunlight all year. The mid-regions get slanted sunlight and the poles never get direct sunlight. When the earth tilts the Northern or Southern Hemisphere towards or away from the sun, seasons are created. When a hemisphere is tilted towards the sun, it is summertime; when it is tilted away from the sun, it is wintertime.

The experiment we are completing gives us additional information about the weather. The difference in the way various materials on earth heat up also has an impact on the weather. Water heats up more *slowly* than any other material. Sand (like in a desert) heats up more *quickly*. Since heat rises, areas of

air over the land or a desert will heat up more quickly than areas over the water. When warm and cold areas of air collide, it creates moving air. As the air moves, it creates winds. The winds make the weather change.”

20. Distribute SCIENCE JOURNAL RUBRIC and discuss. Guide students through recording the data from this experiment in their Science Journals. Tell students the following information:
“Scientists date each entry in their Science Journals. Sometimes scientists will have a witness sign their journals. That way, if a new discovery or invention is made as a result of experiments conducted by a scientist, there is a signed record that the scientist can use as proof that s/he was the first to come up with the discovery of invention.”
21. Explain Step 5 of the Scientific Method, the *Conclusion*. Read or tell:
“When scientists complete their experiment, they develop a conclusion to describe their findings. The conclusion is the last part of the scientific method; it is the place where scientists tell what they learned.
Scientists arrive at conclusions by carefully looking at their journals, by studying once again the data they collected, and by referring back to their hypothesis. Conclusions must reflect the data collected from the experiments conducted. What conclusion could be made from the experiment that we did today in class? How do the results of the experiment help you answer today’s weather question: ‘Why are there different climates?’”
22. Have students write a short Science Journal entry about what they learned in today’s experiment.
23. Instruct students to place their copies of SCIENTIFIC METHOD and SCIENCE JOURNAL RUBRIC in their Science Journals and their Student Guides, Science Journals, and other relevant information into their Team Folders. The Senior Scientist is responsible for managing the Team Folder.



The Science Journal serves various purposes. Decide ahead of time if you will assess only the scientific method component of the students’ entries or if you will also assess their reflections on learning and hypothesizing on new ideas. Use the Science Journal Rubric as appropriate.



DAILY DIRECTIONS

DAY 3

Day 3

Materials

- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency from Day 1*
- MOVING AIR EXPERIMENT 1 — *one per team*
- MOVING AIR EXPERIMENT 2 — *one per team*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #2 — *class set*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*

Moving Air Experiment 1 Materials

- Balloon — *one*
- Bowl (1-quart size) — *one*
- Hot tap water — *one cup*
- Plastic bottle (2-liter size, clear) — *one (at room temperature)*
- Thermometer — *one*

Moving Air Experiment 2 Materials

- Bowl of warm water (1-quart size) — *one*
- Plastic bottle (2-liter size, clear) — *one (placed in freezer for at least one hour)*
- Quarter coin — *one*
- Thermometer — *one*

Teacher Reference

- **Weather Question #2** — *transparency or written on the board*
- **Weather Map Symbol (Wind Direction)** — *one (to display on bulletin board)*
- **Suspect Profile: Joe Breezy** — *one (to read; then post)*

Procedure

1. Have students go over WEATHER HOMEWORK #1, providing answers if needed (See Day 2, #18 for Answer Key). Have any students who watched a weather report share what they learned with the rest of the class. The Weather Reporter from each team is supposed to either watch or read a weather report.
2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).



The **Materials** listed are enough for one experiment. Multiply by the number of teams in your class.

One plastic bottle must be at room temperature; place the other plastic bottle in a freezer for at least one hour prior to beginning the experiment.



Note: Two different weather types might be correct. For example, it could be partly sunny and partly cloudy. In this case, predictions for both sun and clouds would be a correct prediction. Students can reuse the prediction sticky notes later today when they predict tomorrow's weather.

3. Bring out TODAY'S WEATHER from yesterday. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions. The Weather Reporter checks the temperature and reports to the team.
4. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Illuminate your chart with all previous notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "Why are there different climates?" Elicit responses from students, but they should come up with the following information:
 - The tilt of the earth is the major determiner of climate. Opposite hemispheres experience the opposite type of weather. For example, when the Northern Hemisphere is experiencing summer, the Southern Hemisphere is experiencing winter.
 - Latitudes closest to the equator have warmer climates.
 - Latitudes farthest from the equator have colder climates.
5. Ask students if they have thought of any additional questions to add to the "QUESTIONS I HAVE" section of the chart. Add these to your chart as students pose their questions.
6. Write **Weather Question #2** on the board or display it on the overhead transparency. Ask students if they have any idea how temperature affects air. Elicit any responses or predictions the students may have.
7. Tell your students that they are going to conduct two experiments that will help them understand how temperature affects air. Separate students into their five teams and distribute MOVING AIR EXPERIMENT 1. Go through the experiment together so that students understand what they are expected to do.
8. Ask students to get their Science Journals and write today's date. Using the SCIENTIFIC METHOD, have the class come up with a *Question* for the first experiment (for instance, "What will happen to the balloon when the bottle is placed in the hot water?") and a *Hypothesis* (for instance, "The balloon will expand/get bigger/fill with warm air when the bottle is placed in the hot water.") Point out that the directions for the MOVING AIR EXPERIMENT 1 describe the *Procedure* of the experiment. The *Data* and *Conclusion* will be generated later in class.
 - a. Help students as they add the hot tap water to their bowls—the water should be hot to the touch, but it does not have to be extremely hot for the experiment to work.
 - b. Stress how to work with the water, emphasizing safety.



If possible, it's best to measure the temperature at the same time of day each day.



Remind teams that the Experiment Expert leads the team in completing the experiment. The Materials Manager collects the appropriate materials.

DAILY DIRECTIONS

DAY 3



9. Once students have completed the first experiment, ask teams to share the data from their experiment with the class.
10. Ask students what the experiment they just did has to do with the question today, “How does temperature affect air?” If they don’t come to any conclusions themselves, tell them:

“Think about why the balloon expanded in this experiment. As the hot water heats the air, the newly hot air expands and then rises. You probably noticed in the experiment we just did that hot air expands and rises. This impacts the weather because when hot air expands and rises, it moves the cooler air. Moving air is wind, and wind is what moves different types of weather. Wind can actually be a weather hazard on its own. In a couple of minutes we are going to do a second experiment to help us understand how temperature affects air.”
11. Students add the information about the *Data* and *Conclusion* of this experiment to their Science Journal entry.
12. Distribute MOVING AIR EXPERIMENT 2. Go through the experiment together so students understand what they are expected to do. Have the class come up with a *Question* for the second experiment (for instance, What will happen to the quarter when the icy bottle is placed in warm water?) and a *Hypothesis* (for instance, The quarter will move when the icy bottle is placed in warm water).
13. Once students have completed the second experiment, ask teams to share the data from their experiment with the class.
14. Once again, ask students what this experiment has to do with today’s question. If they don’t come to conclusions themselves, tell them:

“As the heat from the water warms the air inside the bottle, that air expands. When a coin seals the mouth of the bottle, the expanding air cannot get out. Air pressure increases in the bottle and pushes the coin up. Air that is heated rises, expands, and moves, creating different wind conditions. The same movement of air creates different weather conditions.



Air moves in large bodies called air masses. All of the air in an air mass has similar temperature and moisture content. As the air mass moves, the air changes as different climates are encountered. This change in the air brings a change in weather. When there are differences between air masses winds occur.”

15. Students add the information about the *Data* and *Conclusion* of this experiment to their Science Journal entry.
16. Show students the **Weather Map Symbol** (Wind Direction). Display this symbol on your bulletin board beside the symbol for Clear Skies.
17. Tell students an easy way to determine wind direction is to blow bubbles outside. Even if the day doesn't appear to be windy at all, bubbles will travel in the direction the wind is blowing because they are so light.
18. Tell the students that they did such a good job today gaining knowledge about weather and climate, they will get information about a second suspect in the case. Show the class **Suspect Profile: Joe Breezy** and read his profile. Remind Profile Detectives to get their SUSPECT LIST from their Science Journal and make notes on this third suspect. Post the profile on the bulletin board beside Bob Blizzard and Juan Sum Light.
19. Display TOMORROW'S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and post their predictions on the graph using new sticky notes or recycling previous predictions. Students write their predictions and their rationale for their predictions in their Science Journals.
20. Distribute WEATHER HOMEWORK #2. Ask students to try to find the information listed on this page tonight and bring the information with them to class tomorrow.

Answers to WEATHER HOMEWORK #2:

1. “Pea soup” fog is a heavy, thick, yellow fog. It occurs in heavily polluted areas.
2. The weight of air (per cubic yard at sea level): over 2 pounds
3. The weight of air [for the entire atmosphere]: 5.1 million billion tons.



DAILY DIRECTIONS

DAY 4

Day 4

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- TYPES OF CLOUDS — *class set + transparency*
- CLOUD INVESTIGATION — *one per team*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #3 — *class set*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*

Cloud Investigation Materials

- Cotton balls — *one per team member*
- Pie pan (8" diameter) — *one*
- Tap water — *one-half cup*

Teacher Reference

- **Weather Question #3** — *transparency or written on the board*
- **Weather Map Symbol (Cloudy)** — *one (to display on bulletin board)*
- **Suspect Profile: Ima Vapor** — *one (to read; then post)*

Procedure

1. Have students go over WEATHER HOMEWORK #2, providing answers if needed (See **Day 3, #20** for Answer Key). Have any students who watched a weather report share what they learned with the rest of the class. The Weather Reporters are supposed to watch or read a weather report.
2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).
3. Bring out TODAY'S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions (in their Science Journals).



The **Materials** listed are enough for one experiment. Multiply by the number of teams in your class.



Note: Two different weather types might be correct. For example, it could be partly sunny and partly cloudy. In this case, predictions for both sun and clouds would be a correct prediction. Sticky note predictions can be reused later today when students predict tomorrow's weather.

If possible, it's best to measure the temperature at the same time of day each day.

4. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of yesterday's notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "How does temperature affect air?" Elicit responses from students, but they should come up with the following information:
- As air is heated, it expands and rises causing different wind and weather conditions.
 - Air masses move to different areas of the world, creating different weather conditions.
 - When air masses bump into each other, fronts are formed. Weather changes usually occur along fronts.
- Elicit any further questions from the students and add these questions to the chart.

5. Write **Weather Question #3** on the board or display it on the overhead transparency. Ask students if they have any idea how different types of clouds help us predict the weather. Elicit any responses or predictions the students may have.
6. Illuminate the transparency of TYPES OF CLOUDS. Have students make predictions about what they think the weather is like under each type of cloud. Have Materials Managers distribute TYPES OF CLOUDS to their team. Discuss the following information about each cloud type to fill in the sheet.

"Clouds are identified based on how they look to the observer on the ground. Latin words are used to describe their appearance.

Cumulus clouds: (in Latin *cumulus* means *heap*)

Resemble puffy cotton balls (When cumulus clouds are not very tall, fair weather is likely. When cumulus clouds grow tall, thunderstorms can occur.)

Stratus clouds: (in Latin *stratus* means *stretched out*)

Resemble flat gray sheets of fog; made up of low layers of clouds that frequently cover the whole sky and block the sun. (Usually these clouds bring overcast conditions or rain.)

Cirrus clouds: (in Latin *cirrus* means *curl*) Resemble wispy, thin feathers (Cirrus clouds are usually high in the atmosphere and bring fair weather when the sky is clear blue and the cirrus clouds are scattered.)



DAILY DIRECTIONS

DAY 4



If there are no clouds outside, consider allowing students to use the Internet to complete a virtual observation. Students can observe various types of clouds and attempt to identify them using TYPES OF CLOUDS.

Note: The word *nimbus* is also associated with clouds. In Latin *nimbus* means that precipitation is falling from the cloud. For instance, cumulonimbus clouds are thunderclouds associated with strong winds and hail and/or rain; nimbostratus clouds are associated with a long, steady rain.”

7. Following this discussion have students bring their TYPES OF CLOUDS and Science Journals and go outside to observe the clouds. Students should describe (or draw) the clouds they see and describe the weather. Using the pictures and information on TYPES OF CLOUDS, have students locate the cloud that most closely resembles the clouds they see. Students write down the name of the cloud next to their Science Journal entry.
8. When you return from the cloud observation, tell students that they are going to conduct an experiment that will help them understand evaporation and precipitation as it relates to clouds. Separate students into five teams and distribute or have Materials Managers collect CLOUD INVESTIGATION. Teams complete the experiment following the procedure (the Scientific Method steps are included within the procedure).
 - a. As teams observe the water soaking into the cotton ball, tell them that this simulates the “evaporation” of water that occurs on earth. In the experiment, the water does not truly evaporate; it is absorbed by the cotton ball. Inform students that when evaporation happens on earth, water changes from a liquid to a gas, becomes water vapor, and evaporates into the clouds.
 - b. As teams observe the water dripping back into the pan (as they pick up the cotton ball), ask them why they think this happens. What they are observing simulates what happens with clouds in the sky. When they become too filled with water, precipitation occurs.
9. Ask students what the experiment and TYPES OF CLOUDS information have to do with the question today, “How do the different types of clouds help us understand the weather?” If they don’t come to any conclusions themselves, tell them:

“Understanding the different types of clouds help us understand what the weather will be like in an area. Look on page 2 of your Student Guide at the diagram of the earth’s atmosphere. Find the area known as the troposphere on your diagram. Clouds only appear in the troposphere, which is the area of the atmosphere within six miles of earth’s surface. The troposphere is where all weather occurs on earth. As water evaporates on earth, it moves into the air and forms clouds in a process called condensation. Clouds carry the water that becomes the precipitation we experience on earth—rain, snow, sleet, and hail. Understanding types of clouds and how they are formed helps us understand the weather.”



10. Show the class the **Weather Map Symbol** (Cloudy). Display these symbols on your weather bulletin board.
11. Tell the students that they did such a good job today gaining knowledge about weather and clouds, they will get information about another suspect in the case. Show the class **Suspect Profile: Ima Vapor** and read her profile. Profile Detectives take notes on their SUSPECT LIST pages and then file them in their Science Journals. Post the profile on the bulletin board beside Bob Blizzard, Juan Sum Light, and Joe Breezy.
12. Display TOMORROW’S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow (considering the types of clouds they observed) and write their predictions in their Science Journals. Students then post their predictions on the graph using new sticky notes or recycling previous predictions.
13. Distribute WEATHER HOMEWORK #3. Ask students to try to find the information listed on this page tonight and bring the information with them to class tomorrow.

Answers to WEATHER HOMEWORK #3:

1. An average cumulus cloud breaks up in about 10 minutes.
2. Clouds can soak up more than 80 percent of the sun’s heat on a cloudy day.



DAILY DIRECTIONS

DAY 5

Day 5

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- WATER CYCLE EXPERIMENT — *one per team*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #4 — *class set*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*

Water Cycle Experiment Materials

- Permanent marker — *one*
- Plastic cup (6-oz. size, clear) — *two*
- Plastic wrap or small plastic bag (clear) — *one*
- Rubber band (2" diameter) — *one*
- Thermometer — *one*
- Warm tap water — *one cup*

Teacher Reference

- **Weather Question #4** — *transparency or written on the board*
- **Weather Map Symbol (Rain)** — *one (to display on bulletin board)*
- **Suspect Profile: Debbie Drizzle** — *one (to read; then post)*

Procedure

1. Have students go over WEATHER HOMEWORK #3, providing answers if needed (See Day 4, #13 for Answer Key). Have any students who watched a weather report share what they learned with the rest of the class (Weather Reporters).
2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals). Students should also note the type of clouds outside.
3. Bring out TODAY'S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions. Beginning today, students add information about their cloud observations to the Today's Weather entry.



The **Materials** listed are enough for one experiment. Multiply by the number of teams in your class.



Note: Students will be making observations about today's experiment over the next three days.

Identifying clouds is a great way for students to use their skills of observation and classification. This process will assist with their weather predictions. There are many other factors that go into weather predictions, however clouds are one component that students can easily observe.

4. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "How do the different types of clouds help us understand the weather?" Elicit responses from students, but they should come up with the following information:
 - There are different types of clouds: cumulus, stratus, and cirrus are the main types.
 - Understanding that there are different types of clouds that are formed differently, helps us to understand the weather as well as to predict what kind of weather to expect.Ask students if there are any other questions that they would like to add to the chart. List any questions generated.
5. Write **Weather Question #4** on the board or display it on the overhead transparency. Ask students if they have any idea how the water cycle impacts the weather. Elicit any responses or predictions the students may have.
6. Tell your students that they are going to complete an experiment that will help them understand how the water cycle impacts the weather.
7. Have students look at the diagram of the water cycle on page 2 of their Student Guides. Remind them about the cloud activity that they did yesterday as you look at each part of the water cycle. Discuss each water cycle term and what it means.
8. Distribute or have Materials Managers distribute the WATER CYCLE EXPERIMENT. Have teams conduct the experiment. The Scientific Method steps are included within the procedure.
9. Ask students what this experiment has to do with the question today, "How does the water cycle impact the weather?" If they don't come to any conclusions themselves, tell them:

"Understanding the water cycle helps us understand the weather. There is a limited amount of water on the earth. The same water has been recycled for the last three billion years in the water cycle. Water in oceans, lakes, streams, and rivers is heated by the sun, becomes water vapor, and goes into the air (*evaporation*). As the water vapor rises, it cools and forms clouds (*condensation*).



DAILY DIRECTIONS

DAY 5



When so much water has condensed that the air can no longer hold it, it falls back to the Earth (*precipitation*). The water may fall into bodies of water or onto the land and become part of the ground water (*collection*). This cycle keeps repeating itself. The water cycle is closely connected with weather.”

