

FORECASTING AND WEATHER INSTRUMENTS

from the *Weather Smart Series*

written and produced by...
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Produced and Distributed by...



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Weather Smart: Forecasting and Weather Instruments

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Forecasting and Weather Instruments from the *Weather Smart* Series

INTRODUCTION

Weather Smart is a series comprised of 10 weather programs for grades 3-8. It is written and produced by Alan Sealls, an award-winning meteorologist who has worked for WGN-TV, and CNN. Each program is supported by exercises, quizzes, Internet references, and hands-on experiments to make the weather come alive to students. The series is an entire "course" in the wonders of weather while each program stands alone in approaching the various facets of meteorology. These delightful and entertaining programs are geared toward kids' fascination with weather. Each program may be used as an introduction, supplement, or follow-up to weather studies.

Forecasting and Weather Instruments introduces students to meteorology as a profession that provides a useful service. It is made clear that the weather forecast that we often take for granted involves observation, research, mathematics, and the use of tools and instruments. Students see that weather forecasts have great value in giving us more enjoyable, productive, and safe lives.

CURRICULUM STANDARDS

Weather Smart: Forecasting and Weather Instruments correlates to the following science standards:

National Science Education Standards, grades K-4

Science as Inquiry

CONTENT STANDARD A:

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Physical Science

CONTENT STANDARD B:

- Properties of objects and materials
- Position and motion of objects
- Light, heat, electricity, and magnetism

Earth and Space Science

CONTENT STANDARD D:

- Properties of earth materials
- Objects in the sky
- Changes in earth and sky

Science and Technology

CONTENT STANDARD E:

- Abilities of technological design
- Understanding about science and technology
- Abilities to distinguish between natural objects and objects made by humans

Science in Personal & Social Perspectives

CONTENT STANDARD F:

- Types of resources
- Changes in environments
- Science and technology in local challenges

History and Nature of Science

CONTENT STANDARD G:

- Science as a human endeavor

National Science Education Standards, grades 5-8

Science as Inquiry

CONTENT STANDARD A:

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Physical Science

CONTENT STANDARD B:

- Properties and changes of properties in matter
- Motions and forces
- Transfer of energy

Earth and Space Science

CONTENT STANDARD D:

- Structure of the earth system

Science and Technology

CONTENT STANDARD E:

- Abilities of technological design

- Understanding about science and technology

Science in Personal & Social Perspectives

CONTENT STANDARD F:

- Science and technology in society

History and Nature of Science

CONTENT STANDARD G:

- Science as a human endeavor
- Nature of science

PROGRAM SUMMARY

Weather Smart: Weather Forecasts and Instruments

shows the basics of how weather forecasts are made. Students learn to identify the symbols that they see on weather maps on TV and in the newspaper. By measuring, charting, and tracking weather, it becomes easy to see how things change as weather moves from one part of the Earth to another. Kids learn that math skills are vital to measuring and forecasting.

We examine the tools and instruments used by meteorologists to detect and measure clouds, precipitation, temperature, humidity, wind and pressure. Students become familiar with the names and functions of weather instruments. Examples of instruments that kids can build are presented. The program concludes with a quiz.

SERIES GOALS

The ***Weather Smart*** series will give students the entire scope of meteorology, fostering an appreciation for weather as a universal, ever-present aspect of life on Earth.

- Varying combinations of heat, air, and water generate weather.
- The sun is the driving force behind weather.
- Air and water have unique properties.
- Neither Earth nor life would exist as we know them without weather.
- Humans can affect weather or climate.

- Weather forecasts make our lives easier and safer.
- Tools and instruments help us to understand and predict weather.
- Mathematics is needed to assess and forecast weather and climate.
- Scientists do not fully know what makes weather and climate change.
- Weather and climate are cyclical.
- There is beauty in the sky.
- Meteorology is a wide-reaching profession.

TEACHER PREPARATION

Duplicate a sufficient quantity of the Blackline Masters for your students. In order to undertake all of the exercises in this program the following items are needed in appropriate amounts and quantities:

computer with Internet connection
 construction paper
 scissors
 crayons
 unsharpened pencil
 tacks
 thermometer

INSTRUCTIONAL NOTES

Before presenting this ***Weather Smart*** lesson to your students, we suggest you preview the program and review this guide and accompanying Blackline Master activities in order to familiarize yourself with their content.

As you review the materials presented in this guide, you may find it necessary to make changes, additions, or deletions to meet the specific needs of your class. We encourage you to do so, for only by tailoring this program to your students will they obtain the maximum instructional benefits afforded by the materials.

We also suggest that the program viewing take place before the entire group under your supervision. The lesson activities grow out of the context of the video; therefore, the presentation should be a common experience for all students.

PRE-TEST

To gauge student level of understanding of weather forecasting and weather instruments, you may use any of several of the Blackline Masters as both pre-test and post-test. Those most appropriate would be **Blackline Master 1, Video Quiz, Blackline Master 3, Discussion Questions,** and **Blackline Master 4, Finish the Sentence.**

STUDENT PREPARATION

Ask students how they knew what to wear for the day. Younger students may respond that their parents told them how to dress. If that is the case, then ask how their parents knew how they should dress for the weather. If it is a hot day, ask why no one is wearing a parka. If it is a cold day, ask why no one is wearing shorts. Lead them to discuss that somewhere along the way somebody read or listened to a weather report. Pass out copies of the weather section of a newspaper. Have the students look at all of the elements that are presented and discuss what they are and what purpose they serve. Assign students to watch a weather forecast on TV and make notes of what the forecast is.

STUDENT OBJECTIVES

After viewing the program and participating in the follow-up activities, students should be able to...

- Identify and describe basic weather symbols.
- Describe techniques of observing weather.
- Create a log of past weather.
- Write the names of various weather instruments.
- List the purposes of weather instruments.
- Demonstrate how to read dials and gauges.
- Describe the steps that go into making a weather forecast.
- Build a simple weather instrument to measure wind.
- List the ways in which weather forecasts benefit people.

