

TEACHER'S MANUAL

We live on a dynamically active and changing planet, but what everyone must deal with every day is the weather. This Suitcase Program provides the materials and lesson plans for teachers of grades 3-5 with content and activities increasing in difficulty by grade level. Activities in this Suitcase Exhibit may assist in meeting the Tennessee State Standards.

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TENNESSEE STATE STANDARDS

3.PS1.1	Describe the properties of solids, liquids, and gases and identify that matter is made up of particles too small to be seen.
3.ESS2.1	Explain the cycle of water on Earth.
3.ESS2.2	Associate major cloud types (nimbus, cumulus, cirrus, and stratus) with weather conditions.
3.ESS2.3	Use tables, graphs, and tools to describe precipitation, temperature, and wind (direction and speed) to determine local weather and climate.
3.ESS2.4	Incorporate weather data to describe major climates (polar, temperate, and tropical) in different regions of the world.
3.ESS3.1	Explain how natural hazards (fires, landslides, earthquakes, volcanic eruptions, floods) impact humans and the environment.
4.ESS3.1	Obtain and combine information to describe that energy and fuels are derived from natural resources and that some energy and fuel sources are renewable (sunlight, wind, water) and some are not (fossil fuels, minerals).
5.PS1.1	Analyze and interpret data from observations and measurements of the physical properties of matter to explain phase changes between a solid, liquid, or gas.

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY I: The Sun's Heat

DURATION OF ACTIVITY: 60 minutes, A and B

LESSON OBJECTIVES

Students will observe temperature differences between objects that are exposed to the sun's rays at different angles

GUIDING QUESTIONS

What is temperature? How is it measured? What causes warm and cool temperatures? How do the seasons affect temperature?

TENNESSEE STATE STANDARDS

- 3.PS1.2 Differentiate between changes caused by heating or cooling that can be reversed and that cannot.
- 3.ESS2.3 Use tables, graphs, and tools to describe precipitation, temperature, and wind (direction and speed) to determine local weather and climate.
- 3.ESS2.4 Incorporate weather data to describe major climates (polar, temperate, tropical) in different regions of the world.
- 4.ETS2.1 Use appropriate tools and measurements to build a model.
- 5.ETS1.1 Research, test, re-test, and communicate a design to solve a problem.

MATERIALS INCLUDED

Skewer
2 digital thermometers
2 tin jar lids painted black
Demonstration Thermometer
Large balloon
In Supplementary Materials
(section of the Teacher's Manual):
Handout, "What Causes the Seasons?" fact sheet,
from Cosmic EdVentures, 2 pages
Handout, "Solar Energy" activity from Nature Activities,
Weather Watcher, 1 page
Handout, "The Seasons" activity, from Nature Activities,
Weather Watcher, 1 page

MATERIALS PROVIDED BY TEACHER

Flashlight
2 shoeboxes and dirt needed to fill them
1 orange
Sharpie marker
Small lamp without a shade, with a bare bulb
Globe

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY II: Evaporation, Condensation, and Frost

DURATION OF ACTIVITY: 2 parts (A and B), 30 minutes each

TENNESSEE STATE STANDARDS (A AND B)

- 3.PS1.1 Describe the properties of solids, liquids, and gases and identify that matter is made up of particles too small to be seen.
- 3.PS1.2 Differentiate between changes caused by heating or cooling that can be reversed and that cannot.
- 3.ESS2.1 Explain the cycle of water on Earth.
- 3.ESS2.3 Use tables, graphs, and tools to describe precipitation, temperature, and wind (direction and speed) to determine local weather and climate.
- 5.PS1.1 Analyze and interpret data from observations and measurements of the physical properties of matter to explain phase changes between a solid, liquid, or gas.
- 5.PS1.2 Analyze and interpret data to show that the amount of matter is conserved even when it changes form, including transitions where matter seems to vanish.

PART A: Invisible Water: Evaporation and Condensation

LESSON OBJECTIVE

Students will perform experiments that show how water evaporates and condenses

GUIDING QUESTION

What causes evaporation and condensation?

MATERIALS INCLUDED

Poster, "The Water Cycle"
Poster, "The Water Cycle, Nature's Recycling System"
Poster, "Types of Precipitation"
Book, Down Comes the Rain Hygrometer
Plastic canister
Glass bowl
Notebook, Weather. St. Louis: Milliken Pub. Co.
Book, **Nature Activities: Weather Watcher**
Handout, "Invisible Water" activity sheet from John Woodward's **Nature Activities: Weather Watcher** found in the Supplementary Materials

MATERIALS PROVIDED BY TEACHER

Cool water
Warm place, such as next to a heat vent

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

PART B: Winter Frost**LESSON OBJECTIVE**

Students will perform an experiment that shows how water vapor cools to form ice.