10. Show the class the **Weather Map Symbol (Rain)**. Display this symbol on your weather bulletin board. Tell your students:
“Rain is part of the water cycle. At the center of each raindrop (or snowflake) is a very small particle of dust. Rain or snow is formed when water vapor condenses around the small particle of dust.”
11. Tell the students that they did such a good job today gaining knowledge about the water cycle, they will get information about the fifth suspect in the case. Show the class **Suspect Profile: Debbie Drizzle** and read her profile. Remind Profile Detectives to take notes on their SUSPECT LIST. Post the profile on the bulletin board beside the other suspects.
12. Display TOMORROW’S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and write their predictions and rationale in their Science Journals. Students should consider the types of clouds they observe when making their predictions. Students then post their predictions on the graph using new sticky notes or recycling previous predictions.
13. Distribute WEATHER HOMEWORK #4. Ask students to try to find the information listed on this page tonight and bring the information with them to class tomorrow.



Answers to WEATHER HOMEWORK #4:

1. At the center of every raindrop is a bit of dust. The water vapor condenses around the dust, which is at the center of the raindrop.
2. Sorry, this was a trick question. There is never new water on Earth. As we learned about the water cycle, the same water has been on Earth since the beginning of time.
3. Yes, animals have fallen with the rain. Frogs fell in Tennessee in October 1946 and in Arkansas in January 1973. Rainstorms swept up the animals, which then came down with the rain.

Day 6

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- SAFETY HINTS: Extreme Heat — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Thermometer — *one per team*
- SUSPECT CLUE #1 — *class set*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #5 — *class set*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*

Make Your Own Thermometer Materials

- Modeling clay — *enough to make a 1-inch ball*
- Permanent marker — *one*
- Plastic straw (clear) — *one*
- *Plastic clear water bottle (16-oz. size, empty) — *one*
- Red food coloring — *five drops*
- Sauce pan (1-qt. size or 9" pie or square pan) — *one*
- Spoon — *one*
- Store-bought thermometer — *one*
- Water (cold) — *one cup*
- Water (hot) — *one cup*
- Water (room temperature) — *one-half cup*

* Carefully remove the label.

Teacher Reference

- **Weather Question #5** — *transparency or written on the board*
- **Weather Map Symbol** (Daily Temperature) — *one (to display on bulletin board)*

Procedure

1. Have students go over WEATHER HOMEWORK #4, providing answers if needed (See **Day 5, #13** for Answer Key). Have any students who watched a weather report share what they learned with the rest of the class (Weather Reporters).
2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).

DAILY DIRECTIONS

DAY 6

3. Bring out TODAY'S WEATHER. Again, have students graph the date, the temperature (noting the time of day), and the weather conditions (including the type of clouds).
4. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "How does the water cycle impact the weather?" Elicit responses from students, but they should come up with the following information:
 - Evaporation — the water on earth evaporates into the sky as it is heated
 - Condensation — as the water rises, it forms into clouds
 - Precipitation — when clouds become too filled with water, some of the water is released back to the ground
 - Collection — water falls to the earth and collects in the ground or in the water

Ask students if there are any other questions that they would like to add to the chart. List any questions generated.

5. Write **Weather Question #5** on the board or display it on the overhead transparency. Ask students what they know about droughts or extreme heat and how to stay safe in extreme heat. Elicit any responses or predictions the students may have.
6. Show your students the description of a drought in their Student Guides (on page 3). After they have read the description, discuss ways that students can stay safe during extreme heat. Distribute SAFETY HINTS: Extreme Heat.
7. Tell students that sometimes during a drought there is a danger of extreme heat, but extreme heat can occur even when there is no drought.
8. Show the class the **Weather Map Symbol** (Daily Temperature). Display this symbol on your weather bulletin board.
9. Ask students how they believe a thermometer works. Tell them that today they will build a model of a thermometer. Move students into their teams and distribute CLASSROOM WEATHER STATION: Make Your Own Thermometer. Have Materials Managers gather the materials. Allow time for each team to make their own thermometer model.

10. Using the discussion prompts on the CLASSROOM WEATHER STATION: Make Your Own Thermometer, have students compare the thermometer they made to a real thermometer. Their thermometers do not measure specific temperatures, just relative temperature. They have high, low, and room temperatures marked on their model thermometer. Students need to understand that warmer temperatures force the liquid in the thermometer to move up; cooler temperatures force the liquid in the thermometer to move down.
11. Distribute SUSPECT CLUE #1 to each student in the class. Tell the students:
 “We received a clue that will help us eliminate one suspect from our suspect list. However, you need to solve a logic puzzle to determine which suspect can be eliminated.”
12. If your students are familiar with elimination charts, allow them to complete this puzzle on their own. If they aren’t familiar with these charts, read through each clue with the class, marking an “X” in the boxes to serve as a *no* answer and “O” in the boxes to serve as a *yes* answer. Students individually complete the chart and then discuss the information. Profile Detectives use this information in eliminating a suspect on the SUSPECT LIST.

Suspects	Time				
	Midnight	2:00 a.m.	4:00 a.m.	6:00 a.m.	8:00 a.m.
Bob Blizzard	X	X	X	O	X
Juan Sum Light	X	X	X	X	O
Joe Breezy	O	X	X	X	X
Ima Vapor	X	O	X	X	X
Debbie Drizzle	X	X	O	X	X

Answer to SUSPECT CLUE #1:

Juan Sum Light is no longer a suspect because he was at McGee’s Weather Company after 7:02 a.m. (sunrise). The documents were stolen between 11:00 p.m. Thursday and 6:00 a.m. Friday.

13. Have students look at the Water Cycle Experiment from Day 5 and write their observations in their Science Journals.



DAILY DIRECTIONS

DAY 6

14. Display TOMORROW'S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow (noting the types of clouds) in their Science Journals. Students post their predictions on the graph using new sticky notes or recycling previous predictions.

15. Distribute WEATHER HOMEWORK #5 to the class. Tell them that there is more than one correct answer to the homework.

Day 7

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- SAFETY HINTS: Tornadoes — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Tornado — *one per team*
- SUSPECT CLUE #2 — *class set*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #6 — *class set*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*

Make Your Own Tornado Materials

- Duct tape (5" length) — *one*
- Plastic bottles (2-liter size, clear) — *two*
- Red food coloring — *10 drops*
- Water — *1.5 liter*

Optional Extension Materials

- Pail (large) — *one*
- Spoon (wooden) — *one*
- Water — *enough to fill the pail three-quarters full*

Teacher Reference

- **Weather Question #6** — *transparency or written on the board*
- **Weather Map Symbols** (High Pressure Area and Low Pressure Area) — *one of each (to display on bulletin board)*

Procedure

1. Have students go over WEATHER HOMEWORK #5, accepting any answer that describes a dry, warm climate. Have any students who watched a weather report share what they learned with the rest of the class (Weather Reporters).
2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like (including types of clouds) and compare it to yesterday's prediction (in their Science Journals).
3. Bring out TODAY'S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions (including types of clouds).



Note: You might decide to have the students help you make one tornado that the class can share, rather than having each team make their own.

Food coloring makes this activity more spectacular, but the dye can stain clothing. Caution students to be careful as they work with their tornado constructions.

The **Materials** listed are enough for one tornado. Multiply by the number of teams in your class.

DAILY DIRECTIONS

DAY 7

4. Have students get out **WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED** from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "What do we know about droughts and how to stay safe in extreme heat?" Elicit responses from students, but they should come up with the following information:

- Droughts occur in every climate in the world and indicate a shortage of water in an area over an extended period of time.
- To stay safe in extreme heat, one should stay inside, drink plenty of fluids and avoid strenuous activity.

Ask students if there are any other questions that they would like to add to the chart. List any questions generated.

5. Write **Weather Question #6** on the board or display it on the overhead transparency. Ask students what they know about tornadoes and how to stay safe during a tornado. Elicit any responses or predictions the students may have.
6. Show your students the description of tornadoes in their Student Guides (on page 4). After they have read the description, discuss ways that students can stay safe during a tornado. Distribute the **SAFETY HINTS: Tornadoes**.
7. Show the class the **Weather Map Symbols** (High Pressure Area and Low Pressure Area). Display these symbols on your weather bulletin board.
8. Tell students that they are going to have the opportunity to make their own tornadoes today. Move students into their teams and distribute **CLASSROOM WEATHER STATION: Make Your Own Tornado** and materials. **Note:** the "tornado" students create simulates the swirling motion of a tornado. For-the activity to work it is necessary to have an empty bottle underneath the full one on top. Obviously, tornadoes occur without requiring holes in the ground (the empty bottle). However, the activity allows students to observe the swirling motion of the water and hypothesize about the direction of the air funnel inside the water.

9. Allow time for students to create their own tornadoes. As students complete the activity, assist them to see how the bottle tornado only looks like the real thing. Have students consider the following:
- In what direction does the water flow (downward)
 - What happens to something caught in a tornado (it moves upward)
 - What would happen if something was caught in the water (it-would move downward)
 - In what direction does the air move inside the water (upward; moving from the bottom bottle to the top bottle)
10. Interesting facts to share with your students about tornadoes:
- “Most tornadoes happen in April, May, and June.
 - The United States has more tornadoes than any other country.”
11. **Teacher Background Information**
There are two kinds of tornadoes: descending and non-descending.
- The majority are descending. Forces in the clouds caused primarily by differences in air temperature start the cloud moving faster and faster. This creates a vortex of air—a column that reaches down toward the surface of earth, but with the air at the center of the swirl moving upward. When a descending tornado “touches down” it draws everything upward in the column.
 - Scientists now know that there is another class of tornadoes that actually are non-descending. They form much like the “dust devils” in the desert. These spin round and round, and like the descending tornadoes, grab soil and other objects not tied down and spin them upward into the column.
12. **Optional Extension**
Demonstrate what occurs when there is no empty bottle underneath. Using a large pail of water and a wooden spoon, paddle the wooden spoon in the top few inches of the water. Start slowly to get the water moving and then stir faster and faster. The spoon should not go below the top few inches, but the vortex will form right down to the bottom of the pail. This demonstrates that the energy can be applied at the top (upper cloud levels) and still form a vortex that reaches the ground, as in a descending tornado.



DAILY DIRECTIONS

DAY 7



13. Distribute SUSPECT CLUE #2 to each student in the class. Tell the students:

“We received a clue that will help us eliminate a second suspect from our suspect list. However, you need to break a code to determine which suspect can be eliminated.”

If students need additional clues to break the code, give them some of the small words in the puzzle — the, can, you, is

Students individually solve the clue or teams can work together to solve the clue. Profile Detectives use this information in eliminating a suspect on the SUSPECT LIST.

Answer to SUSPECT CLUE #2:

MLR KOKERV M WCO VZA RDJBJAZMR
THE SUSPECT YOU CAN ELIMINATE

MCTZW JK XCX XDJYYZIT.
TODAY IS BOB BLIZZARD.

14. Have students look at the Water Cycle Experiment from Day 5 and write their observations in their Science Journals.
15. Display TOMORROW’S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and post their predictions on the graph using new sticky notes or recycling previous predictions. Be sure that students consider the types of clouds observed.
16. Distribute WEATHER HOMEWORK #6 to the class. Tell them that there is more than one correct answer to the homework.

Day 8

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- SAFETY HINTS: Hurricanes — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Weather Vane — *one per team*
- SUSPECT CLUE #3 — *class set*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #7 — *class set*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*

Make Your Own Weather Vane Materials

- Compass — *one*
- Glue — *one container*
- Masking tape — *one roll*
- Plastic straw (clear) — *one*
- Poster board or cardboard (8" x 8") — *one*
- Ruler — *one*
- Scissors — *one pair*
- Shoe box — *one*
- Thread spool (empty) — *one*
- Weights (such as rocks) — *several (enough to weigh down the shoe box)*

Teacher Reference

- **Weather Question #7** — *transparency or written on the board*
- **Weather Map Symbols** (Cold Front and Warm Front) — *one of each (to display on bulletin board)*

Procedure

1. Have students go over WEATHER HOMEWORK #6, accepting any answer that names a state that experiences tornadoes. States in the Midwest area of the United States experience more tornadoes than anywhere else in the world. "Tornado Alley" includes: North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Louisiana, Arkansas, Missouri, Iowa, and parts of other states. Have any students who watched a weather report share what they learned with the rest of the class (Weather Reporters).



The **Materials** listed are enough for one weather vane. Multiply by the number of teams in your class.

Note: If you find enough inexpensive compasses, each team of students can attach a compass to the top of the shoe box to determine which way the wind is blowing no matter where the weather vane is placed.

DAILY DIRECTIONS

DAY 8

2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).
3. Bring out TODAY'S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions (including the type of clouds).
4. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "What do we know about tornadoes and how to stay safe in tornado?" Elicit responses from students, but they should come up with the following information:
 - Tornadoes are severe forms of weather. Even though it doesn't last very long, a tornado acts like a giant vacuum cleaner causing great destruction on the ground when it touches down.
 - To stay safe in a tornado, go to a basement or a small room in the middle of the first floor of a house. Stay away from glass.

Ask students if there are any other questions that they would like to add to the chart. List any questions generated.

5. Write **Weather Question #7** on the board or display it on the overhead transparency. Ask students what they know about hurricanes and how to stay safe during a hurricane. Elicit any responses or predictions the students may have.
6. Show your students the description of hurricanes in their Student Guides (page 5). After they have read the description, discuss ways that students can stay safe during a hurricane. Distribute the SAFETY HINTS: Hurricanes.
7. Show the class the **Weather Map Symbols** (Cold Front and Warm Front). Display these symbols on your weather bulletin board.

8. Ask students how they believe a weather vane works. Tell students that a weather vane is an instrument that measures wind direction. Move students into their teams and distribute CLASSROOM WEATHER STATION: Make Your Own Weather Vane and materials. Allow time for students to create their own weather vanes and use them to note the direction of the wind. Use the following discussion prompts as students complete the activity.
1. What does a weather vane do?
 2. How does a weather vane work?
 3. If the wind was blowing, what direction was it blowing?

9. Distribute SUSPECT CLUE #3. Tell the students:
- “We received another clue. You need to complete a word search puzzle to determine which suspect we can eliminate from our suspect list. After you find all the words in the word search puzzle, the letters that remain in the first line and a half spell out the name of the person who can be eliminated as a suspect.”

Students work individually or as a team to solve the clue. Profile Detectives use this information in eliminating a suspect on the SUSPECT LIST.

N D T E B B R I W E E D R I Z
M I W H Z L E E O A N L G Q J
E R A I E W T R N U E W S H T
T C O R N R E E S J R L Y U H
U H U T W D M H F S G K M R U
H M A A S O O O E O Y O S R N
R U T I M B R D M A V Z I I D
S E M E L F G H A E T Z I C E
R D T I R F Y E M N T W A A R
A E U O D E H E Y W R E O N Q
R R S O T I N C N R Y O R E A
Q T D K L T T M E B K Q T L Z
M Z Y C O C V Y N I M B U S P
G I C D M X P F V Q F Z C M K
S C Z G C G N I N T H G I L H

Debbie Drizzle is no longer a suspect



*Additional activities to consider:
observe bubbles to find the wind
direction or fly kites to feel the
strength and direction of the wind.*



DAILY DIRECTIONS

DAY 8

10. Have students look at the Water Cycle Experiment from Day 5 and write their observations in their Science Journals. This is the final day of this experiment. Point out once again that this experiment shows how the water cycle works. The atmosphere acts as a “lid” to keep water on earth.
11. Display TOMORROW’S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and post their predictions on the graph using new sticky notes or recycling previous predictions. Students continue to note the type of clouds when making their predictions.
12. Distribute WEATHER HOMEWORK #7. Ask students to try to find the information listed on this page tonight and bring the information with them to class tomorrow.



Answers to WEATHER HOMEWORK #7:

1. In Asia, hurricanes are called *typhoons*.
2. In Australia, hurricanes are called *Willy Willies*.
3. Hurricanes are given names because sometimes there is more than one hurricane forming at one time. Naming a hurricane makes it easier to understand which storm a person is referring to.

Day 9

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- SAFETY HINTS: Lightning — *class set*
- SAFETY HINTS: Floods — *class set*
- CLASSROOM WEATHER STATION — Make Your Own Anemometer — *one per team*
- SUSPECT CLUE #4 — *class set*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #8 — *class set*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*

Make Your Own Anemometer Materials

- Glue — *one container*
- Masking tape — *one roll*
- Paint (tempera; a different color than the plastic cups) — *small amount*
- Paper or plastic cups (2-oz. to 4-oz. size) — *four*
- Plastic straw (clear) — *one*
- Scissors — *one pair*
- Shoe box — *one*
- Thread spool (empty) — *one*
- Weights (such as rocks) — *several (enough to weigh down the shoe box)*
- Wooden craft sticks — *two*

Teacher Reference

- **Weather Question #8** — *transparency or written on the board*
- **Weather Map Symbols** (Thunderstorms, Showers, Snow) — *one of each (to display on bulletin board)*

Procedure

1. Have students go over WEATHER HOMEWORK #7, providing answers if needed (See Day 8, #12 for Answer Key). Have any students who watched a weather report share what they learned with the rest of the class (Weather Reporters).
2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).



The **Materials** listed are enough for one anemometer. Multiply by the number of teams in your class.
Note: You might opt to have the students help you make one anemometer for the class.

DAILY DIRECTIONS

DAY 9

3. Bring out TODAY'S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions (including the type of clouds).
4. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "What do we know about hurricanes and how to stay safe in a hurricane?" Elicit responses from students, but they should come up with the following information:
 - Hurricanes are one of the most severe forms of weather on Earth. Hurricanes can last for hours and cause lots of destruction.
 - To stay safe in a hurricane, people should listen to the radio and follow directions given by authorities, stay away from flooding waters, and, unless you are evacuated, you should stay in the center of the house away from windows.

Ask students if there are any other questions that they would like to add to the chart. List any questions generated.