INTRODUCING THE PROGRAM

Any of the **Blackline Master** exercises or experiments (**numbers 6 through 9, or 11 and 12**) may be used to introduce the topic. These may be undertaken by the students or by the class, in small groups.

Present the program. *Weather Smart: Forecasting and Weather Instruments* runs 15 minutes. A video quiz corresponding to **Blackline Master 1** is at the conclusion of the program. You may choose to pause the program for a longer period between questions to allow more time for answers or for discussion.

DISCUSSION QUESTIONS

As printed in **Blackline Master 3**, the answers are found in the Answer Key on page 8.

1. Five hundred years ago, how did people know what the weather forecast was?
2. In what ways can a weather forecast help to save money?
3. When you are outside, what things can you use to observe the weather?
4. How many different weather instruments or tools can you name?
5. What things would help to make weather forecasts more accurate?
6. How can we know what the weather is over the oceans and up in the air?
7. What would happen if all meteorologists stopped making weather forecasts?
8. Do you think computers can forecast the weather better than humans can?
9. What are some things you need to do before you make a weather forecast?
10. In what ways do weather forecasts make our lives better?

BLACKLINE MASTER ACTIVITIES

1. **Video Quiz** may be used as a pre-test and post-test. The actual quiz is in the conclusion of the program.

2. **Forecasting and Weather Instruments Vocabulary**

Word Search is a fun way to familiarize students with the words associated with weather instruments and forecasting. You might have students work in groups to find some of the hidden words.

3. **Discussion Questions** may be administered at any time or given as a take-home assignment.

4. **Finish the Sentence** is another opportunity to assess student comprehension and retention.

5. **Weather Symbols** is simply a guide that students can keep for reference in reading weather maps.

6. **Read a Thermometer** gives practice in reading a thermometer. It requires that you either shade in various values for the mercury before duplication or write a value in the box and then have the students color in the height of the mercury. You may develop further math or weather questions from the values you enter.

7. **Read a Rain Gauge** gives practice in reading a rain gauge. It requires that you either shade in various values for the water before duplication or write a value in the box and then have students color in the height of the water.

8. **Read a Compass** gives practice in reading a compass. It requires that you either draw in arrows (pointers) for wind direction before duplication or write a direction in the box and then have students draw in the arrow.

9. **Read a Barometer** gives practice in reading a barometer. It requires that you either draw in arrows (pointers) for pressure before duplication or write a direction in the box and then have students draw in the arrow.

10. **Weather for a Month** allows students to keep a monthly picture chart of what the weather was. They will need to fill in the dates for the appropriate days of the chosen month.

11. **Watch the Wind** allows students to build a simple wind-measuring device (anemometer).

12. **Sun or Shade** teaches students that proper placement of weather instruments is key in getting accurate data.

13. **Weather Forecasting and Instruments Fun Facts** will keep students interested and entertained beyond the lesson.

14. **Internet Sites** lists a handful of fun and educational websites for further study.

EXTENDED LEARNING ACTIVITIES

Contact local businesses and agencies that are very dependent on weather forecasts. Your class may be allowed to visit them to gain a local perspective. You might also assign students to contact and arrange for a visit or interview.

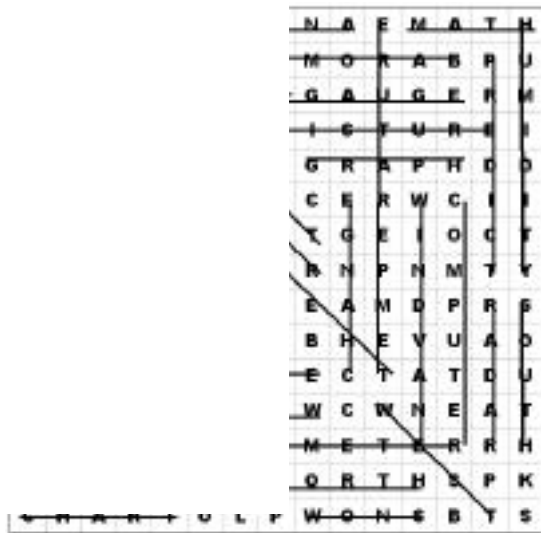
- Meteorologists who work at a nearby office of the National Weather Service or on TV or at a university can discuss observing and forecasting weather.
- Any grocery or general merchandise store can describe how they stock products based on the season and forecasts. They can also enlighten students on how people make purchases based on weather forecasts.
- Law enforcement and emergency response crews can explain how they use weather forecasts to determine staffing and resources.
- Your city's department of public works can explain the processes they go through when they hear a storm, or snow, or extreme temperatures are coming.
- Golf courses, parks, or amusement areas can explain how their attendance, and emergency action plan is based on weather forecasts.
- Truckers, shippers, and delivery companies can describe the importance of weather forecasts for their businesses
- Your local emergency management agency will have safety information.

ANSWER KEY

Video Quiz

- | | |
|----------|----------|
| 1. true | 6. true |
| 2. false | 7. true |
| 3. true | 8. true |
| 4. true | 9. false |
| 5. false | 10. true |

Forecasting & Weather Instruments Vocabulary



Discussion Questions

1. There were no weather forecasts 500 years ago, as we know them. The only predictions were those made for the immediate future based on personal observation of clouds, wind direction, and other basic parameters.
2. Weather forecasts allow airlines, truckers, and ocean shippers to save fuel costs by going in a direction where the weather is calm and the wind is in their favor. People can budget their water bill by not watering the lawn on days when rain is forecast. When a blizzard is forecast, schools and companies can cancel their days and not have to pay some employees, or pay utilities to keep the facilities in operational mode.
3. We can use our eyes, ears, nose, and sense of touch to observe weather. Specifically, we see clouds, we hear wind and thunder, we can smell a change in wind direction if the wind carries odors from a known source like a chocolate factory, and we can feel big changes in humidity.
4. Weather balloon (radiosonde), radar, satellite, thermometer, barometer, anemometer, wind vane, hygrometer, compass, and rain gauge are the common weather instruments.