5. Write **Weather Question #8** on the board or display it on the overhead transparency. Ask students what they know about lightning and how to stay safe in lightning. Also ask students what they know about floods and how to stay safe during a flood. Elicit any responses or predictions the students may have.
6. Show your students the description of floods and lightning in their Student Guides (pages 6–7). After they have read these descriptions, discuss ways that students can stay safe during flooding and a lightning storm. Distribute the SAFETY HINTS: Floods and the SAFETY HINTS: Lightning.
7. Show the class the **Weather Map Symbols** (Thunderstorms, Showers, and Snow). Display these symbols on your weather bulletin board.
8. Ask students if they know what an anemometer is. If they need help, tell students that an anemometer measures wind speed. Move students into their teams and distribute CLASSROOM WEATHER STATION: Make Your Own Anemometer and materials. Allow time for students to create their model anemometer and use it to rate the wind speed (very slow, slow,

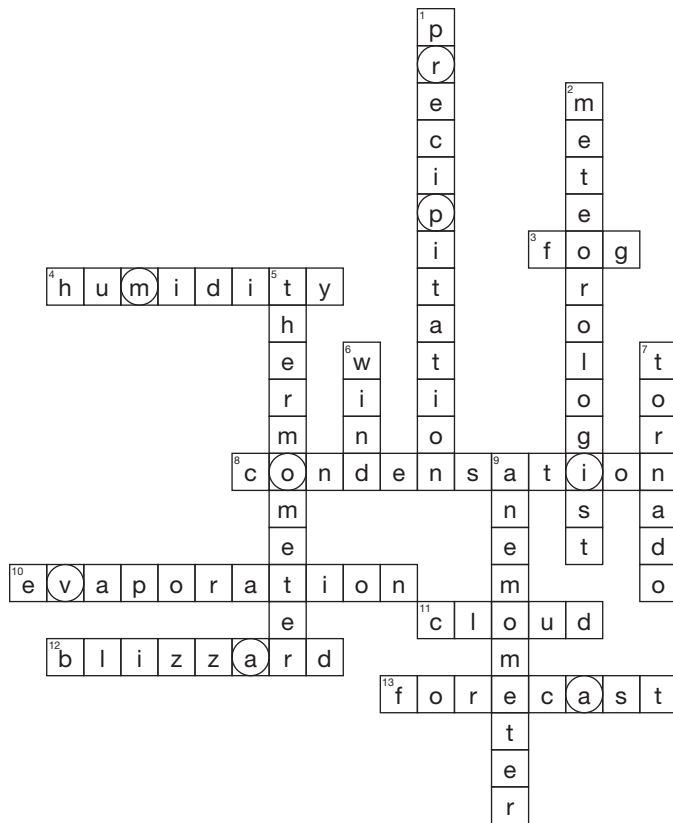
medium, fast, or very fast). Following the weather station activity, discuss what students learned using the discussion prompts on CLASSROOM WEATHER STATION: Make Your Own Anemometer. Students should understand that anemometers measure wind speed.

9. Distribute SUSPECT CLUE #4. Tell the students:

“We received a clue that will help us eliminate another suspect from our suspect list. However, you need to solve a crossword puzzle to determine the person who is no longer a suspect.”

Students work individually or as a team to solve the clue. Profile Detectives use this information in eliminating a suspect on the SUSPECT LIST.

Answer to SUSPECT CLUE #4:



Ima Vapor is no longer a suspect



One of the cups is painted so that it is easier for students to see the number of times their cups rotate. They can compare their homemade anemometers to others in the class, but their constructions do not provide a precise measure of the wind speed as a real anemometer does.



DAILY DIRECTIONS

DAY 9

10. Even though the class has now narrowed the suspects to one, tomorrow's activity concerning the suspects will confirm whether our elimination efforts were correct.
11. Display TOMORROW'S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and post their predictions on the graph using new sticky notes or recycling previous predictions.
12. Distribute WEATHER HOMEWORK #8. Tell students there are many correct responses. Examples include: Kauai, Hawaii; Portland, Oregon; New Orleans, Louisiana; Seattle, Washington.

Day 10

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- SAFETY HINTS: Blizzards — *class set*
- CLASSROOM WEATHER STATION: Make Your Own Rain/Snow Gauge — *one per team*
- SUSPECT CLUE #5 — *class set*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER HOMEWORK #9 — *class set*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*

Make Your Own Rain/Snow Gauge Materials

- Duct tape (5" length) — *one*
- Permanent marker — *one*
- Plastic water bottle (16-oz. size, clear) — *one*
- Ruler — *one*

Teacher Reference

- **Weather Question #9** — *transparency or written on the board*

Procedure

1. Have students go over WEATHER HOMEWORK #8, accepting any reasonable answer. Have any students who watched a weather report share what they learned with the rest of the class (Weather Reporters).
2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).
3. Bring out TODAY'S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions.



Note: You might opt to have the students help you make one rain/snow gauge for the class.

The Materials listed are enough for one rain/snow gauge. Multiply by the number of teams in your class.

DAILY DIRECTIONS

DAY 10

4. Have students get out **WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED** from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "What do we know about floods and lightning and how to stay safe in floods or a lightning storm?" Elicit responses from students, but they should come up with the following information:
- Although floods kill more people each year, lightning causes more fatalities than tornadoes and hurricanes combined.
 - Lightning is caused by a build-up of electricity in the atmosphere.
 - Flooding occurs when more rain falls than can be absorbed by the ground or bodies of water in a given area.
 - To stay safe in a lightning storm, if outside: water should be avoided, people should move to lower elevations, and stay away from tall objects; if inside: stay away from windows and doors, avoid electrical appliances, and metal objects.
 - To stay safe in a flood, follow directions given by authorities, avoid low-lying areas, and know a route to higher elevations.

Ask students if there are any other questions that they would like to add to the chart. List any questions generated.

5. Write **Weather Question #9** on the board or display it on the overhead transparency. Ask students what they know about blizzards and how to stay safe in a blizzard. Elicit any responses or predictions the students may have.
6. Show your students the description of blizzards in their Student Guides (page 8). After they have read the description, discuss ways that students can stay safe during a blizzard. Distribute **SAFETY HINTS: Blizzards**.
7. Ask students if they know what a rain/snow gauge is. If they need help, tell students that a rain/snow gauge measures the amount of rain or snowfall in an area. Move students into their teams and distribute **CLASSROOM WEATHER STATION: Make Your Own Rain/Snow Gauge** and materials. Allow time for students to create their model rain/snow gauge.

8. Distribute SUSPECT CLUE #5. Tell the students:

“This is our final clue regarding the suspects in this case. Since the other four suspects have been eliminated, we know who the culprit is. However, we will need to unscramble this clue to get official confirmation that we are correct about our suspect.”

Students work individually or as a team to solve the clue. Profile Detectives use this information to confirm their final suspect.

Answer to SUSPECT CLUE #5:

E J O Z Y B E R E S I H E T L P C R U T I .
I O E B R E E Z Y I S T H E C U L P R I T

9. Tell students that you will contact Michael McGee to let him know that the class has determined the guilty suspect.
10. Display TOMORROW’S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and post their predictions on the graph using new sticky notes or recycling previous predictions.
11. Distribute WEATHER HOMEWORK #9. Tell students that there is more than one correct answer to this homework assignment.



DAILY DIRECTIONS

DAY 11

Day 11

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- WEATHER MAP — *class set + transparency*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- WEATHER EXTENSIONS — *as needed (optional)*
- Recorded weather forecast — *if possible*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*
- Weather map from a local or national paper (in color) — *one (optional)*

Procedure

1. Have students go over WEATHER HOMEWORK #9, accepting any reasonable answer. Have any students who watched a weather report share what they learned with the rest of the class (Weather Reporters).
2. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).
3. Bring out TODAY'S WEATHER. Again, have students graph the date, the temperature (noting the time of day), and the weather conditions (including type of clouds).
4. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students to review what they learned yesterday starting with yesterday's question, "What do we know about blizzards and how to stay safe in a blizzard?" Elicit responses from students, but they should come up with the following information:
 - Listen to what the authorities tell you to do.
 - To stay safe in a blizzard, avoid going outside. Be prepared with drinking water, canned foods, a flashlight, batteries, a radio, and a first aid kit.

- If you are in a car, pull off the road, put on hazard lights, and hang a distress signal from the antenna. Only run the car for 5–10 minutes each hour for heat.

Ask students if there are any other questions that they would like to add to the chart. List any questions generated.

5. Distribute a WEATHER MAP to each student. Have students locate the symbols discussed during the past two weeks:
 - Symbols for clear skies, rain (thunderstorms, drizzle, showers) and clouds
 - Daily temperature
 - High Pressure and/or Low Pressure Areas
 - Cold Fronts and/or Warm Fronts
6. If you brought a colored weather map to class, show it to your students. Tell them the cool colors on the map (blue, green) represent cool temperatures. The warm colors on the map (red, orange, yellow) represent warm temperatures.
7. Tell students that their task this week is to develop their own weather report, just like one they might see on the news.
8. Show the class the taped weather report. Tell students that they will create their own weather report using the same information that was used in the taped weather report.
 - a. Run the tape several times while students take notes on the information in the report—temperature, high or low pressure areas, cold or warm fronts, predictions for upcoming weather, etc.
 - b. If students are interested in making their weather report a bit unique, they may add a little-known weather fact or other interesting information.
9. Have students write their weather reports based on the notes they made while watching the taped weather report.
 - a. Move students into pairs and allow them to deliver their weather reports to one another.
 - b. If a few students are interested in sharing their weather report with the entire class, allow time for them to do so.



Note: Choosing a few sample weather reports that are especially well done to share with the entire class will provide all students with a good weather report model.

DAILY DIRECTIONS

DAY 11

10. Display TOMORROW'S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and post their predictions on the graph using new sticky notes or recycling previous predictions.
11. Tell students that they should try to watch the weather on television tonight for homework, since they will be creating their own *Weather Reports*, complete with weather predictions, this week.
12. **Option:** For students who would like to extend their learning, allow them to select one of the activities from the WEATHER EXTENSIONS (or encourage them to add an extension of their choice). Students may also use any unanswered questions from the QUESTIONS I HAVE column of the chart for an extension.

Day 12

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- WEATHER REPORT: Checklist and Rubric — *class set or one per team + one to post*
- TOMORROW'S WEATHER PREDICTION CHART — *from previous day*
- Almanacs — *several*
- Encyclopedias — *several*
- Science Journals — *from previous day*
- Sticky notes — *class set or reuse predictions from previous day*
- Weather map (current) from a local or national paper (in color) — *one per team*

Procedure

1. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).
2. Bring out TODAY'S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions (including type of clouds).
3. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students if they have any ideas about how meteorologists predict the weather. Elicit any responses the students have and then share any of the following information with the class that they didn't already bring up in the discussion.
 - Meteorologists gather information about weather conditions from weather stations around the world, from weather balloons, and from satellites in space.
 - All of the information meteorologists gather is entered into very powerful computers which are able to create weather maps from this information.
 - Meteorologists use the computer-generated weather maps, along with the data gathered, and knowledge about changing weather patterns, to make predictions about weather.



Students will use these weather maps for the current day as a frame of reference while conducting research on their assigned city and preparing their reports.

DAILY DIRECTIONS

DAY 12

- Even with all the knowledge and advanced technology we have, it is very difficult to predict the weather for more than five or six days in advance.

Ask students if there are any other questions that they would like to add to the chart. List any questions generated.

4. Move students into teams and assign each team a different city in the United States. The team is responsible for creating a *Weather Report* for that city in the next couple of days.
 - a. The cities are:
 - Atlanta, Georgia
 - Chicago, Illinois
 - Los Angeles, California
 - New York, New York
 - Seattle, Washington
 - b. These *Weather Reports* should include the elements of a weather report practiced yesterday: current temperature, current weather conditions, predictions about the weather, and interesting weather facts.
 - c. They will share these reports with the rest of the class and any visitors you decide to invite.
5. Distribute WEATHER REPORT: Checklist and Rubric to each team. Read the information with the class to be sure that students understand your expectations for the *Weather Reports*.
6. Distribute a current weather map to each team of students. Tell them that they will need to conduct some research about weather conditions in their team's city on the Internet, in the almanac, or in an encyclopedia. The almanac and encyclopedia will provide teams with weather information that occurred in the past. The current weather maps will provide students with information about recent weather in their own city.
7. Allow teams time to conduct research and to plan their *Weather Reports*.
8. Display TOMORROW'S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and post their predictions on the graph using new sticky notes or recycling previous predictions.
9. Tell students that they should try to watch the weather on television again tonight for homework.

Days 13–14

Materials

- Student Guide — *class set*
- TODAY’S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- ORAL PRESENTATION RUBRIC (Content and Presentation) — *class set or one per team + one to post*
- TOMORROW’S WEATHER PREDICTION CHART — *from previous day*
- Science Journals — *from previous day*
- Weather map (current) from a local or national paper (in color) — *one per team*

Procedure

1. Look at yesterday’s prediction chart for today’s weather. Have students document what the weather is actually like and compare it to yesterday’s prediction (in their Science Journals).
2. Bring out TODAY’S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions (including type of clouds).
3. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days’ notes recorded. Ask students if they know any specific information about weather satellites. Elicit any responses the students have and then share any of the following information with the class that they didn’t already bring up in the discussion
 - There are two different kinds of weather satellites: geostationary satellites and polar-orbiting satellites.
 - Geostationary satellites always remain at the same spot high above the equator. There are five geostationary satellites in space around the equator. Every half hour they send information about the weather to Earth. Because of where these satellites are located, they provide a complete picture of the Earth except for the North and South Pole.
 - Polar-orbiting satellites circle the globe in strips from pole to pole. These satellites collect information about weather over the North and South Pole.



The **Content** segment of the ORAL PRESENTATION RUBRIC is a team score and the Presentation segment is an individual score.

Students will use these weather maps for the current day as a frame of reference while conducting research on their assigned city and preparing their reports.

DAILY DIRECTIONS

DAYS 13–14

Ask students if there are any other questions that they would like to add to the chart. List any questions generated.

4. Distribute the copies of today's weather map to each team of students. Tell them that they should continue working on the *Weather Reports* for their cities using today's weather map and any other research material they need. Allow teams time to conduct research and to plan their *Weather Reports*.
5. Distribute ORAL PRESENTATION RUBRIC (Content and Presentation) and discuss with the class. Be sure that students are clear on your expectations. The Content section of the rubric provides a team score and the Presentation section provides an individual score.
6. Display TOMORROW'S WEATHER PREDICTION CHART. Have each member of the class predict what they think the weather will be like tomorrow and post their predictions on the graph using new sticky notes or recycling previous predictions.
7. Allow students to work on their *Weather Reports* on Day 14. Tell them that they will deliver their *Weather Reports* to their classmates on Day 15. If your classroom has a United States map, students will need to use it as a prop. Let students know that they can create their own props for their weather reports.
8. Tell students that they should try to watch the weather on television again tonight for homework.

Day 15

Materials

- Student Guide — *class set*
- TODAY'S WEATHER — *from previous day*
- WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED — *transparency*
- WEATHER EXTENSIONS — *as needed (optional)*
- ORAL PRESENTATION RUBRIC (Content and Presentation) — *one (for your reference)*
- Science Journals — *from previous day*

Procedure

1. Look at yesterday's prediction chart for today's weather. Have students document what the weather is actually like and compare it to yesterday's prediction (in their Science Journals).
2. Bring out TODAY'S WEATHER. Once again, have students graph the date, the temperature (noting the time of day that the temperature was taken), and the weather conditions (including type of clouds).
3. Have each team of students deliver their *Weather Report* to the rest of the class.
4. Have students get out WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED from their Science Journals. Use the overhead projector to illuminate your chart with all of the previous days' notes recorded. Ask students to share what they learned about the weather over the past three weeks.

If there are any questions that students still have, add them to the projects listed on the WEATHER EXTENSIONS handout for students interested in conducting additional research about weather.

5. **Option:** Have students write an essay about what they learned in this unit of study. Both the discussion and the writing activity will help students recognize the learning that took place as a result of participating in this simulation. Consider the following essay prompts:
 - Why are there different climates?
 - How does the temperature affect air and how does this impact the weather?

DAILY DIRECTIONS

DAY 15

- How do different clouds help us understand the weather?
 - How does the water cycle impact the weather?
 - What were the three most interesting things you learned about weather and why were they so interesting?

 - What are the steps of the Scientific Method?
 - Why does an experiment need to be repeated several times before results are accepted as correct?

 - You are a weather forecaster (meteorologist) and have been asked to speak to a class about your job. What would you tell the students about what you do and why it is important?
 - What information is important to include in a weather report and why?
 - Write an information report about the weather. Include important factors that effect the weather, instruments that help predict the weather, and information that makes a successful weather report.
6. **Option:** For students who would like to extend their learning, allow them to select one of the activities from the WEATHER EXTENSIONS (or encourage them to add an extension of their choice). Students may also use any unanswered questions from the QUESTIONS I HAVE column of the chart for an extension.
7. **Option:** Students continue to monitor weather (as with Today's Weather). Using graphs, students organize this data monthly to describe weather trends. Students could record weather data throughout the year and compare seasonal weather conditions.

GLOSSARY (1)

TEACHER REFERENCE

- Air mass** — a portion of the atmosphere that possesses the same temperature and humidity
- Air pressure** — a force that is put out by the atmosphere
- Alto cumulus** — a cloud that is thin, has layers, appears “rippled,” and is patchy
- Altostratus** — clouds that encompass the whole sky, they are smooth, thin, and gray or blue
- Anemometer** — an instrument used to measure the speed of the wind
- Atmosphere** — the mass of gas that surrounds the Earth
- Barometer** — instrument used to measure the air pressure
- Blizzard** — snowstorm with high winds
- Breeze** — winds with speeds up to 31 mph
- Cirrocumulus** — clouds that are found in “sheets” and look like puffy balls
- Cirrostratus** — veil-like clouds that are large and wispy
- Cirrus** — clouds that are found five miles or higher above the earth, they are curly, very thin, wispy clouds that are made of ice crystals
- Cloud** — many very tiny droplets of water and ice suspended in the air
- Cold front** — the first part of an atmospheric air mass that is cold and moving against a warm air mass, which it eventually replaces
- Condensation** — the process of gas or vapor changing into liquid
- Coriolis effect** — weather systems are pushed to the right in the Northern Hemisphere and to the left in the Southern Hemisphere as a result of the rotation of the earth below the atmosphere
- Cumulonimbus** — fast rising clouds that have a spreading top, and are dark, rolling and very large
- Cumulus** — clouds that are puffy, that have a flat bottom, and a rounded top (caused by rising air)
- Dew point** — temperature at which air can no longer hold water vapor, and thus condensation occurs and the air becomes liquid
- Drizzle** — drops of rain that are smaller than .02 of an inch
- El Niño** — warming of the water in the Pacific Ocean, which occurs periodically and often times also causes rising air temperatures and severe storms
- Evaporation** — the process of water changing from liquid to gas
- Flash floods** — floods that are sudden, and very violent
- Fog** — clouds that are very low, close to the earth (Fog often forms when cold air settles to the ground on a windless, clear night.)
- Forecast** — a prediction of temperature and weather conditions using meteorological data
- Freezing rain** — rain droplets that immediately freeze when they come into contact with any surface
- Front** — the portion of air that is between air masses of different temperatures or have different densities

GLOSSARY (2)

TEACHER REFERENCE

Frost — the result of the dew point temperature going below freezing (Areas of frost are often very large, and can cover two states.)

Gale — a very strong wind, which moves from 45–90 knots

GOES (Geostationary Operational Environmental Satellite) — a satellite that moves with the rotation of the earth, and collects weather information both day and night for the same location

Greenhouse effect — what occurs when the atmosphere traps heat

Hailstones — clusters of raindrops that become balls of ice when they are frozen repeatedly in a thunderstorm

Hemisphere (northern and southern) — the lower and upper halves of the Earth

Humidity — the amount of moisture contained in the air

Hurricane — a tropical cyclone that usually involves heavy rains (A hurricane originates in the equatorial regions of the Atlantic Ocean or Caribbean Sea or eastern regions of the Pacific Ocean and travels north, northwest, or northeast from its point of origin.)

Hurricane warning — this means that a hurricane is likely to strike within the next 24 hours

Hurricane watch — this means that a hurricane might strike in the next 36 hours

Hygrometer — an instrument that is used to measure the amount of moisture in the air

Jet stream — a tube of wind that moves at 100 MPH or more at heights of 6–8 miles above the ground (The jet stream usually moves from east to west.)

La Niña — a periodic cooling of the temperatures of an area; it often occurs along with droughts

Latitude — lines that run horizontally and are used to measure the distance north or south from the equator

Lightning — what occurs when clouds are charged with electricity (When the charge is great enough the electricity leaps from one cloud to another and we see lightning.)

Longitude — lines that run vertically and are used to measure the distance east or west of the prime meridian

Meteorologist — a person who predicts and reports weather

Nephoscope — an instrument that is used to observe the speed and direction of clouds to determine the direction of winds above the Earth's surface

Nimbostratus — a rain cloud that is thick and dark

Polar climate — places on earth that are typically cold year round

Precipitation — water falling to Earth

Prevailing winds — winds which cause most of the circulation in the atmosphere

Rain — droplets of water that are bigger than .02 of an inch

Rainbow — caused when sunlight shines through droplets of water in the atmosphere (The droplets of water act as a prism, splitting the sunlight into its colors.)

GLOSSARY (3)

TEACHER REFERENCE

Rain gauge — an instrument that measures the amount of precipitation

Relative humidity — the amount of water in the air compared to the amount of moisture that the specific temperature can hold

Sleet — drops of rain that have frozen in the air

Snow — crystals of ice

Stationary front — a zone between two air masses that are nearly stationary and have different densities

Stratocumulus — a cloud that is rounded and gray

Stratus — a fast moving layered, gray cloud that usually means steady, slow rain or snow

Seasons — the four natural divisions of the year that are based upon weather changes

Temperate climate — areas on the Earth that have dry, warm summers and wet, cold winters

Temperature — the heat or coldness of a body or environment, measured in degrees

Tornadoes — a swirling vortex of spinning air; usually a product of thunderstorms (Tornadoes are the most violent storms on Earth.)

Thermometer — an instrument that is used to measure the temperature in degrees

Thunderstorm — the most common type of storm; occurs most often in spring and summer when the air near the ground is at its warmest

Tropical climate — areas on the Earth that are hot and rainy all year

Troposphere — the layer of the atmosphere where life is and weather occurs

Transpiration — the process of plants releasing water vapor from their leaves into the atmosphere

Typhoon — the name used in Asia for a hurricane

Warm front — the front of a warm atmospheric air mass that is moving against and will eventually replace a cold air mass

Weather — conditions of the atmosphere in a specific time and place, usually involving measurements in moisture, temperature, barometric pressure, and wind velocity

Weather satellites — space satellites that take pictures of clouds and collect other weather information

Wind (moving air) — occurs because the earth is unevenly heated and the air then travels from high pressure areas to low pressure areas

Windchill factor — effect of wind speed and temperature on exposed human skin

Wind gauge — a device that is used to measure the speed of wind

Wind vane — an instrument that is used to measure the direction that the wind is blowing

TODAY'S WEATHER GUIDELINE

TEACHER REFERENCE

What do the clouds look like today? Draw and/or write a detailed description of the clouds.

What I Remember	Correct Answer

What is the temperature today?

What I Remember	Correct Answer

Describe the wind conditions outside.

What I Remember	Correct Answer

Is it humid (moist) or dry outside today?

What I Remember	Correct Answer

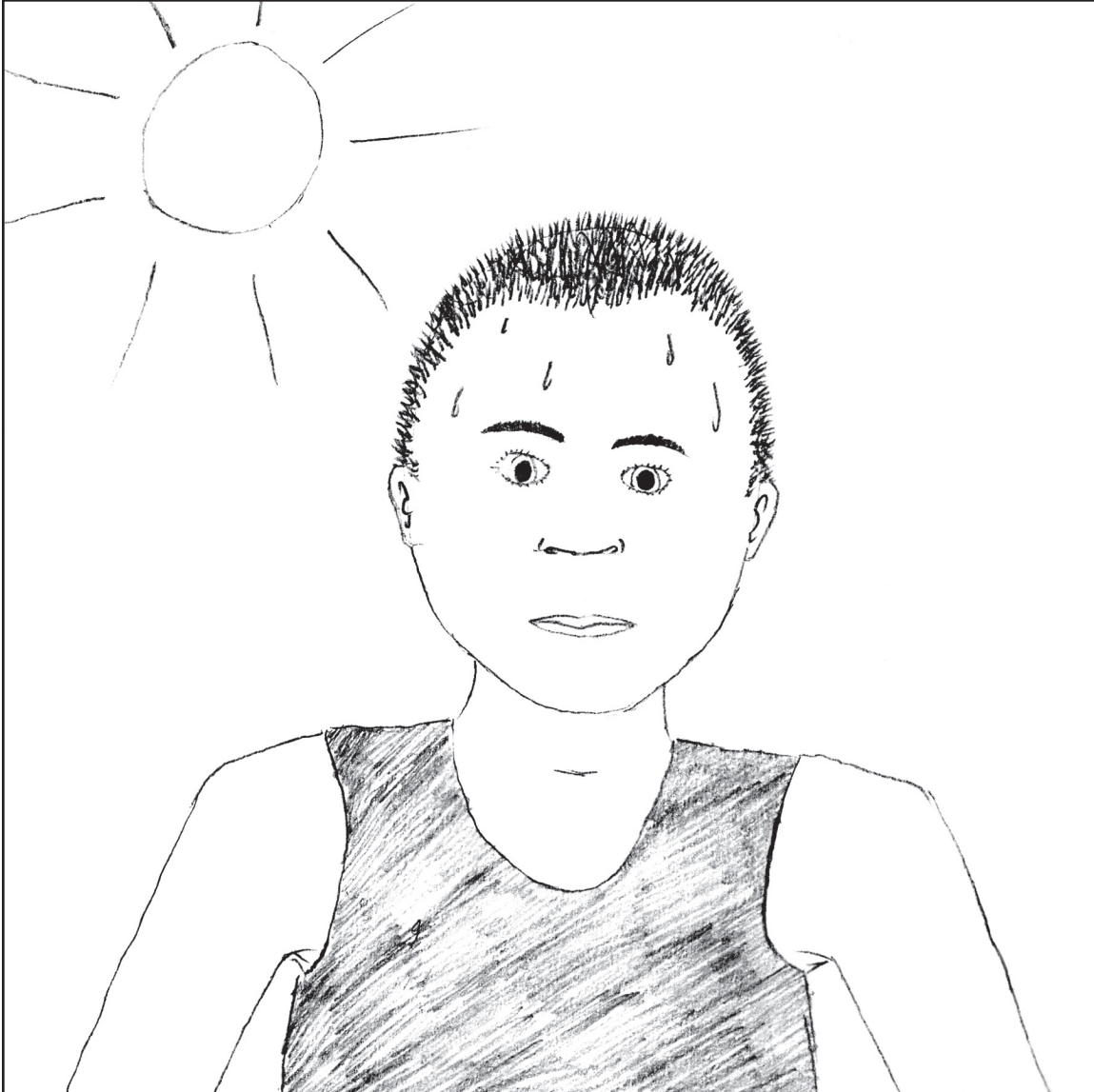
SUSPECT PROFILE: BOB BLIZZARD

TEACHER REFERENCE



- Bob Blizzard loves cold, snowy areas of the world.
- His favorite place: Antarctica
- Favorite foods: ice, ice cream, popsicles, frozen yogurt, snow cones, and slushies
- Bob Blizzard feels that snowy weather has a bad reputation that is not deserved. He also thinks the work at McGee's Weather Company will add to this bad reputation. He has made threatening remarks about the company. Bob has filed a lawsuit to stop the company from giving away materials.
- Known friends: Yuri Flake, Ivana Avalanche

SUSPECT PROFILE: JUAN SUM LIGHT TEACHER REFERENCE



- Juan is only seen during the day.
- He stays in dry, sunny places.
- Juan likes to visit Death Valley, CA in the summer.
- Favorite foods: sun tea, sun-dried tomatoes, sunflower seeds, and sun chips
- Juan applied to work at McGee's Weather Company. He was not hired because in his interview, Juan only discussed sunny weather conditions.
- He was often seen outside McGee's Weather Company during work hours.
- Juan wanted to see the booklets being made at McGee's Weather Company. He said he really wanted to see the booklets on heat, droughts, and sunny weather.

SUSPECT PROFILE: JOE BREEZY TEACHER REFERENCE



- Joe Breezy collects hair dryers and fans.
- Favorite foods: MickFlurries
- Favorite movies: *The Wizard of Oz*, *Mary Poppins*
- Joe has been working on making a huge wind tunnel. He hopes that the tunnel will be able to change wind conditions in an area.
- He does not like that McGee's Weather Company has information about all types of weather.
- Joe felt that telling people about weather safety in windy conditions would lead people to fear the wind. Joe did not want this to happen.

SUSPECT PROFILE: IMA VAPOR TEACHER REFERENCE



- Ima’s friends say that even though Ima seems to be “walking around in a fog,” she is really very smart.
- She hates sunny weather and avoids it.
- Favorite food: pea soup
- Ima told a friend that she was very close to releasing a new invention. The “cloud maker” would be able to make clouds in any area.
- Ima is against the work of McGee’s Weather Company. She feels that it puts a bad light on driving or walking in foggy weather. Ima was heard to say that she had a plan to put this company out of business.
- Her job is making a better type of high beam headlights for cars.

SUSPECT PROFILE: DEBBIE DRIZZLE

TEACHER REFERENCE



- Debbie Drizzle's family became rich when they opened an umbrella factory. Lately, the family business has been losing money. Friends say that Debbie blames the loss on too much sunny weather around the world.
- Her favorite place on Earth is Mount Wai-'ale-'ale in Kauai, Hawaii. She loves this place because it has the greatest number of rainy days each year (350 days per year).
- Favorite food: chocolate sauce that can be dripped over ice cream
- Whenever Debbie Drizzle plans to stay in a place for any length of time, she does the same thing. She hires a plane to fly in the air and add "seeds to the clouds" to make it rain in that area. It seems that Debbie has been able to make rain in certain areas. When this happens, other areas nearby seem to get less rain than normal. Weather detectives have been watching Debbie Drizzle for a long time. She seems to have an impact on the weather around her.
- Debbie tried to steal McGee's Weather Company's information on weather safety when it rains. She was caught and put on probation because she had never before been accused of a crime.

WEATHER QUESTIONS

TEACHER REFERENCE

WEATHER QUESTION #1

Why are there different climates?

WEATHER QUESTION #2

How does temperature affect air?

WEATHER QUESTION #3

How do the different types of clouds help us understand the weather?

WEATHER QUESTION #4

How does the water cycle impact the weather?

WEATHER QUESTION #5

What do we know about droughts and extreme heat?

How do we stay safe in extreme heat?

WEATHER QUESTION #6

What do we know about tornadoes?

How do we stay safe in tornadoes?

WEATHER QUESTION #7

What do we know about hurricanes?

How do we stay safe in hurricanes?

WEATHER QUESTION #8

What do we know about floods?

What do we know about lightning?

How do we stay safe in floods?

How do we stay safe in lightning?

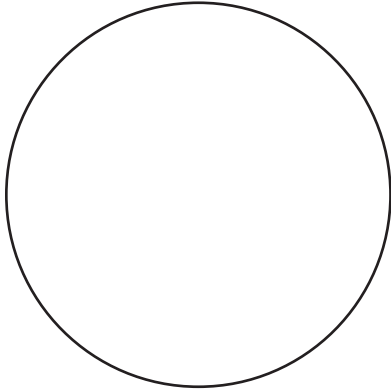
WEATHER QUESTION #9

What do we know about blizzards?

How do we stay safe in blizzards?

WEATHER MAP SYMBOLS (1)

TEACHER REFERENCE

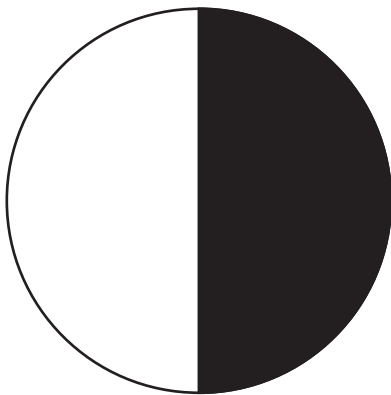


Clear Skies

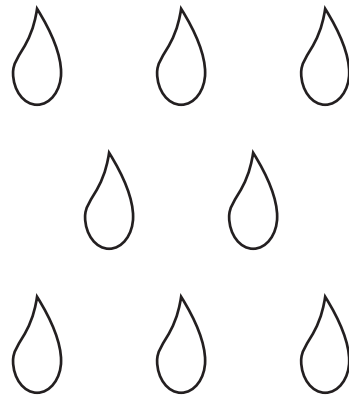


(pointing in the direction
the wind is blowing)

Wind Direction



Cloudy



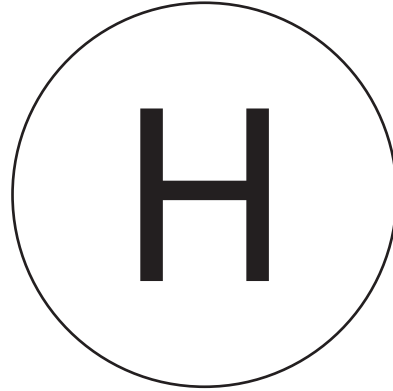
Rain

WEATHER MAP SYMBOLS (2)
TEACHER REFERENCE

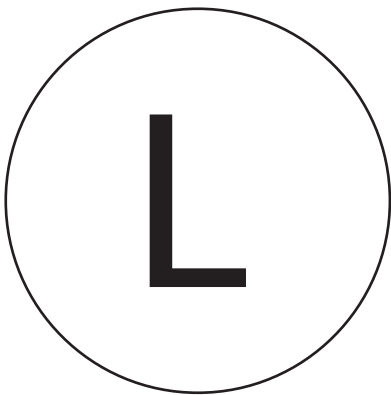
77/59

(high temperature first,
low temperature second)

Daily Temperature



High Pressure Area



Low Pressure Area

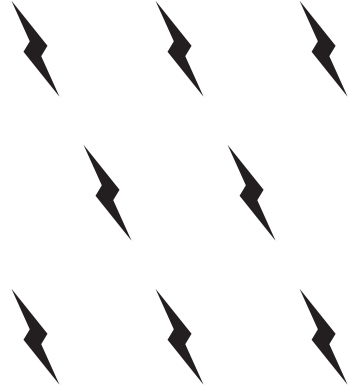


Cold Front

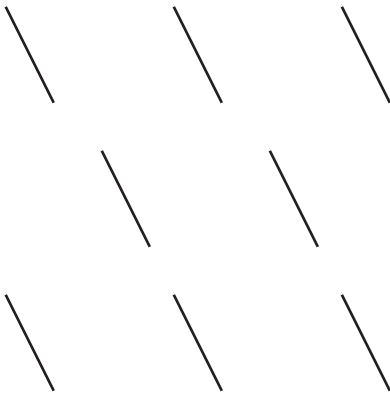
WEATHER MAP SYMBOLS (3)
TEACHER REFERENCE



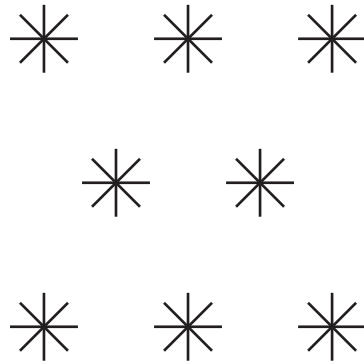
Warm Front



Thunderstorms

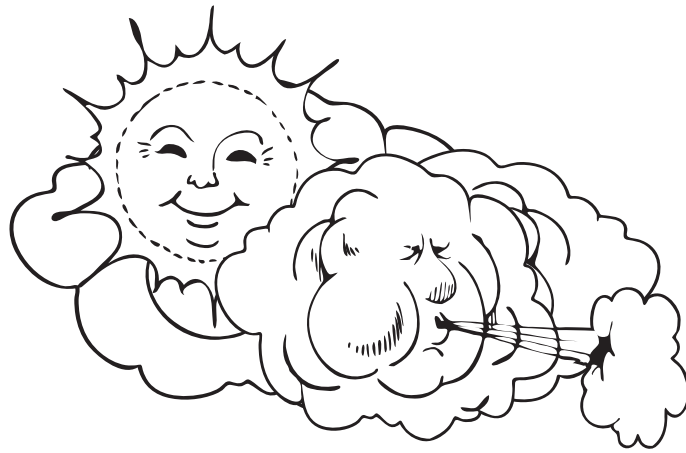


Showers



Snow

MY SCIENCE JOURNAL



Name: _____

WHAT I KNOW, QUESTIONS I HAVE, WHAT I LEARNED

What I Know	Questions I Have	What I Learned

TOMORROW'S WEATHER PREDICTION CHART

Sunny	Cloudy	Windy	Rain	Snow

WEATHER DETECTIVES ROLES AND RUBRIC

Weather Detective Team Roles

While working on WEATHER DETECTIVES, you will each have a role. Each role has a different job to help the team finish all the activities.