5. Forecasts will be more accurate when we can fully and accurately measure the current state of the atmosphere and when we better understand how it works. Right now we don't have a lot of information or understanding of what happens over the oceans which cover the majority of Earth.

6. We can know what the weather is over oceans and up in the air by using ocean buoys carrying instruments, or ships carrying instruments. Some ships launch weather balloons. Airplanes give us weather data from over the oceans and in the air. Satellites show us the storms over oceans and how the clouds are moving there. More recent technology allows satellites to remotely sense temperature, wind, and humidity over the oceans.

7. If there were no weather forecasts, air travel would almost be paralyzed, people would spend a lot of time rescheduling outdoor events, and there would likely be many more injuries from lightning, floods, hurricanes, and other storms.

8. Computers only follow instructions fed to them by humans. Their forecasts are not better, they are only faster.

9. Before a forecast is made, one must know the general weather history for that area, and then observe the current weather.

10. Weather forecasts allow us to dress comfortably, schedule yardwork or outdoor painting, be safe from hazards, and not waste time going to outdoor events that are canceled.

Finish the Sentence

1. satellite
2. radar
3. wind
4. pressure
5. thermometer
6. barometer
7. vane
8. hygrometer
9. observation
10. meteorologist

Read a Thermometer

Answers will depend upon how high you shade the thermometers. Use different ranges of temperature to arouse discussion of what time of day, or what seasons they are more likely. Note that the thermometers are in Fahrenheit increments of two degrees. This means that students must interpolate (estimate) between the lines to determine odd numerical values. You might modify the exercise to where you give the students temperatures and have them shade the thermometer.

Read a Rain Gauge

Answers will depend upon how high you shade the gauges. The units are intended to be inches. You might modify the exercise to where you give the students a rain amount and have them shade the rain gauge.




Read a Compass

Answers will depend upon where you draw your arrows or pointers. In this exercise students are merely identifying the wind direction. Actual wind direction tells you where the wind is coming from. You might modify the exercise to where you give the students a wind direction and you have them draw the arrow or pointer.

Read a Barometer

Answers will depend upon where you draw your arrows or pointers. Note that the units are millibars and they are in increments of two. You might modify the exercise to where you give the students a pressure reading and you have them draw the arrow or pointer. In most places, the pressure does not get much higher than 1030 millibars, or much lower than 990 millibars. The exceptions are high pressure centers from the Poles that can be over 1040 millibars, and major winter storms and hurricanes that can have pressure far below 980 millibars.

Weather for a Month

			Friday	Saturday
			 6	 7
			 13	14
			20	21
			27	28

This is only a sample of what a chart might look like. Other information that students can include would be high and low temperatures, and rainfall or snowfall.

Watch the Wind

The pinwheel tells the relative speed of wind. It spins faster as the wind is stronger.

Sun or Shade?

The thermometer in direct sunlight will change the most in temperature. This experiment shows that a weather instrument must be placed in a location where it can give unbiased data. Actual air temperature readings are always recorded in a shaded area. When placed in a closed car, the thermometer will show a much higher temperature, even if the car is not in direct sunlight. This illustrates that without air motion (wind) heat builds fast, as in a greenhouse.

Internet Activities

As listed on **Blackline Master 14**.

National Weather Service kids links

<http://www.nws.noaa.gov/om/reachout/kids.htm>

Click on "Forecasting" to practice being a meteorologist. If you are you looking for a good weather science project to do, then this is a good place to start.

Interactive Weather Information Network from the National Weather Service

<http://weather.gov>

Get the latest weather and weather forecasts for any place in the United States. See clouds moving on a satellite picture and use the radar pictures to help your family plan a trip.

The Franklin Institute online weather section

<http://sln.fi.edu/weather/>

Do more reading on weather readings and observe information on observations.

University of Michigan weather cameras

<http://cirrus.spri.umich.edu/wxnet/wxcam.html>

See the weather where you live or where your relatives live to help make a forecast.

The Globe Program student investigations

<http://www.globe.gov/fsl/welcome.html>

Learn what other students around the world are studying in weather. Click on "Student Investigations."

As Internet addresses can change, you may have to use a search engine to find the title of the page or website that you are seeking. You may also have luck by going to the host website URL. For example, if you are looking for <http://www.alan.edu/weather/cloud.html> and you get a message that the page is no longer available, then try <http://www.alan.edu/> and look or search for weather and then cloud or something that sounds similar.

REFERENCE MATERIAL

Project DataStreme

<http://www.comet.ucar.edu/dstreme/extras/dsinfo.html>

See how your class can exchange weather readings and data with other schools.

The GLOBE Program (Global Learning and Observations to Benefit the Environment)

<http://globe.fsl.noaa.gov/welcome.html>

Share your weather data via an international data project for elementary schools.

Hurricane Hunters

<http://www.hurricanehunters.com>

Learn all about the men and women who fly into hurricanes to take weather readings and the special instruments they use. Take a virtual flight and see images from inside the eye of hurricanes.

Energizer WeatherBeat

<http://www.energizer.com/weatherbeat/>

Fun weather and science projects for kids and teachers.

Environment Canada weather Information

<http://weatheroffice.ec.gc.ca>

See weather forecasts and information for Canada, in metric units. You'll also find good resource information for ozone, storms, pollution, sky watching, as well as an online cloud chart.

Find many more experiments and simple designs for weather instruments in the "Hands on Weather" programs also distributed by United Learning.

Comments, suggestions, or questions regarding this ***Weather Smart*** program should be addressed to the producer, Alan Sealls (Sealls@aol.com).

SCRIPT OF NARRATION

Sunny weather makes it easy to play outside, do work around the yard, go on vacation and even go to school. Sometimes weather changes very fast. You might get caught in a rain shower on a summer afternoon. In the winter, a snowstorm can happen overnight. In the spring some people have to watch out for tornadoes. Without a good weather forecast you might be in danger.