Senior Scientist

(Team Leader)

- Help your team work cooperatively.
- Lead team discussions.
- Help members when they are having trouble.
- Manage the Team Folder.

Experiment Expert

(Oversee all experiments and labs)

- Lead team through the steps of the **Scientific Method**.
- Read and follow the **Procedure** found on all experiment and lab handouts.
- Following the experiment or lab, discuss results and possible conclusions with your team.

Profile Detective

(Oversee profiling of the suspects)

- Take notes on **Suspect Profiles**.
- Collect and read all Suspect Clues.
- Lead team in solving Suspect Clues.
- Monitor suspects using **Suspect List**.

Weather Reporter

- Read the temperature on the thermometer daily.
- Make daily weather observations.
- Watch or read the local weather report.

Materials Manager

- Pick up everything you and your team use.
- Put away everything you and your team use and leave a clean working area.

Weather Detectives Team Rubric

Level 4 — Exemplary

You consistently and actively help your team achieve its goals by encouraging the team to work together, and by willingly accepting and completing the necessary daily work.

Level 3 — Expected

You usually help your team achieve its goals by communicating with other team members, by encouraging the team to work together, and willingly accepting and completing daily work.

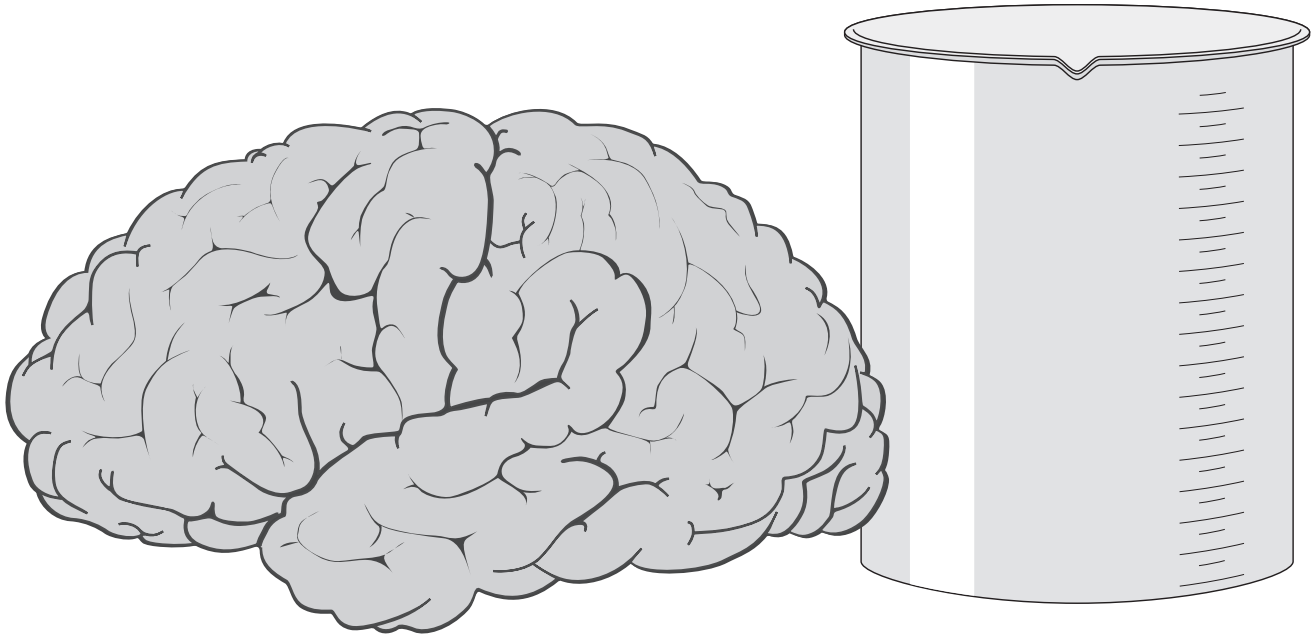
Level 2 — Nearly There

You sometimes help your team achieve its goals.

Level 1 — Incomplete

You do very little to help your team achieve its goals.

SCIENTIFIC METHOD



1. **Problem/Question:** What do you wish to find out?
2. **Hypothesis:** What do you think the answer is?
3. **Experiment:** Design a procedure (experiment) to test your hypothesis.
4. **Data:** Conduct the experiment and keep accurate records of your results. Repeat the experiment several times. Record the information you collect (data) in a Science Journal. (You may also put information on a graph.)
5. **Conclusion:** Summarize what you have discovered (what you conclude) as a result of doing this experiment.

SCIENTIFIC JOURNAL RUBRIC

Level 4 — *Exemplary*

- Your entries include all the relevant Scientific Method components:
 - Date
 - Problem/Question
 - Hypothesis
 - Data
 - Conclusion
- Your reflections, hypotheses, and definitions are exceptionally thoughtful and concise.
- You consistently use correct grammar, punctuation, and spelling.

Level 3 — *Expected*

- Your entries include all of the relevant Scientific Method components:
 - Date
 - Problem/Question
 - Hypothesis
 - Data
 - Conclusion
- Your reflections, hypotheses, and definitions are thoughtful and concise.
- You use correct grammar, punctuation, and spelling.

Level 2 — *Nearly There*

- Your entries include most of the relevant Scientific Method components:
 - Date
 - Problem/Question
 - Hypothesis
 - Data
 - Conclusion
- Your reflections, hypotheses, and definitions are not clear and/or lack evidence of thoughtful reflection.
- You do not always use correct grammar, punctuation, and spelling.

Level 1 — *Incomplete*

- Your entries miss most of the relevant Scientific Method components:
 - Date
 - Problem/Question
 - Hypothesis
 - Data
 - Conclusion
- Your reflections, hypotheses, and definitions are disorganized and/or off topic.
- You seldom use correct grammar, punctuation, and spelling.

HEAT ‘EM UP EXPERIMENT

A thermometer is an important instrument used to measure the weather. A thermometer measures the temperature. Temperature is an important part of the weather.

Materials

- **Temperature of Grass, Sand, Soil, and Water** — *one*
- Colored pencils (four different colors) — *one of each*
- Graph paper — *one*
- Grass — *one-half cup*
- Heat lamp (if it is not sunny) — *one*
- Insulated plastic cups (6-oz. size) — *four*
- One-cup measuring cup — *one*
- Paper towels — *two*
- Sand — *one-half cup*
- Soil — *one-half cup*
- Thermometer — *one*
- Water — *one-half cup*

Preparation

Use the measuring cup to prepare four insulated plastic cups of different materials.

1. Measure grass and place in one plastic cup. Wash the measuring cup and dry it with a paper towel.
2. Measure sand and place in the second plastic cup. Wash and dry the measuring cup.
3. Measure soil and place in the third plastic cup. Wash and dry the measuring cup.
4. Measure room temperature water and place in the fourth plastic cup.

Procedure

1. Carefully insert a thermometer into one of the cups and note the temperature of the substance on the **Temperature of Grass, Sand, Soil, and Water** chart.
2. Wipe off the thermometer with the paper towel and take the temperature of the second substance.
3. Continue this process for all four substances.
4. Put your cups in direct sunlight (or under a heat lamp if it is not sunny).
5. You will be measuring the temperatures of all four substances every 10 minutes to note the differences in temperature change for each substance. Each time you observe a substance's temperature record the date on your **Temperature of Grass, Sand, Soil, and Water** chart.
6. Following the **Scientific Method**, think of a question you would like answered by doing this experiment. It might be: Which substance's temperature will change the most? Which substance's temperature will change the least? Write the word **Question** and then write your question in your Science Journal.
7. Predict what you think will happen in this experiment. Write the word **Hypothesis** and then write your prediction in your Science Journal.
8. After 60 minutes, note the differences in temperature change for each of the substances. Write the word **Data** and note your observations in your Science Journal.
9. Using the graph paper and a different colored pencil for each substance, create a graph comparing how the temperatures changed during the course of the hour.
10. Write **Conclusion** in your Science Journal and record the conclusions you have.






TEMPERATURE OF GRASS, SAND, SOIL AND WATER

	Grass	Sand	Soil	Water
Start				
10 Minutes				
20 minutes				
30 minutes				
40 minutes				
50 minutes				
60 minutes				

SUSPECT LIST

Instructions for the Profile Detective

1. As your teacher reads each suspect profile, take notes on the information you think may help you in solving the mystery (who stole the weather information from McGee's).
2. As your teacher gives you **Suspect Clues** work together with your team to solve the clue and then check off the box next to the suspect you can eliminate.
3. Once you have solved all the clues, circle the suspect you believe is guilty.

Suspect Image	Suspect Name	Suspect Profile Notes	Suspect Eliminated
	Bob Blizzard		<input type="checkbox"/>
	Juan Sum Light		<input type="checkbox"/>
	Joe Breezy		<input type="checkbox"/>
	Ima Vapor		<input type="checkbox"/>
	Debbie Drizzle		<input type="checkbox"/>

WEATHER HOMEWORK #1

Name: _____

1. What was the highest temperature ever recorded? Where on earth did this happen?

2. What was the highest temperature ever recorded in North America? Where in North America did this happen?

3. What is the driest place in the world? Add any details you find.

4. What is the driest place in North America? Add any details you find.

Extra Credit

Watch a weather forecast on the news tonight. Write down the information you learn.

MOVING AIR EXPERIMENT 1

Materials

- Balloon — *one*
- Bowl (1-quart size) — *one*
- Hot tap water — *one cup*
- Plastic bottle (2-liter size, clear) — *one (at room temperature)*
- Thermometer — *one*

Procedure

1. Take out your Science Journal. Write today's date and "*Moving Air—Experiment 1*" in your journal. During today's experiment you will attach a balloon to a bottle and place the bottle in hot water.
 - a. Following the Scientific Method, think of a question you would like answered by doing this experiment. Write the word **Question** and then write your question in your Science Journal.
 - b. Predict what you think will happen in this experiment. Write the word **Hypothesis** and then write your prediction in your Science Journal.
2. The Materials Manager gathers the appropriate materials and the Experiment Expert leads the experiment.
3. Attach the balloon to the empty 2-liter bottle that has been stored at room temperature.
4. Your teacher will assist your team when adding the hot water to your bowl. Although this water is not extremely hot, be careful with the hot water.
5. Take the temperature of the hot water and note that information in your Science Journal.
6. Carefully place your 2-liter bottle in the bowl filled with hot water.
7. Note what happens during this experiment. Write the word **Data** and record your observations in your Science Journal.
8. Write **Conclusion** in your Science Journal and record the conclusions you have about this experiment.
9. Give your balloon and bottle to your teacher.
10. You will use the bowl of hot water for the second experiment today.

MOVING AIR EXPERIMENT 2

Materials

- Bowl of warm water (1-quart size) — *one*
- Plastic bottle (2-liter size, clear) — *one (placed in freezer for at least one hour)*
- Quarter coin — *one*
- Thermometer — *one*


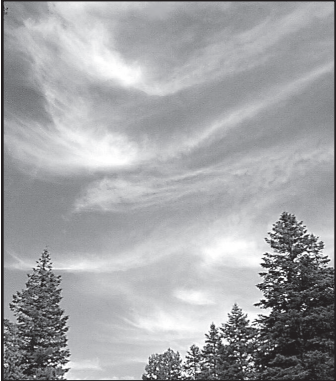
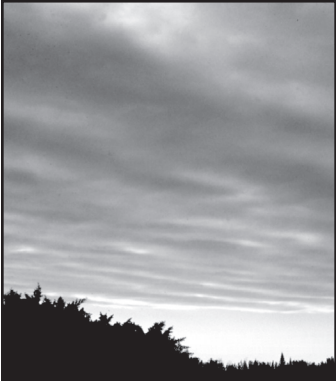
Preparation

- Place the empty plastic bottle in a freezer for at least one hour.

Procedure

1. Write today's date and "Moving Air—Experiment 2" in your journal. During this experiment you will place a quarter over the opening of an icy bottle and place the bottle in warm water.
 - a. Following the Scientific Method, think of a question you would like answered by doing this experiment. Write the word **Question** and then write your question in your Science Journal.
 - b. Predict what you think will happen in this experiment. Write the word **Hypothesis** and then write your prediction in your Science Journal.
2. Record the temperature of the warm water that is in the bowl from the last experiment and write it in your Science Journal.
3. Place the quarter over the opening of the icy bottle.
4. Stand the icy bottle in the warm water and watch what happens.
5. Note what happens during this experiment. Write the word **Data** and record your observations in your Science Journal.
6. Write **Conclusion** in your Science Journal and record the conclusions you have about this experiment. Explain how you knew when the warm air began to rise in the bottle.

TYPES OF CLOUDS

Types of Clouds	What the Weather is Like When I See this Type of Cloud
 <p data-bbox="253 793 412 831">CUMULUS</p>	
 <p data-bbox="272 1329 393 1367">CIRRUS</p>	
 <p data-bbox="261 1860 404 1898">STRATUS</p>	

CLOUD INVESTIGATION

Materials

- Cotton balls — *one per team member*
- Pie pan (8" diameter) — *one*
- Tap water — *one-half cup*

Procedure

1. Take out your Science Journal. Write today's date and "*Cloud Investigation*" in your journal. In today's investigation, the cotton ball is going to simulate the processes of evaporation and precipitation.
2. Think about what you learned today about the three main types of clouds: cumulus, stratus, and cirrus and what you know about weather. Write the following **Questions** in your Science Journal:
 - a. How do clouds fill with water?
 - b. When does it rain?
3. Write your **Hypotheses** for each question in your Science Journal.
4. The Materials Manager gathers the appropriate materials and the Experiment Expert leads the investigation
5. Look at the cotton ball and feel its weight.
6. Fill your pie pan one-half full with tap water.
7. Put a small part of the cotton ball into the water. Observe what happens to the water. Write the word **Data** and record your observations in your Science Journal.
8. Slowly lift your cotton ball directly above the pie pan. Observe what happens to the water. Write about these differences in your Science Journal under **Data**.
9. Write **Conclusion** in your Science Journal and record the conclusions you have about this investigation. How do you think that this investigation is similar to and different from what really happens with clouds?

WATER CYCLE EXPERIMENT

Materials

- Permanent marker — *one*
- Plastic cup (6-oz. size, clear) — *two*
- Plastic wrap or small plastic bag (clear) — *one*
- Rubber band (2" diameter) — *one*
- Thermometer — *one*
- Warm tap water — *one cup*

Procedure

1. Take out your Science Journal. Write today's date and "Water Cycle Experiment" in your journal.
2. The Materials Manager gathers the appropriate materials and the Experiment Expert leads the experiment.
3. Using the permanent marker, have each member of your team write his/her name in a straight line on the side of both of the plastic cups.
4. Fill each plastic cup about one-half full with warm tap water.
5. Take the temperature of the tap water and note it in your Science Journal.
6. Cover the top of one of the cups with plastic wrap or a baggie. Keep the plastic wrap or baggie secure by placing a rubber band around the mouth of the cup and around the plastic wrap. The second cup should not be covered with plastic wrap or baggie.
7. Place the cups directly in the sunlight or under a heat lamp.
8. Following the **Scientific Method**, think of a question you would like answered by doing this experiment. It might be: Which cup of water will evaporate more quickly? Or Which cup of water is most like the earth's water cycle? Write the word **Question** and then write your question in your Science Journal.
9. Predict what you think will happen in this experiment. Write the word **Hypothesis** and then write your prediction in your Science Journal.
10. After an hour, observe what is happening in your plastic cups. Write the word **Data** and record your observations in your Science Journal.
11. Speculate about what you think will happen to the water over the next two days and write about it in your Science Journal.
12. When this experiment is complete write **Conclusion** in your Science Journal and record the conclusions you have.

WEATHER HOMEWORK #4

Name: _____

1. What is at the center of every raindrop?

2. Where does new water on Earth come from?

3. You have probably heard the expression, "It's raining cats and dogs." Has it ever rained animals?

Extra Credit

Watch a weather forecast on the news tonight. Write down the information you learn.

SAFETY HINTS: EXTREME HEAT

Inside

- Replace air filters often, so the air conditioner does not have to work so hard.
- Drink plenty of fluids.
- Place shades over the windows in the house that receive the afternoon sun.
- Don't participate in extreme temperature changes.
- Try to limit your physical activity if you are extremely hot.
- Try to conserve electricity. Power outages occur when too many people are using air conditioning continuously.

Outside

- Avoid going outside unless it is necessary. If you must go outside, apply sunscreen with a high SPF rating, since your body will have more trouble cooling itself if you get a sunburn.
- Dress in clothing that is light, loose fitting, and covers as much skin as possible.
- If possible, slowly acclimate your body to hot temperatures during the first few days of very hot weather.
- Wear a wide-brimmed hat to protect your face and neck.
- Avoid strenuous activities.

SAFETY HINTS: EXTREME HEAT

Inside

- Replace air filters often, so the air conditioner does not have to work so hard.
- Drink plenty of fluids.
- Place shades over the windows in the house that receive the afternoon sun.
- Don't participate in extreme temperature changes.
- Try to limit your physical activity if you are extremely hot.
- Try to conserve electricity. Power outages occur when too many people are using air conditioning continuously.

Outside

- Avoid going outside unless it is necessary. If you must go outside, apply sunscreen with a high SPF rating, since your body will have more trouble cooling itself if you get a sunburn.
- Dress in clothing that is light, loose fitting, and covers as much skin as possible.
- If possible, slowly acclimate your body to hot temperatures during the first few days of very hot weather.
- Wear a wide-brimmed hat to protect your face and neck.
- Avoid strenuous activities.

CLASSROOM WEATHER STATION: MAKE YOUR OWN THERMOMETER (1)

Materials

- Modeling clay — *enough to make a 1-inch ball*
- Permanent marker — *one*
- Plastic straw (clear) — *one*
- Plastic water bottle (16-oz. size, clear) — *one*
- Red food coloring — *five drops*
- Sauce pan (1-qt. size or 9" pie or square pan) — *one*
- Spoon — *one*
- Store-bought thermometer — *one*
- Water (cold) — *one cup*
- Water (hot) — *one cup*
- Water (room temperature) — *one-half cup*

Procedure

1. Take out your Science Journal. Write today's date and "Thermometer" in your journal.
2. The Materials Manager gathers the materials and the Experiment Expert leads the activity.
3. Put the store-bought thermometer in the room temperature water and note the temperature. Write "room temperature" and the temperature in your Science Journal. Take the thermometer out and place it to the side.
4. Add five drops of food coloring to the room temperature water. Stir the water. Pour the colored water into the clear water bottle.
5. Place the clay about two inches from the top of the straw. *See the illustration.*
6. Put the straw in the bottle and shape the clay so that the straw is sealed in place at the top of the bottle. The straw should not touch the bottom of the bottle. *See the illustration.*
7. Allow the bottle of water to sit without being disturbed until the level of water in the straw stops changing.
8. Using the permanent marker, mark the water bottle at the same level of the water in the straw. Write the temperature (from your notes in your Science Journal) next to this mark.



CLASSROOM WEATHER STATION: MAKE YOUR OWN THERMOMETER (2)

- Place one cup of cold water in the pan. Put your homemade thermometer bottle in the pan. Allow the bottle of water to sit until the level of water in the straw stops changing.
- Put the store-bought thermometer in the pan of water and note the temperature. Write “cold water” and the temperature in your Science Journal. Take the thermometer out and place it to the side.
- Using the permanent marker, mark the water bottle at the same level of the water in the straw now that it is sitting in cold water. Write the temperature (from your notes in your Science Journal—cold water) next to this mark.
- Pour the cold water in the sink and allow the pan to return to room temperature. Fill the pan with hot water and place your thermometer bottle in the pan. Allow the bottle of water to sit until the level of water in the straw stops changing.
- Put the store-bought thermometer in the pan of water and note the temperature. Write “hot water” and the temperature in your Science Journal. Take the thermometer out and place it to the side.
- Using the permanent marker, mark the water bottle at the same level of the water level in the straw now that it is sitting in hot water. Write the temperature (from your notes in your Science Journal—hot water) next to this third mark.

NOTE: You have just made a thermometer that shows when the temperature is warmer, room temperature, or cooler. From doing this, you can better understand how a real thermometer works.

Discussion

Respond to the following questions in your Science Journal.

- What did you see when your homemade thermometer was in cool water?
- What did you see when your homemade thermometer was in hot water?
- What happens to the liquid in a real thermometer when it takes the temperature?

SUSPECT CLUE #1

Directions

Using the clues and elimination chart below, determine which suspect can be eliminated.

Clues

The police questioned the security guards. They have determined the following facts:

- The documents were stolen between 11:00 p.m. Thursday evening and 6:00 a.m. Friday morning.
- The guards saw all of the suspects at some time during their 12 a.m. to 8 a.m. shift.
- The sun came up at 7:02 a.m.
- Joe Breezy was seen near McGee's Weather Company before 4:00 a.m.
- Debbie Drizzle was seen near McGee's Weather Company after midnight, but before 6:00 a.m.
- Bob Blizzard was seen near McGee's Weather Company before 8:00 a.m.
- Ima Vapor was seen near McGee's Weather Company at 2:00 a.m.
- Juan Sum Light was seen at McGee's Weather Company after sunrise on Friday. He only goes outside after sunrise.

Elimination Chart

Your goal is to eliminate possibilities with each clue you read. As you read each clue, mark an "X" in the boxes for times that the suspect was **not** seen near McGee's. If the clue tells when the suspect was seen at McGee's, mark an "O" in that box. Each suspect only gets one "O" (yes). Only one suspect was seen at each time listed. Once you mark an "O" for a specific time, mark an "X" for all other suspects for that time. Using the process of elimination, determine when each suspect was seen at McGee's.

Suspects	Time				
	Midnight	2:00 a.m	4:00 a.m.	6:00 a.m	8:00 a.m.
Bob Blizzard					
Juan Sum Light					
Joe Breezy					
Ima Vapor					
Debbie Drizzle					

SAFETY HINTS: TORNADOES

Assemble an Emergency Supply Kit

- First aid kit
- Drinking water (at least one gallon per person)
- Essential medications
- Canned food that can be eaten without being cooked
- Hand-operated can opener
- Battery-powered flashlight
- Battery-powered radio
- Extra batteries
- Special items needed for infants, elderly, or disabled family members
- Blankets or sleeping bags
- Written instructions on how to turn off electricity, gas, and water if authorities advise you to do so. (Remember that you will need a professional to turn them back on.)

If you are in your house when a tornado strikes

- If you are in your house and your house has a basement, it is best to go to the basement and stay along the north or east walls.
- If you do not have a basement, hide under a heavy table or under the stairs. These areas may protect you from falling wreckage.
- If possible, go to a small room in the middle of the first floor of the house that doesn't have any windows—a room like a closet or small bathroom. The toilet and bathtub are the safest areas in the bathroom. Get into the bathtub and cover yourself with something (like a couch cushion or a mattress) to protect you from falling debris.
- If you do not have a bathroom or closet in the middle of the first floor of the house, get in a hallway in the middle of the first floor and find a cover to protect yourself from falling wreckage.

If you are in a car when a tornado strikes

- Do not try to drive away from the tornado, because you do not know the direction of the storm!
- Leave your car and find shelter in a building using the same safety tips listed for if you are in your house.

If you are in a high rise building when a tornado strikes

- Stay away from glass windows and walls.
- The safest areas are interior rooms or hallways.
- Do not go into the elevator in case the building loses electricity.

CLASSROOM WEATHER STATION: MAKE YOUR OWN TORNADO

Materials

- Duct tape (5" length) — *one*
- Plastic bottles (2-liter size, clear) — *two*
- Red food coloring — *10 drops*
- Water — *1.5 liter*



Procedure

1. Take out your Science Journal. Write today's date and "*Tornado*" in your journal.
2. The Materials Manager gathers the materials and the Experiment Expert leads the activity.
3. Fill one of the 2-liter bottles three-quarters full with water.
4. Add 10 drops of food coloring to the water. Do not cap off.
5. Place the empty 2-liter bottle on top of the 2-liter bottle with the water.
6. Tape the bottles securely together with duct tape. You want to be sure that no water can leak from the bottles after they are taped together.
7. Turn the bottles upside down and swirl *in one direction four times*.
8. Watch your "tornado" funnel into the other bottle.

Discussion

Respond to the following questions in your Science Journal.

1. In what direction does the water flow?
2. What happens to something caught in a tornado?
3. What would happen if something were caught in the water?
4. In what direction does the air move inside the water?
5. How is the "tornado" you created similar to and different from a real tornado?

SUSPECT CLUE #2

Directions

This clue was mailed to McGee's Weather Company. Unfortunately, it was written in code! If you can break the code, you'll be able to determine which suspect can be eliminated: Bob Blizzard, Juan Sum Light, Joe Breezy, Ima Vapor, or Debbie Drizzle.

M L R K O K E R V M W C O V Z A

— — — — — — — — — — — — — — — — — — — — — — —

R D J B J A Z M R M C T Z W J K

— — — — — — — — — — — — — — — — — — — — — — — — —

X C X X D J Y Y Z I T .

— — — — — — — — — — — — — — — .

Clues

1. In this puzzle, the code for the letter "t" is the letter "m."
2. In this puzzle, the code for the letter "a" is the letter "z."
3. In this puzzle, the code for the letter "i" is the letter "j."
4. A two letter word is often "is" "it" or "to."
5. A common three letter word is "the" "you" and "can."
6. If you need more clues to solve the puzzle, see your teacher.

SAFETY HINTS: HURRICANES

Assemble an Emergency Supply Kit

- First aid kit
- Drinking water (at least one gallon per person)
- Essential medications
- Canned food that can be eaten without being cooked
- Hand-operated can opener
- Battery-powered flashlight
- Battery-powered radio
- Extra batteries
- Special items needed for infants, elderly, or disabled family members
- Bedding or sleeping bags
- Written instructions on how to turn off electricity, gas, and water if authorities advise you to do so. (Remember that you will need a professional to turn them back on.)

When a hurricane **WARNING** is issued

- Listen to the radio and follow the advice given by the authorities—evacuate (leave) if you are told to do so.
- When evacuating, stay away from flood waters. If you come to a road that is flooded, do not attempt to drive through it. Turn around and go another way. If you are caught on a flooded road with waters that are rising, get out of the car and climb to higher ground.
- If you are not advised to leave, stay inside, in the center of your home, away from windows.
- If a hurricane actually occurs, understand that the calm “eye of the storm” is deceptive; the storm is not over. After the eye of the storm passes, winds blow from the opposite direction. This can actually be the worst part of the storm because anything damaged by the first winds of the hurricane can be totally destroyed by the second winds.
- Be prepared for a tornado. Tornadoes can happen during or after a hurricane. Remain indoors, in the center of your home, in a closet or bathroom without windows.

After a hurricane is over

- Keep listening to the radio or television for instructions.
- If you evacuated, return home when local officials tell you it is safe to do so.
- Inspect your home for damage.
- Use flashlights in the dark; do not use candles.

CLASSROOM WEATHER STATION: MAKE YOUR OWN WEATHER VANE

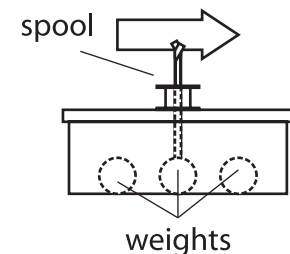
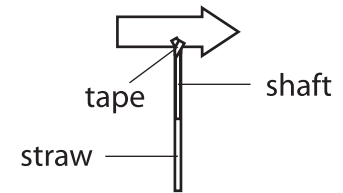
Materials

- Compass — *one*
- Glue — *one container*
- Masking tape — *one roll*
- Plastic straw (clear) — *one*
- Poster board or cardboard (8" x 8") — *one*
- Ruler — *one*
- Scissors — *one pair*
- Shoe box — *one*
- Thread spool (empty) — *one*
- Weights (such as rocks) — *several (to weigh down the shoe-box)*



Procedure

1. Take out your Science Journal. Write today's date and "Weather Vane" in your journal.
2. The Materials Manager gathers the materials and the Experiment Expert leads the activity.
3. Using scissors and the poster board or cardboard, cut a large arrow that has a long, slender shaft coming out of the bottom. *See the illustration.*
 - Your arrow should be at least 5 inches long.
 - The shaft should be at least 3 inches long.
4. Put the shaft into the straw and tape the two together.
5. Make a hole in the top of the shoebox that is large enough for a straw to fit through it.
6. Position the thread spool over the hole, so that the hole in the spool aligns with the hole in the shoebox. Once the holes are lined up, glue the spool to the top of the box. *See the illustration.*
7. Place weights in the shoebox and tape it closed. The weights will prevent the box from being blown away on a windy day.
8. Put the straw through the holes in the spool and shoebox so that the straw and arrow spin easily.
9. Place your weather vane outside. If the wind is blowing, note the direction that the weather vane arrow is pointing. Use the compass to find north, then look at your weather vane arrow. Based on the compass reading, note the direction of the wind.



Discussion

Respond to the following questions in your Science Journal.

1. What does a weather vane do?
2. How does a weather vane work?
3. If the wind was blowing, what direction was it blowing?

SUSPECT CLUE #3

Directions

This word search puzzle contains all of the weather words listed below. The words may be written forwards, backwards, up-and-down, or diagonally. Find and circle all of the weather words. The letters remaining spell out the name of an innocent suspect. You will find that suspect's name in the first letters that are not used in this puzzle. Eliminate that person from your list of suspects.

N D T E B B R I W E E D R I Z
M I W H Z L E E O A N L G Q J
E R A I E W T R N U E W S H T
T C O R N R E E S J R L Y U H
U H U T W D M H F S G K M R U
H M A A S O O O E O Y O S R N
R U T I M B R D M A V Z I I D
S E M E L F G H A E T Z I C E
R D T I R F Y E M N T W A A R
A E U O D E H E Y W R E O N Q
R R S O T I N C N R Y O R E A
Q T D K L T T M E B K Q T L Z
M Z Y C O C V Y N I M B U S P
G I C D M X P F V Q F Z C M K
S C Z G C G N I N T H G I L H

Word List

ANEMOMETER	HEAT	MOVEMENT	THERMOMETER
CLOUDS	HUMIDITY	NIMBUS	THUNDER
ENERGY	HURRICANE	RAIN	TORNADO
FROST	HYGROMETER	SNOW	WATER
HAIL	LIGHTNING	STORM	WIND

WEATHER HOMEWORK #7

Name: _____

1. In other parts of the world, hurricanes are called different things. What are hurricanes called in Asia?

2. What are hurricanes called in Australia?

3. Why are hurricanes given names?

Extra Credit

Watch a weather forecast on the news tonight. Write down the information you learn.

SAFETY HINTS: FLOODS

Assemble an Emergency Supply Kit

- First aid kit
- Drinking water (at least one gallon per person)
- Essential medications
- Canned food that can be eaten without being cooked
- Hand-operated can opener
- Battery-powered flashlight
- Battery-powered radio
- Extra batteries
- Special items needed for infants, elderly, or disabled family members

Be prepared before a flood

- Know a safe route to a high area in case a flood occurs.

When a flood WARNING is issued

- Monitor the weather over the radio or television.
- If officials tell you to evacuate, follow these directions right away.
- Avoid low-lying areas that are prone to flooding.
- If you are walking and come to a stream where water is above your ankles, STOP! Turn around and go the other way.
- Do not play around high water, rivers, streams, or storm drains. Water in these bodies of water can move very quickly.

If you are in a car

- Do not try to drive over a flooded road.
- If the car stalls, leave it immediately and move to higher ground.
- Be especially careful when you are in the car at night because it is hard to recognize flood dangers when it is dark.
- Do not park your car near water, especially during very rainy weather.

After the flood

- Throw away any fresh water that has come in contact with flood waters.
- Boil any water that you want to drink.
- Check electronics before using them, making sure they are dry.

SAFETY HINTS: LIGHTNING

Although floods kill more people each year, lightning causes more fatalities than tornadoes and hurricanes combined. 90% of people struck by lightning survive, but they often suffer life-long injuries.

If you are inside your house

- Stay away from windows and doors.
- Turn off and stay away from appliances because lightning can strike outdoor electric and phone lines, possibly causing a shock if appliances inside are touched.
- Do not use the telephone.
- Do not touch anything that is metal.
- Avoid touching or standing in water.

If you are outside

- Use the 30-second rule: If you see lightning, start counting until you hear thunder. If you count up to a number less than 30, go to a safer place.
- Avoid water, including swimming pools.
- Move from higher to lower elevations.
- Do not move into open spaces.
- Avoid metal objects.
- If possible, get inside a vehicle with the windows closed or get inside a large fully enclosed building with the windows closed.
- Move away from trees or telephone poles or light posts. Lightning usually strikes the tallest objects.
- Do not move under a covered picnic area or a canopy. These are not safe areas in lightning.
- Follow the 30-minute rule: Suspend all outdoor activities for at least 30 minutes after thunder and lightning has stopped.

If lightning strikes near you

- You may get a few seconds of warning. Some people have felt their hair standing on end, felt tingling skin, or noticed that metal objects vibrate.
- Crouch down with your feet together, your head tucked, and place your hands over your ears.
- Crouch at least 20 feet away from other people.

If lightning strikes someone who is with you

- Call 911 immediately.
- A person who has been struck by lightning does not hold an electrical charge.
- Only administer first aid if you know what you are doing.