People who make weather forecasts are called meteorologists. They have an important job because bad weather can keep airplanes from flying, it could keep food and vegetables from growing, it can make cars get stuck on a highway or it can just rain out a baseball game.

Meteorologists have many tools to help forecast the

weather. Before they make a forecast or a weather prediction, they have to know exactly what the weather is doing right now. The first part of making a weather forecast is measuring the weather. A meteorologist must know if it is cloudy or sunny, hot or cold, wet or dry, and which way the air is moving.

We use our eyes to see the weather, and our bodies can feel the wind, temperature, and even humidity. Since everyone feels weather a little differently, meteorologists use tools called weather instruments to take measurements.

A weather instrument that you probably have in your home is a thermometer. Thermometers measure heat. They tell us how warm or cold the air is. When you read the number on the thermometer, you are reading the air temperature. High temperatures mean the air is warm and low temperatures mean the air is cold. Sometimes when you are riding down the street, you will see a big thermometer in front of banks and other buildings.

Meteorologists measure how strong the wind is with an instrument that spins, called an anemometer. The stronger the wind is, the faster the anemometer spins. Wind is important to know because it pushes weather around the Earth. Because wind starts in different places, we need another tool to tell where it is coming from. You can see this instrument on top of houses and barns. It's a wind vane. When the air moves across the wind vane, it makes the wind vane point into the wind. That way we know where the wind is coming from. The wind vanes that meteorologists use look more like this.

You can make your own wind vane using cardboard, scissors, tape, a sewing pin, a pencil, and a straw. Cut out the cardboard into the shape of a small rectangle. Then cut a triangle out of the rectangle as you see right here. Tape the triangle to one end of the straw and tape the other piece of cardboard to the other end. Stick the pin straight through the middle of the straw so that it is flat with the pieces of cardboard. Now stick the pin and straw into the eraser on the pencil. You've just made a wind vane. When

the wind blows, the wind vane will show you where it is coming from.

Winds come from four main directions, but you need another tool to know what the directions are. That tool is called a compass. A compass is an instrument that shows which way is north, south, east and west. Once a meteorologist knows where the wind is coming from, he or she can know if it will be a wet wind, dry wind, cold wind, or warm wind. Learn which way is north, south, east, and west where you live. The directions always stay the same. It helps to remember that the sun rises in the east and sets in the west.

When we take weather measurements, we also need to know how much air is on top of us. We don't feel air unless it's moving but air is strong and sometimes heavy. Look at this! Air is strong enough to hold you on top of a balloon! To measure how strong the air is, we use an instrument called a barometer. When the barometer shows a lower number, we say the air pressure is low. Low pressure comes along with cloudy weather and sometimes stormy weather. When the barometer shows a higher number, then the air pressure is high. High pressure brings clear skies, and usually dry weather.

Did you know that even when the weather is dry, there is invisible water in the air? It's called humidity. Humidity is a way to tell how much water or moisture is floating around us in the air. The instrument used to measure humidity is called a hygrometer. A low number on a hygrometer means the air is dry. That's what you find in a desert. When hygrometers show high numbers, we say the air is humid and that means that clouds might form to make rain.

Clouds are easy to see with our eyes but we only see a small part of the sky. Meteorologists use weather satellites to look down on the Earth to show the clouds all over. Once you know where you are on Earth, you can see the clouds that are moving your way. Some clouds make rain or snow and we need to know that so we can dress properly. When there is rain or snow, we use a tool called a

radar to know where the rain or snow is falling. Radars show precipitation as it falls to the ground.

When snow falls and piles up, you can measure it with a ruler, but to measure rain, you have to catch it in something first. A jar will work fine but meteorologists use a rain gauge. A rain gauge is a tube that has numbers on the side to show you how much rain fell.

When you take weather readings, you are watching or observing the different parts of weather. It ends up to be a lot of measuring and a lot of math. Instead of just writing down numbers, meteorologists put some measurements on a map, graph, or chart. Maps, graphs, and charts help to show a lot of information in a way that's easy to understand. We can see how the weather is changing by how the line slants on a graph.

Don't forget to use your eyes! One easy observation you can make is to guess the color of the sky. You can use a piece of cardboard to make a sky chart. Put different colors on your chart to try to match it to the sky. Keep track of the colors in a week.

Now that we know how to measure weather, we are ready to make a weather forecast. Predicting the weather can be tricky because so many things happen in the air above our heads. We can't always see or measure them but the easiest forecast starts with the wind.

Let's say that it is sunny and dry in your city and there's a rainstorm in a place called Alantown to your west. If the wind is blowing from west to east, it means that the rain will probably leave Alantown and get pushed toward you.

Or let's say that it is cloudy and warm where you are but there's a lot of cold air north of you. If the wind is blowing from north to south, then the wind will blow the cold air toward you.

As long as you know how fast the wind is blowing and how far away something is from you, you can use math to figure out how long it will take to reach you.

The main wind that moves weather systems around the Earth is a few miles or a few kilometers above the ground. It's called the jetstream. We know it's there because we see it move clouds on a satellite. We also know about the jetstream because meteorologists around the world send weather balloons up into the air every day. These balloons carry instruments to give us the wind, temperature, humidity, and air pressure above the ground.

When you take all the readings from weather balloons, satellites, radars, thermometers, barometers, hygrometers, anemometers, and wind vanes, you can use them in computers to make weather predictions for a day or even a week ahead. These computers are much more powerful than the one you have at home. They use math to make predictions. Even though computers can make a prediction fast, it does not mean it's better than a prediction that a person makes. Forecasts from computers are not perfect, and they probably never will be, but they do give meteorologists an idea of how the weather might change.

A good weather forecaster knows what kind of weather happens in a city. We all know that it is hot near the equator in the summer and cold near the South Pole in the winter. A person would never forecast a hurricane to start in mountains because they never do. When you forecast the weather it helps to know what the weather was like a week ago, a month ago, and for many years in the past. Even if you don't keep track of your own weather, you can find out what the weather was by checking reports in newspapers and on the Internet.