CLASSROOM WEATHER STATION: MAKE YOUR OWN ANEMOMETER (1)

Materials

- Glue — *one container*
- Masking tape — *one roll*
- Paint (tempera; a different color than the plastic cups) — *small-amount*
- Paper or plastic cups (2-oz. to 4-oz. size) — *four*
- Plastic straw (clear) — *one*
- Scissors — *one pair*
- Shoe box — *one*
- Thread spool (empty) — *one*
- Weights (such as rocks) — *several (enough to weigh down the shoe-box)*
- Wooden craft sticks — *two*

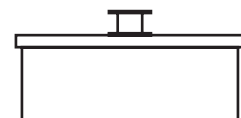
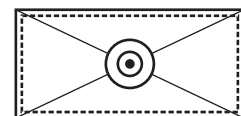
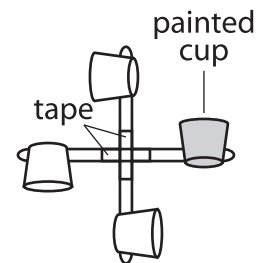
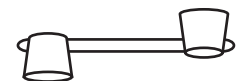


Procedure

1. Take out your Science Journal. Write today's date and "Anemometer" in your journal.
2. The Materials Manager gathers the materials and the Experiment Expert leads the activity.
3. Paint one of the cups and allow it to dry.
4. Using tape, attach one cup to the end of one of the craft sticks. The cup should face sideways to the straws' length. *See the illustration.*
5. Attach the second cup to the same stick, facing in the opposite direction. *See the illustration.*
6. Repeat steps four and five with the remaining two cups and the second wooden craft stick.

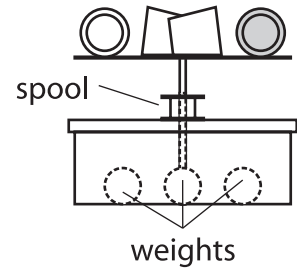
Note: the painted cup can be placed at any location.

7. Make an "X" with the two craft sticks and tape them together in the middle of the "X."
8. Make a hole in the top of the shoebox that is large enough for a straw to fit through it.
9. Position the thread spool over the hole, so that the hole in the spool aligns with the hole in the shoebox. Once the holes are lined up, glue the spool to the top of the box. *See the illustration.*



CLASSROOM WEATHER STATION: MAKE YOUR OWN ANEMOMETER (2)

10. Place weights in the shoebox and tape it closed. The weights will prevent the box from being blown away on a windy day.
11. Put the straw through the holes (in the spool of thread and shoebox). Make sure that the straw can spin easily.
12. Tape the other end of the straw to the middle of the “X” made by the craft sticks.
13. Take your homemade anemometer outside and place it on the ground. The rate of speed that the cups spin measures how fast the wind is moving. While your anemometer does not give you a precise measure of the wind, label the speed of the cups spinning as very slow, slow, medium, fast, or very fast.



Note: The reason one of the cups is painted is so that it is easier for you to count the number of times the cups rotate on your anemometer.

Discussion

Respond to the following questions in your Science Journal.

1. What does an anemometer do?
2. How does an anemometer work?
3. If the wind was blowing, how fast was it blowing (very slow, slow, medium, fast, or very fast)?

SUSPECT CLUE #4

Directions

Solve the crossword puzzle, unscramble the circled letters, and find the next suspect who can be eliminated.

Across

3. clouds that are close to the ground
4. the amount of moisture in the air
8. the process of gas changing into liquid
10. the process of water changing from liquid to gas
11. a large collection of tiny droplets of water on ice crystals
12. a snow storm with high winds
13. the prediction of weather using data

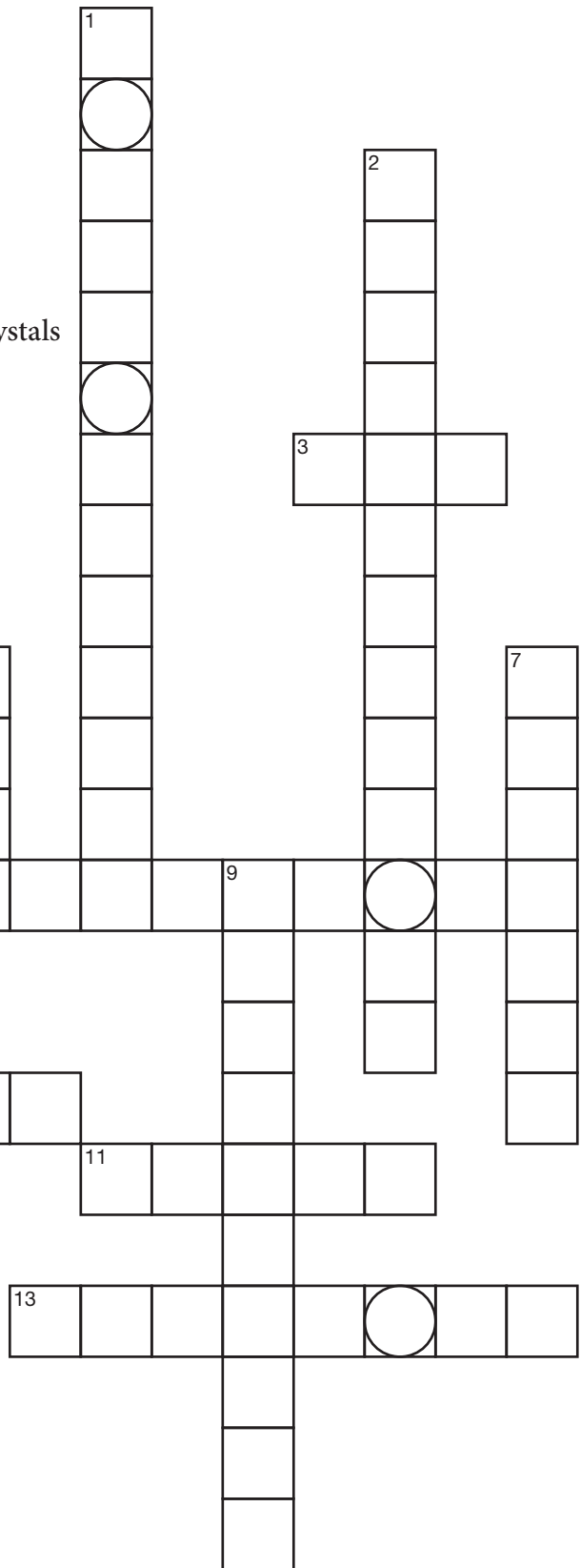


Down

1. water that falls back to Earth
2. a person who predicts and reports weather forecasts
5. an instrument that is used to measure the temperature
6. moving air
7. when winds whirl into a funnel that works its way to the ground



9. instrument used to measure the force of the wind



Solution:

SAFETY HINTS: BLIZZARDS

Assemble an Emergency Supply Kit

- First-aid kit
- Drinking water (at least one gallon per person)
- Essential medications
- Canned food that can be eaten without being cooked
- Hand-operated can opener
- Battery-powered flashlight
- Battery-powered radio
- Extra batteries
- Special items needed for infants, elderly, or disabled family members
- Blankets or sleeping bags

If you are in a house

If possible, stay inside. If the authorities tell you to evacuate (leave), tell someone where you are going. Follow the routes suggested by authorities.

If you are in a car

- Pull off the road.
- Put on hazard lights.
- Hang a distress flag from the antenna.
- Turn off the car, but run the motor and heater every hour for five–10 minutes. The window should be cracked slightly and you should check that the exhaust pipe in the back of the car is not blocked to avoid carbon monoxide poisoning. When running the car, turn on the dome light so that people passing by will notice that you are in trouble.
- Keep an emergency kit in your car.

Avoid going outside if possible. If you must go outside, dress appropriately

- Wear several layers of clothing.
- Wear a warm hat, mittens, boots, and wrap a scarf around your mouth to avoid breathing freezing air directly into your lungs.

CLASSROOM WEATHER STATION: MAKE YOUR OWN RAIN/SNOW GAUGE

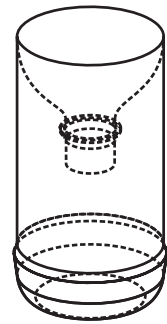
Materials

- Duct tape (5" length) — *one*
- Permanent marker — *one*
- Plastic water bottle (16-oz. size, clear) — *one*
- Ruler — *one*



Procedure

1. Take out your Science Journal. Write today's date and "Rain/Snow Gauge."
2. The Materials Manager gathers the materials and the Experiment Expert leads the activity.
3. Discard the lid of the water bottle. Cut the top off the water bottle, turn it upside down, and tape it over the cut open water bottle. Tape the two parts of the water bottle together. *See the illustration.*
4. Use the ruler and permanent marker to mark the rain gauge. Measure and mark the side of the water bottle at one-quarter inch intervals. Write the number beside each inch mark on the water bottle.
5. If rain or snow is forecast, take the rain/snow gauge outside. Dig a small hole or anchor your rain/snow gauge by putting rocks around it so that it doesn't blow over in the wind.
6. Check your rain/snow gauge after it rains or snows.



Discussion

Respond to the following questions in your Science Journal.

1. What does a rain/snow gauge do?
2. How does a rain/snow gauge work?
3. If it rained or snowed what did your rain/snow gauge tell you?

SUSPECT CLUE #5

Directions

The following clue was mailed to McGee's Weather Company. Unfortunately, it is a scrambled message! If you can unscramble the message, you will know who the culprit is in this weather mystery.

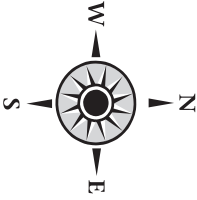
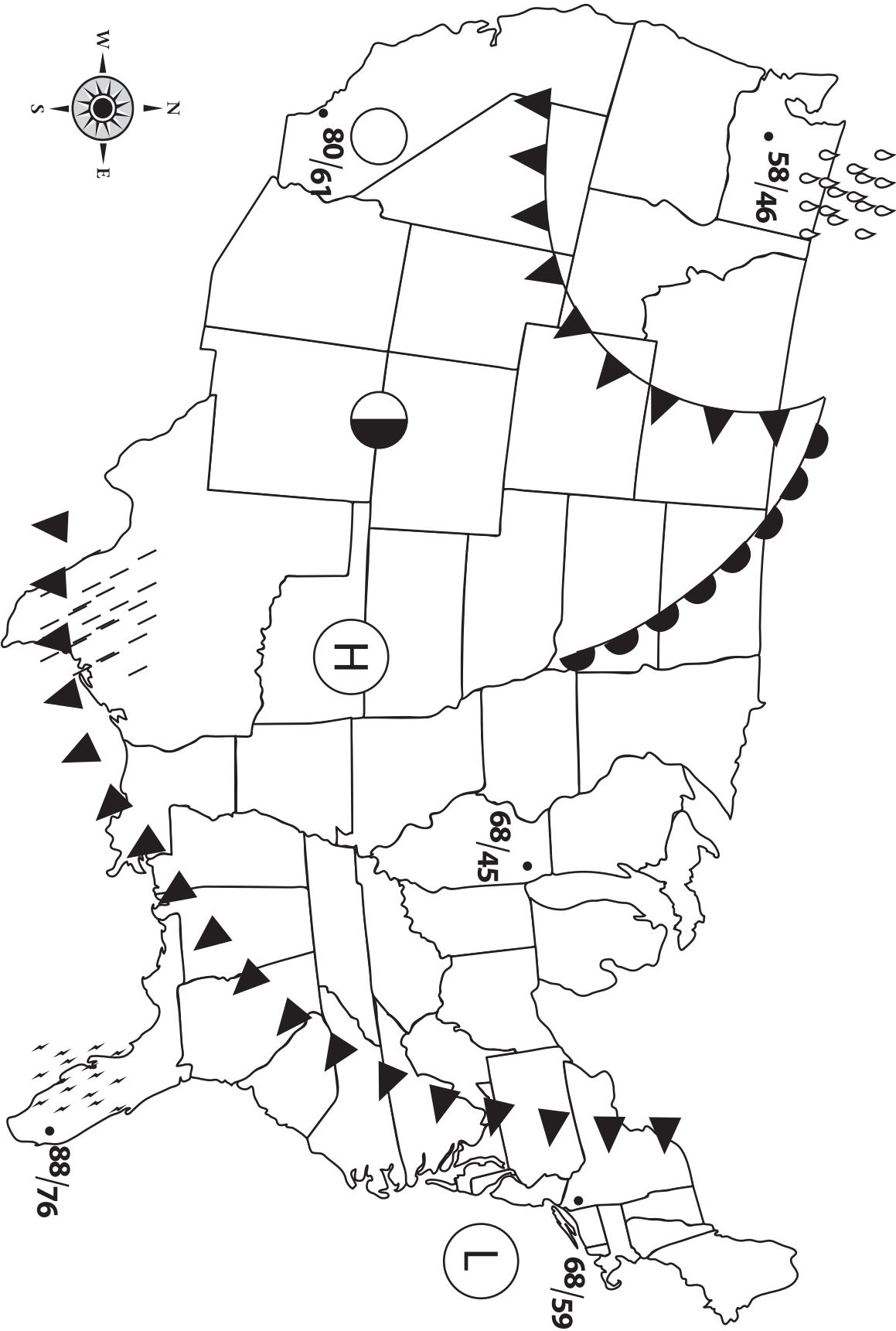
E J O Z Y B E R E

— — — — — — — — —

S I H E T L P C R U T I.

— — — — — — — — — — — — .

WEATHER MAP



WEATHER REPORT: CHECKLIST AND RUBRIC

Each team will create a weather report for a different city in the United States. You will have three days to complete your research, write your report, and practice your oral presentation. Each member is responsible for conducting research. As a team you will decide what information to include in the final weather report. Each member *must* participate in the oral presentation of the weather report. As a team, decide what information each member will provide.

Creating Weather Reports

1. Each team's weather report will include the following:
 - a. Current temperature
 - b. Current weather conditions
 - c. High or low pressure areas
 - d. Cold or warm fronts
 - e. Predictions about the weather
 - f. Air quality
 - g. Interesting weather facts
2. Use the following to conduct research on your city:
 - a. Internet
 - b. Almanac
 - c. Encyclopedia
 - d. Weather map
 - e. Weather reports (in newspapers or televised)

The almanac and encyclopedia will provide weather information that occurred in the past. The current weather maps will provide information about recent weather.
3. All reported information must be the member's original work. It must not be copied from reference materials or the Internet.
4. Use the following checklist and rubric when completing research and preparing your weather report.

Weather Report Oral Presentation Rubric

4— EXCEEDS!!! We did a great job!!!

- We have followed the directions and have gone significantly beyond what was expected or asked.
- We have presented our weather report in an appealing and/or eye-catching way.

3 — MEETS!! We did a good job!!

- We have followed the directions.
- We have presented our weather report neatly.

2 — NEARLY THERE. Oops, we forgot something!

- We have followed all but one of the directions.
- We need to correct our weather report and resubmit it as soon as possible.

1 — INCOMPLETE. Back to the drawing board.

- We have not followed the directions.
- We need to see the teacher immediately for a plan of action.

Weather Report Checklist

_____ Accurate and thorough research

_____ Clear facts

_____ Organized information

_____ Use complete and clear sentences

ORAL PRESENTATION RUBRIC

Content: Preparation, organization, and detail

4 — EXCEEDS!!!

- Your weather report provided an excellent summary of the weather in your city.
- The information was very well organized, and your team provided more information than expected.
- Your weather report consistently provided detailed descriptions.

3 — MEETS!!

- Your weather report provided an accurate and appropriate summary of the weather in your city.
- Your weather report provided some detailed descriptions.

2 — NEARLY THERE.

- Your weather report offered only some information about the weather in your city.
- Your weather report seldom provided detailed descriptions.

1 — INCOMPLETE.

- Your weather report offered too little information or was disorganized.

ORAL PRESENTATION RUBRIC

Presentation: Volume, clarity, eye contact, and visual aids

4 — EXCEEDS!!!

- Your voice was loud and very clear.
- You maintained eye contact with your audience.
- You effectively used visual aids.

3 — MEETS!!

- Your voice was loud and clear.
- You made eye contact with your audience.
- You used visual aids.

2 — NEARLY THERE.

- Your voice was not loud enough or you did not speak clearly.
- You seldom made eye contact with your audience.
- You did not effectively use visual aids.

1 — INCOMPLETE.

- The audience could not understand your presentation.

WEATHER EXTENSIONS

1. Study about and explain the origins of weather folklore. For example, investigate the origins of one or more of these sayings (you can also investigate weather folklore that is not listed):
 - On February 2, if the groundhog sees his shadow, some believe that there will be six more weeks of winter.
 - It's raining cats and dogs.
 - A lot of winter snow means the summer crops will grow.
 - Red sky at night, sailor's delight; red sky in the morning, sailor take warning.
 - When the cows are lying down, it will soon rain.
 - A circle around the moon means it will rain soon.
2. Investigate how things in nature help us predict the weather. Some examples might include:
 - Scarlet Pimpernel (flower)
 - Morning Glory (flower)
 - Pine cones
 - Frogs croak more in certain weather conditions
 - Crickets *chirr* louder in certain weather conditions
3. Research about El Niño and La Niña. Share your findings.
4. Explore a severe weather disaster that occurred near your hometown or elsewhere in the United States. Share your findings.
5. Consider different careers that involve the weather. Investigate one of them and share your findings.
6. We learned about the three main types of clouds. Do further research about the different types of clouds and what they indicate about the weather. Some examples to get you started include:
 - cumulus, altocumulus, cumulonimbus
 - stratus, altostratus, nimbostratus stratocumulus
 - cirrus, cirrocumulus, cirrostratus
7. Investigate how different animals adapt to different weather conditions. Try to find out about an unusual weather adaptation that not many people might know.

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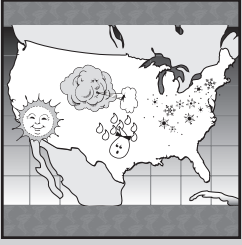
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WEATHER DETECTIVES



STUDENT GUIDE

Dear Students,

I am writing to ask for your help to solve a mystery. I own McGee's Weather Company. We are a non-profit business. Our goal is to inform the public about the weather. For the last five years, we have researched and experimented on the weather. As you might guess, we have a lot of information about the weather and weather safety.