Sometimes weather forecasts are easy because weather in some cities repeats itself almost every day. In places near water, you can predict fog in the morning, or summer thunderstorms to happen at the same time every day. In deserts, you can predict sunny and hot weather. Most of the time, the forecast will be correct. Whenever weather happens the same way over and over, we call that a cycle.

A cycle is anything that repeats itself. Day and night is a

cycle. The seasons are a cycle. Many things in weather are cycles but you have to study weather long enough to figure them out. When you look at storms around the Earth from a satellite, you can almost see why they happen on a cycle. When they are spaced apart evenly, the wind moves them at the same speed so the weather in any city would change on a cycle.

Watching and studying the weather makes weather forecasting a lot easier. Nobody knows for sure what weather tomorrow will bring. You can use simple instruments to measure your own weather and make your own prediction.

To make a weather forecast, measure before you start. Keep watching the sky and stay weather smart.

Now let's take a quiz. Can you predict your grade? Answer these questions true or false.

Number one- The wind affects which way weather moves.
Number two- If you want to know air pressure you need to have a thermometer.

Number three- Satellites show us the clouds over Earth.
Number four- Computers use math to make weather forecasts.

Number five- One day weather forecasts will be perfect.
Number six- Radar shows you where there is rain or snow.

Number seven- Meteorologists measure the weather before they forecast.

Number eight- Air pressure is measured with a barometer.

Number nine- Low pressure means dry, sunny weather.

Number ten- Snow can be measured with a ruler.

Weather Smart: Forecasting and Weather Instruments**Video Quiz**

Directions: Answer either true or false.

1. _____ The wind controls which way weather moves.
2. _____ A thermometer tells you air pressure.
3. _____ Satellites show us the clouds over Earth.
4. _____ Computers use math to make weather forecasts.
5. _____ One day weather forecasts will be perfect.
6. _____ Radar shows you where there is rain or snow.
7. _____ Meteorologists have to measure the weather before they forecast.
8. _____ Air pressure is measured with a barometer.
9. _____ Low pressure usually means dry, sunny weather.
10. _____ Snow can be measured with a ruler.

Weather Smart: Forecasting and Weather Instruments
Forecasting and Weather Instruments Vocabulary Word Search

Directions: Draw a line through each word that you find.

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

Words are forward, backward, or diagonal.

anemometer
barometer
change
chart
clouds
compass
computer
east
forecast

graph
humidity
hygrometer
location
math
measurement
moisture
north
observation

plot
predict
pressure
radar
rain
rain gauge
reading
satellite
snow

south
temperature
thermometer
west
wind
wind vane

Weather Smart: Forecasting and Weather Instruments
Discussion Questions

Directions: Answer the following questions as directed by your teacher.

1. Five hundred years ago, how did people know what the weather forecast was?
2. In what ways can a weather forecast help to save money?
3. When you are outside, what things can you use to observe the weather?
4. How many different weather instruments, or tools, can you name?
5. What things would help to make weather forecasts more accurate?
6. How can we know what the weather is over the oceans and up in the air?
7. What would happen if all meteorologists stopped making weather forecasts?
8. Do you think computers can forecast the weather better than humans can?
9. What are some things you need to do before you make a weather forecast?
10. In what ways do weather forecasts make our lives better?

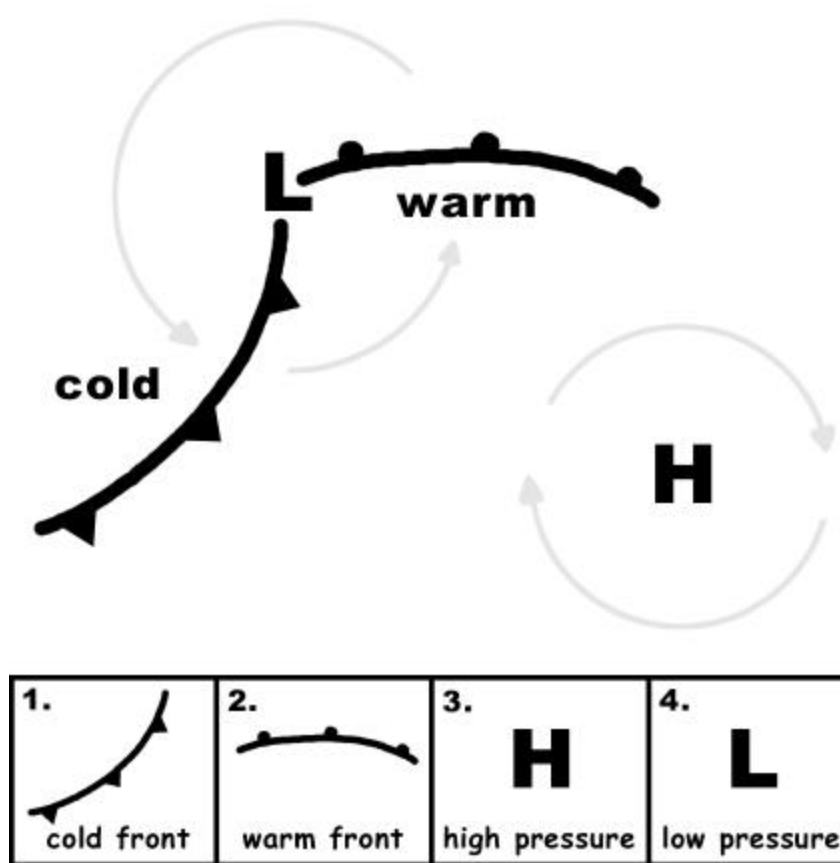
Weather Smart: Forecasting and Weather Instruments**Finish the Sentence**

Directions: Write in the correct word from your vocabulary list to finish the sentence.

1. The best tool for seeing storms over the ocean is a _____ .
2. A _____ shows precipitation.
3. To forecast a storm, you must know which way the _____ is blowing.
4. Sunny, calm weather usually comes with high _____ .
5. Weather balloons carry a _____ to give us the temperature reading above the ground.
6. When a _____ shows falling pressure, stormy weather might be coming.
7. Some houses have a wind _____ on the roof to give the wind direction.
8. We can measure moisture using an instrument called a _____ .
9. We can make a weather _____ using our own eyes.
10. A person who studies weather is called a _____ .

Weather Smart: Forecasting and Weather Instruments

Weather Symbols



1. The cold front is colored blue. The triangles show you which way it is moving. The cold front is the front of the cold air. It may make rain or snow showers.

2. The warm front is colored red. The half-circles show you which way it is moving. It is the front of the warm air and it may make steady rain or snow.

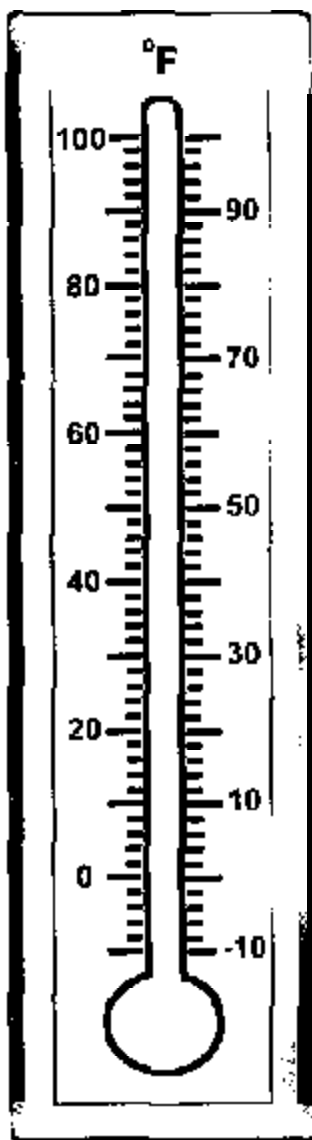
3. High pressure has wind that blows around it in the direction of a clock- that's called clockwise. It is colored blue and usually means dry, clear weather.

4. Low pressure is colored red and it has wind that blows around it in the opposite direction of a clock- counterclockwise. It usually brings cloudy, wet, or stormy weather.

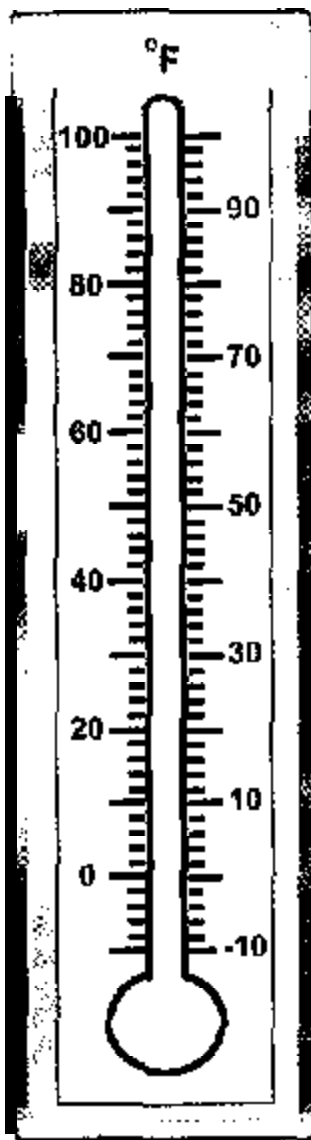
Weather Smart: Forecasting and Weather Instruments**Read a Thermometer**

Directions: Write the temperature in the box below each thermometer.

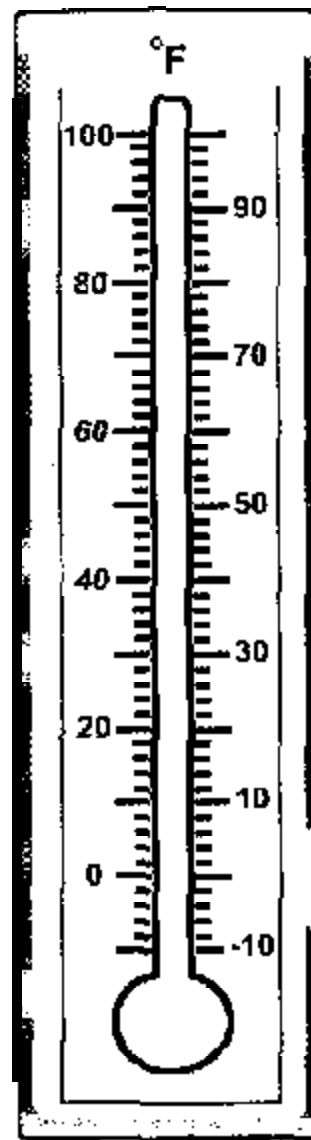
#1



#2



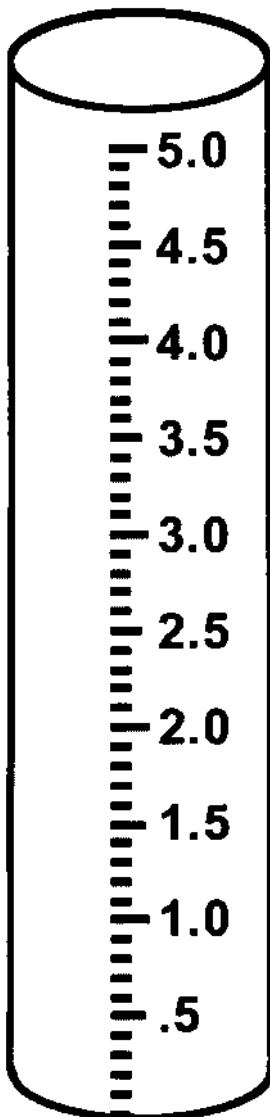
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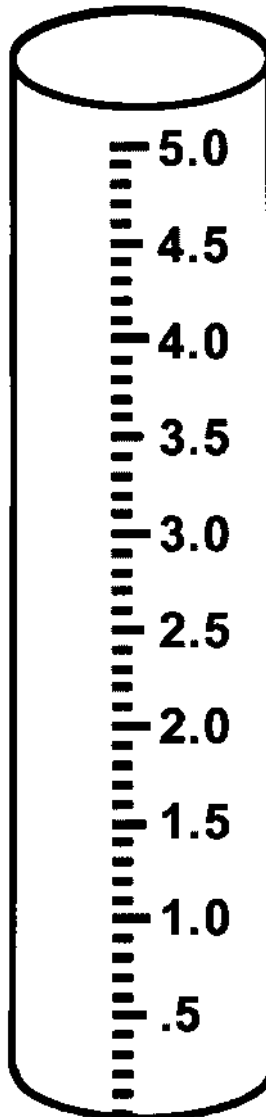
Weather Smart: Forecasting and Weather Instruments
Read a Rain Gauge