We have been using this information to make booklets about the weather. Our goal was to give away the booklets free of charge, starting next month. To our shock, last week someone broke into our office and took all of our data. We can think of no reason why anyone would want to steal our weather data!

Local detectives are on the case, but they have other crimes to solve. I would search for the thief myself, but I do not have the time or the resources. All of my employees have been with me for at least five years, and I know they were not involved in this crime.

I hope that you can help me. I know that schools have lots of science resources. I also know about your great teacher. Would your class like to become science detectives? Can you find who has taken my weather data?

It is crucial that this mystery is solved soon. I need the stolen weather data. I hope you will find the thief in the next three weeks. We hope to give out our booklets on schedule next month. Thank you for your help.

*Sincerely,
Michael McGee*

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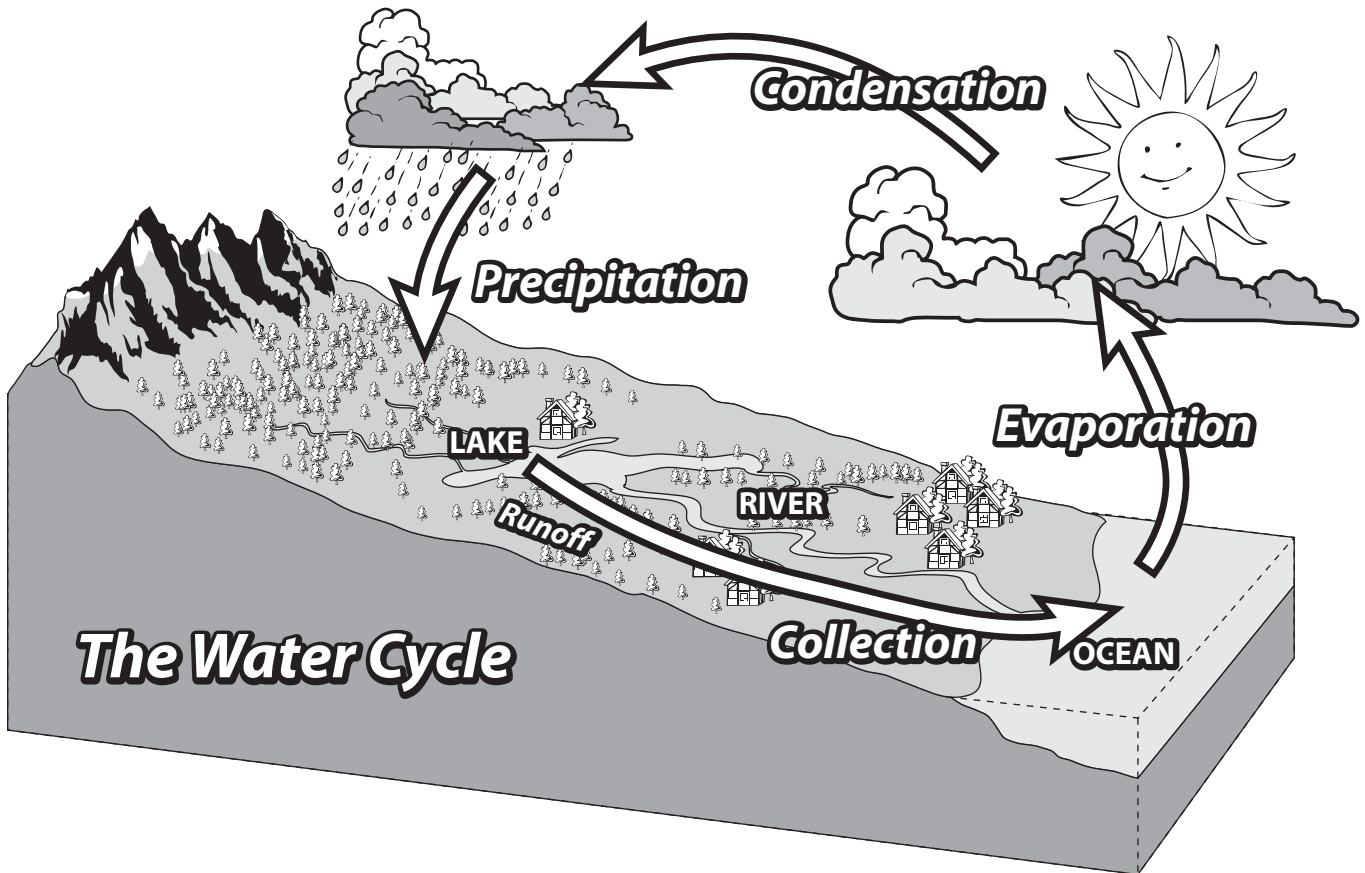
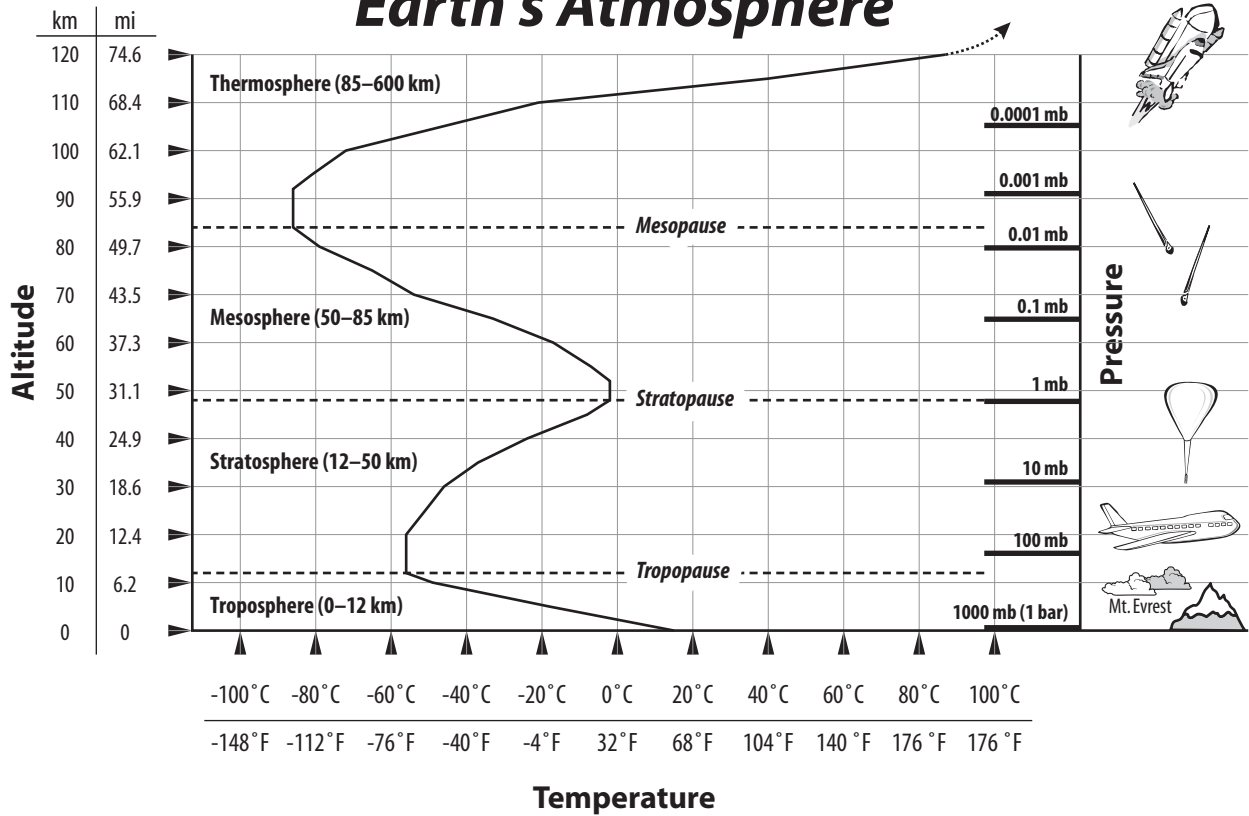
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DROUGHT INFORMATION

Precipitation (rainfall) varies around the world. The amount of precipitation considered to be “normal” also varies from place to place. A drought occurs when there has been little or no precipitation in an area for at least three months. The lack of precipitation creates a water shortage. The water shortage impacts people, plants, and animals. A drought becomes serious when it has been dry in an area for a long time (usually for a whole season). The larger the area impacted, the more serious the drought.



What Defines a Drought?

There are many ways to define a drought:

- *Meteorologists* define a drought by measuring the precipitation in an area. This amount is compared to normal precipitation for the area. *A drought in one area of the world is not always a drought in another area of the world.*
- *Farmers* define drought as a lack of moisture in the soil that becomes so great that the soil can no longer support a certain crop.
- *Hydrologists* study water. Hydrologists define a drought by how far below normal the surface water and subsurface water falls.
- *Sociologists* and *economists* define a drought by its effect on the people and how it limits the normal use of water.

Weather Information You Should Know

- Droughts occur in every climate zone.
- More states have become aware of the need to be prepared for a drought. In 1980, there were only three states with drought plans. In 2004, 38 states have drought plans.
- The states in the western part of the United States are more likely to have a drought than other states.

Did You Know?

Some people think droughts are rare, but they naturally occur in all climate areas. A famous drought occurred in the 1930s in the United States. There was little rainfall for eight years, which caused a drought. This drought ruined many farming areas. The land areas affected by this drought were known as the “dust bowl.” It was named the Dust Bowl because there was so little rain and when it was windy, dust blew all around. The Dust Bowl affected many states—Texas, Oklahoma, Kansas, Colorado, and New Mexico. Even though many people love sunny weather, if it is sunny all the time without precipitation, a weather disaster can occur.

TORNADO INFORMATION

Tornadoes get their start inside windy thunderclouds. The winds whirl into a funnel that works its way to the ground. When the funnel touches the ground, it acts like a vacuum cleaner and causes great damage.



What Defines a Tornado?

- To be a tornado, the funnel must contact both the ground *and* the cloud base.
- Tornadoes are known by many names such as twisters, waterspouts, and whirlwinds.
 - When a tornado is over the water, it is called a waterspout.
 - A very small tornado over a desert is called a dust devil.

Weather Information You Should Know

- Tornadoes can last from seconds to more than an hour. Most tornadoes last less than 10 minutes.
- Tornadoes are strong enough to pick up buildings, trees, and cars, carry them, and then smash them to the ground.
- About 800 tornadoes hit the United States each year.
- Tornadoes cause about 80 deaths and over 1,500 injuries each year in the United States.
- Tornadoes can occur at any time of year. Most tornadoes occur in the spring during the late afternoon or early evening.

Did You Know?

- The word tornado comes from the Spanish word *tronado* (which means *thunderstorm*) and *tornar* (which means *to turn*).
- Tornadoes are small, fierce cyclones.
- Tornadoes can range from a yard wide to a mile wide.
- In the Southern Hemisphere, tornadoes turn in a clockwise direction.
- In the Northern Hemisphere, tornadoes turn in a counter-clockwise direction.

HURRICANE INFORMATION

Hurricanes are strong storms that can be hundreds of miles wide. The *eye* of the hurricane is a calm spot in the center of the storm. The eye of the hurricane is surrounded by a wall of clouds called the *eyewall*. The hurricane's strongest winds and rain occur in the eyewall. Hurricanes can be deadly.



What Defines a Hurricane?

- Hurricanes start over warm, tropical oceans. These storms can last longer and move further over water than they do over land.
- When hurricanes come to land, the heavy rain, strong winds, and large waves can do great damage.
- Hurricanes turn in a counter-clockwise direction. They have winds of at least 74 miles per hour. They are classified by their wind speed:

Class	Wind Speed (mph)	Effect
1 (minimal)	74–95	damage to trees; some flooding; storm surge* up to 5 feet
2 (moderate)	96–110	damage to roofs, windows, doors; storm surge* 6–8 feet
3 (extensive)	111–130	damage to homes, flooding at elevations up to 5 feet above sea level; storm surge* 9–12 feet
4 (extreme)	131–155	major damage to structures, flooding at elevations up to 10 feet above sea level; storm surge* 13–18 feet
5 (catastrophic)	156+	massive structural damage; flooding at elevations up to 15 feet above sea level; storm surge* 19+ feet

* A storm surge is the water that is pushed to the shore by the force of the winds in a storm.

Weather Information You Should Know

Meteorologists use satellites to find hurricanes forming over the ocean. These storms can be tracked as they come to the land. Hurricane warnings can be made well before the storm hits.

- On average, six hurricanes form each year over the Atlantic Ocean, Caribbean Sea, the Gulf of Mexico, or the eastern Pacific Ocean. Most of these hurricanes stay over the ocean. On average, five hurricanes strike the U.S. coast every three years. Of these five storms, two will be extreme hurricanes.
- A *hurricane watch* means that a hurricane is likely within 36 hours.
- A *hurricane warning* means that a hurricane is likely within 24 hours. People living in the area should plan to leave when a hurricane warning is given.

Did You Know?

- More people die in hurricanes than in any other type of storm.
- Shoreline areas with high populations are at risk from hurricanes.
- At times, it is hard to evacuate people from areas on the coast. This difficulty occurs when there are not enough roadways leading away from the coast.

FLOOD INFORMATION

Floods occur for a variety of reasons. Two weather-related reasons for floods include:

1. When rain fills natural water sources (like rivers, streams, etc.) with too much water too quickly.
2. When heavy rains fall over a short time. The ground absorbs most rain when it first starts to fall. If rain continues to fall, the ground will get drenched with water and will no longer absorb it. This is when flooding occurs.



What Defines a Flood? What Defines a Flash Flood?

A flood occurs gradually and lasts awhile—sometimes more than a week. A flash flood happens within six hours of a heavy rain.

- Flash floods occur when too much rain falls too fast. In a flash flood, water flows over banks of rivers and streams. Flash floods can occur quickly after a heavy rainfall.
- A flash flood can cause a lot of damage. It can lift trees, destroy buildings, and cause deaths. Flash floods can cause mudslides. Most people who die during a flood are victims of flash floods.

Weather Information You Should Know

The National Weather Information Center can issue these warnings:

- A *flood watch* means flooding is possible.
- A *flood warning* means that flooding is about to occur or is already occurring.
- A *flash flood watch* means a flash flood is possible.
- A *flash flood warning* means that a flash flood is about to occur or is already occurring.

Did You Know?

It is important that people learn about water sources in their community and the risk of flood. Everyone should:

- Learn the normal height of nearby rivers, streams, and lakes.
- Find out how high your own house is above nearby water sources.
- Develop a plan if a flood should occur.

LIGHTNING INFORMATION

Lightning only occurs during thunderstorms. Thunderstorms form when warm air takes water drops from the land to colder levels of the atmosphere. Here water drops form clouds. As the water falls back to earth, positive and negative charges in the clouds mix. These positive and negative charges make lightning.



More about Lightning

- Thousands of bolts of lightning strike the earth each day. Some of these bolts last only a millionth of a second.
- A lightning bolt can be five times hotter than the surface of the sun.
- Most times, you hear thunder after you see lightning. This is because light travels faster than sound. Without lightning, there is no thunder.
- Benjamin Franklin was one of the first to study lightning. In a famous kite experiment in 1752, Benjamin Franklin attached a key to the end of a kite string. He flew this kite in a thunderstorm. When he saw sparks fly from his key, he knew that lightning was a natural form of electricity.

Weather Information You Should Know

More than one hundred years after Benjamin Franklin's experiments, scientists formed the National Lightning Detection Network. This network uses computers and sensors to find where lightning strikes around the world.

- Lightning can strike anywhere. Scientists found that lightning can strike up to 15 miles away from a thunderstorm.
- A *severe thunderstorm watch* is issued by the National Weather Service when a severe thunderstorm is likely to occur.
- A severe thunderstorm has winds of 58 miles per hour (or more).
- A *severe thunderstorm warning* is issued when the National Weather Service has seen a severe thunderstorm. At this point, people need to find a safe place to listen to a battery-operated radio for more information.

Did You Know?

- Benjamin Franklin used his discovery about lightning to help people.
- He made the lightning rod. A lightning rod is a piece of metal that is attached to the highest point of a home. The metal rod attracts lightning. When lightning hits, a ground wire takes the electric charge safely to earth.
- Mr. Franklin did not sell his invention. He gave his invention to the world.

BLIZZARD INFORMATION

Blizzards are the most dangerous winter storms. A blizzard is a storm that has heavy snowfall, strong winds, and cold temperatures. These elements make blinding snow, deep drifts, and life-threatening wind chills.



What Defines a Blizzard?

- In a blizzard, temperatures are low (usually below 20°F) and strong winds blow (at least 35 mph).
- In a blizzard, there is so much snow in the air that visibility is cut to 1/4 mile or less (for at least 3 hours).
- In a severe blizzard, temperatures are below 10°F, winds are over 45 mph, and visibility is near zero.

Weather Information You Should Know

- When *heavy snow* is predicted, it means that there will be 6 or more inches of snow in a 12-hour period.
- *Freezing rain* occurs when the air above the Earth is warm enough for snow to melt into rain as it falls to the Earth. Once it hits the cold Earth's surface, the rain will freeze.
- A *wind chill advisory* is given when wind chills are likely to be cold enough to produce frostbite.
- A *blizzard warning* is issued when snow and strong winds make blinding snow.-
- A *freezing rain advisory* is issued when lots of ice is likely to form over the next few hours.
- A *winter weather advisory* is issued when the weather is expected to cause hazardous conditions.-
- A *winter storm outlook* means that hazardous weather may start in the next few days.
- A *winter storm watch* is issued when hazardous weather may start in the next day.
- A *winter storm warning* is issued when severe and hazardous weather conditions are about to start or have already started.

Did You Know?

- If the temperature is at or below 32°F, snow can occur.
- A ground blizzard occurs when the wind blows snow that is on the ground hard enough so that it is hard to see.
- During a winter storm, the leading cause of death is a heart attack that occurs when shoveling snow.