Directions: Write the rain amount in the box below each rain gauge.

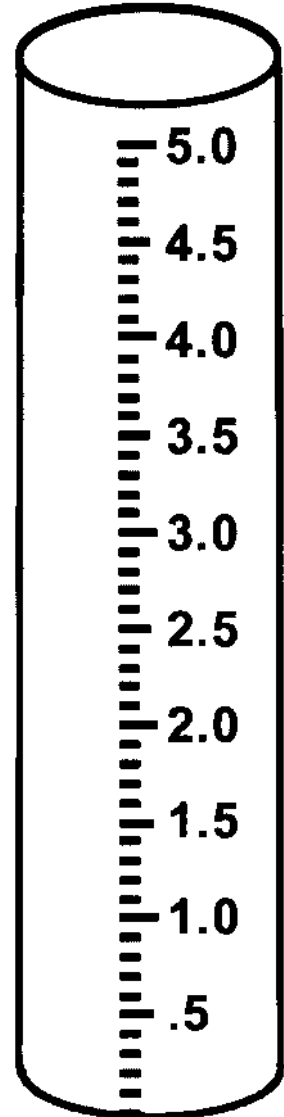
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#2



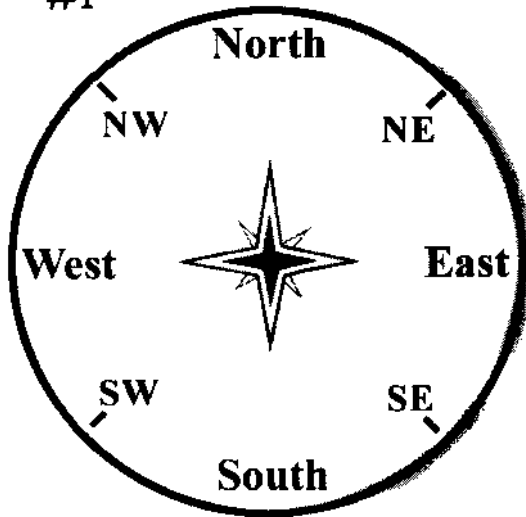
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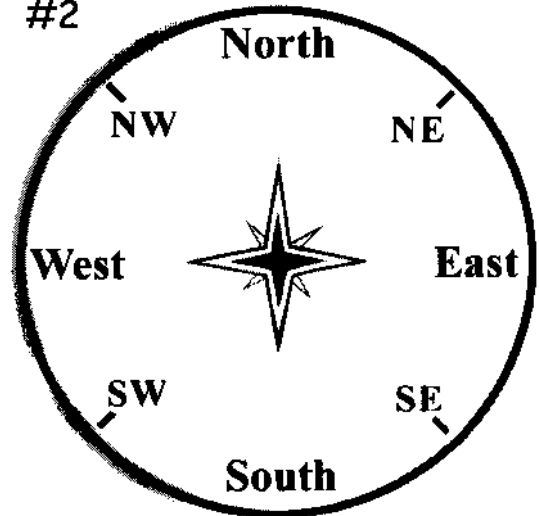
Weather Smart: Forecasting and Weather Instruments**Read a Compass**

Directions: Write the direction that the compass is showing.

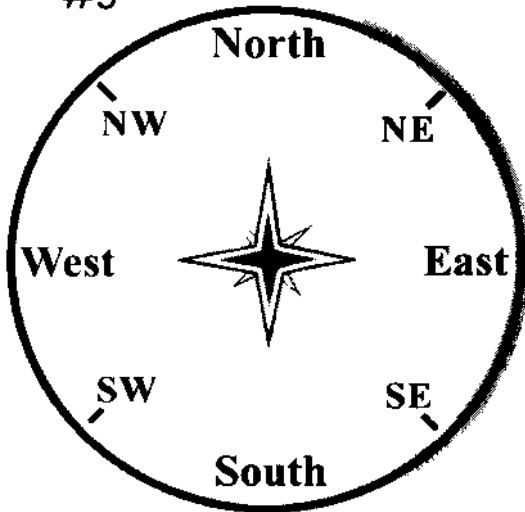
#1



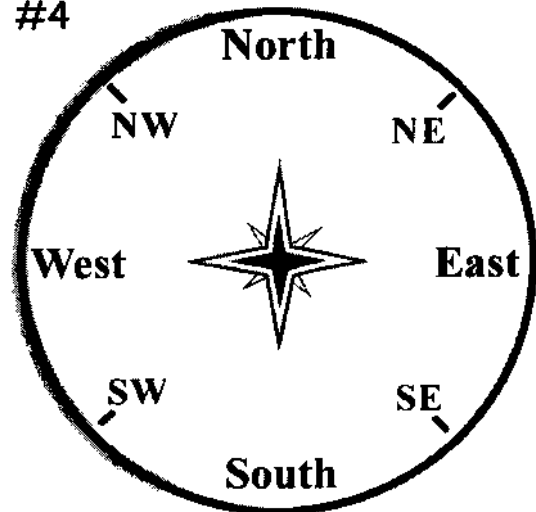
#2



#3

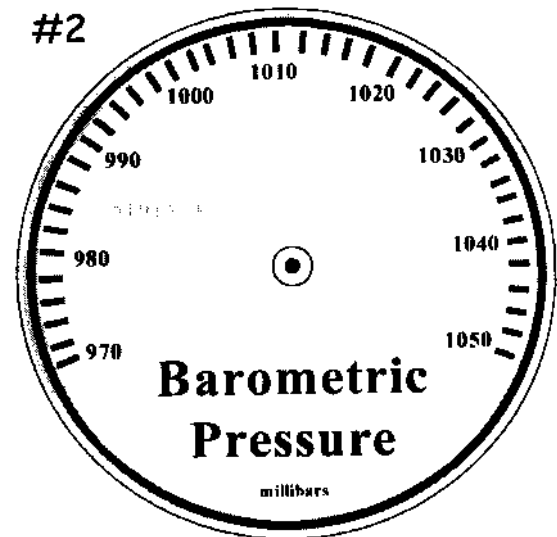


#4



Weather Smart: Forecasting and Weather Instruments
Read a Barometer

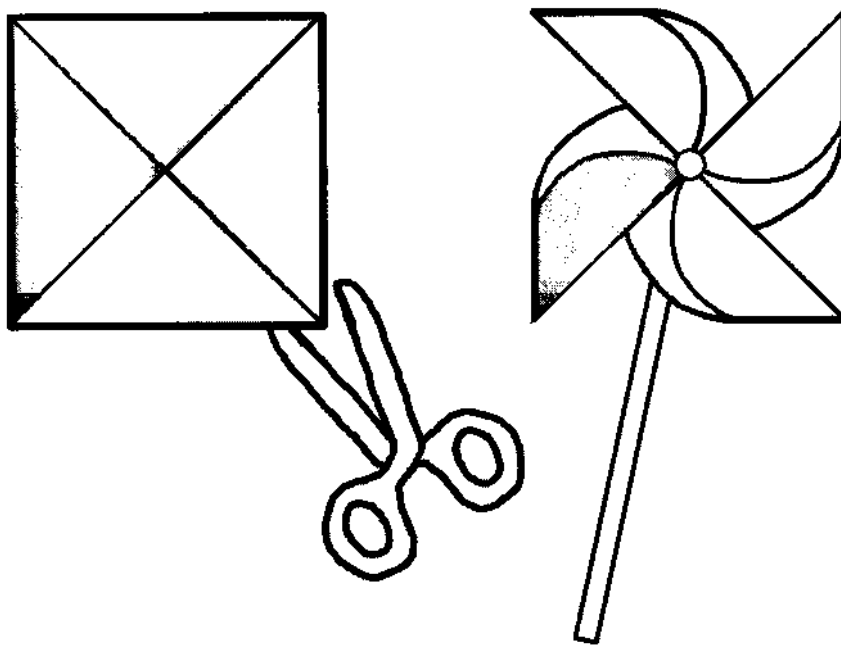
Directions: Write the air pressure that the barometer is showing.



Weather Smart: Forecasting and Weather Instruments
Watch the Wind

You need:

a square piece of construction paper
crayons
a tack
a pencil
scissors



Cut the construction paper into a square piece that is about six inches on each side. Draw lines from each corner to divide it into four triangles. Color each triangle with a different color. Use the scissors to cut about halfway from each corner to the middle. Fold back one part of each corner, as you see in the picture, to the center of the paper. Push the tack through all four of the folded corners into the eraser on the pencil. Hold it up to the wind and watch what happens.

Weather Smart: Forecasting and Weather Instruments**Sun or shade?**

You need:

two thermometers
a sunny day



Read both thermometers before you start and write down the temperatures. Leave one in the sun and place another in a shady spot. Wait five minutes and read the temperatures. Which one changed the most? Take another reading in 10 minutes and see which one is hotter.

When you are done, take the thermometers inside to let them get back to the same temperature. Then try the same experiment leaving one in the shade and one in a car parked in the sun with the windows rolled up. Where would you rather be on a warm sunny day?

Weather Smart: Forecasting and Weather Instruments
Weather Forecasting and Instruments Fun Facts

Human hair is good for measuring humidity. When the air is more humid, each hair gets a little longer.

A weather balloon can rise to more than 15 miles, or 23 kilometers, high.

Many barometers are filled with mercury but some of the earliest ones were filled with water or wine.

A good weather forecast can save money. If an airplane pilot knows where the best wind is, he or she can use it to help save fuel, time, and money.

The weather satellites that show us clouds can be more than 22,000 miles, or 36,000 kilometers, away from Earth.

Before people got electricity, most people didn't know what the weather might be for the next day.

Millions of dollars can be lost when a professional baseball game is rained out.

Storms spin the opposite way south of the equator as they do north of the equator.

Most weather information collected by different countries is shared around the world because weather crosses in and out of many countries.

When a weather balloon bursts, a parachute lets it fall safely to the ground.

Weather Smart: Forecasting and Weather Instruments**Internet Sites for *Weather Forecasting & Instruments***

National Weather Service kids links

<http://www.nws.noaa.gov/om/reachout/kids.htm>

Click on "Forecasting" to practice being a meteorologist. If you are you looking for a good weather science project to do, then this is a good place to start.

Interactive Weather Information Network from the National Weather Service

<http://weather.gov>

Get the latest weather and weather forecasts for any place in the United States. See clouds moving on a satellite picture and use the radar to help your family plan a trip.

The Franklin Institute online weather section

<http://sln.fi.edu/weather/>

Do more reading on weather readings and observe information on observations.

University of Michigan weather cameras

<http://cirrus.spri.umich.edu/wxnet/wxcam.html>

See the weather where you live or where your relatives live to help make a forecast.

The Globe Program student investigations

<http://www.globe.gov/fsl/welcome.html>

Learn what other students around the world are studying in weather. Click on "Student Investigations."

Sometimes the address for a website changes. When that happens, you can usually find it again by doing an Internet search for the title of the page.