GUIDING QUESTION

What causes frost to form on grass, trees, other plants and windows on freezing mornings?

MATERIALS INCLUDED

Heavy aluminum can
Rock Salt

MATERIALS PROVIDED BY TEACHER

Crushed ice

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY III: Clouds

DURATION OF ACTIVITY: 30 minutes on background, 15 minutes per activity (Parts A and B)

LESSON OBJECTIVE

Students will watch experiments that cause clouds to form inside jars.

GUIDING QUESTIONS

What are clouds? How are they formed?

TENNESSEE STATE STANDARDS

- 3.PS1.1 Describe the properties of solids, liquids, and gases and identify that matter is made up of particles too small to be seen.
- 3.PS1.2 Differentiate between changes caused by heating or cooling that can be reversed and that cannot.
- 3.ESS2.2 Associate major cloud types (cumulus, cumulonimbus, cirrus, stratus, nimbostratus) with weather conditions.
- 4.ETS2.1 Use appropriate tools and measurements to build a model.
- 5.PS1.1 Analyze and interpret data from observations and measurements of the physical properties of matter to explain phase changes between a solid, liquid, or gas.

MATERIALS INCLUDED

Glass jars
Talcum powder
Balloons
Baggies
Rubber bands
Poster, "Clouds"
Poster, "Types of Clouds"
Poster, "The Water Cycle, Nature's Recycling System"
Book, **Cloud**, Book Plus Science Models, The Earth Science series
Book, *The Kids' Book of Clouds & Sky*
Book, **Nature Activities: Weather Watcher**
3 handouts, found in Supplementary Materials: "Kinds of Clouds," "Clouds," and "Naming Clouds" (These were copied from the back of the "Clouds" poster).

MATERIALS PROVIDED BY TEACHER

Ice cubes
Water
Matches
Black construction paper
Adhesive tape

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY IV: Wind, Parts A & B

DURATION OF ACTIVITY:

60 minutes to construct and learn to use wind vanes, then 15 minutes per day to record wind direction, for as many days as possible

TENNESSEE STATE STANDARDS

- 3.ESS2.3 Use tables, graphs, and tools to describe precipitation, temperature, and wind (direction and speed to determine local weather and climate.
- 4.ETS2.1 Use appropriate tools and measurements to build a model.
- 5.ETS2. Use appropriate measuring tools, simple hand tools, and fasteners to construct a prototype of a new or improved technology.
- 5.ETS2.3 Identify how scientific discoveries lead to new and improved technologies.

PART A: Making a Wind Vane

LESSON OBJECTIVE

Students will construct wind vanes and use them to record the wind direction over a period of days.

GUIDING QUESTIONS

Does the wind in one location usually blow from the same direction? What does it mean when the wind changes direction?

MATERIALS INCLUDED

Nova videos: **Lightning, Tornado, Hurricane**
Wire nuts, one per group
Thin wooden skewers, one per group
32 clothespins, 8 groups of 4
8 compasses
Six Way Weather Meter
In Supplementary Materials (section of the Teacher's Manual): Handout, "Make a Wind Vane" from **Nature Activities: Weather Watcher**

MATERIALS PROVIDED BY TEACHER

Thin poster boards, 8.5" X 11", 1 per group
Pencils, 2 per group
Scissors, 1 pair per group
Pennies, 2 per group
Masking tape to share among groups
Long dowels or bamboo poles, 1 for each wind vane

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

PART B: Learning to Use an Anemometer: Constructing a Beaufort Wind Scale**LESSON OBJECTIVE**

Students will learn to use an anemometer to measure wind speed. Students will each make a Beaufort Wind Scale spinner and record the wind speed for several days.

GUIDING QUESTIONS

How can the wind be measured? What is the Beaufort wind scale? How does wind speed affect the forecast?

MATERIALS INCLUDED

Wind Wizard Wind Speed Indicator
Anemometer
Six Way Weather Meter
Videos: **Wild Weather: A NOVA Classroom Trip:**
Hurricane! Tornado! and Lightning!
Book, *The Kids' Book of Weather Forecasting*.
Jar of bubbles
Paper plates
Fine-tip markers
In Supplementary Materials (Teacher's Manual):
Handout, "Make a Beaufort Scale Spinner" from
The Kids' Book of Weather Forecasting
Handout, "Breeze or Gale? Check the Beaufort Wind Scale"
Handout, "Beaufort Scale" Handout, "Wind,
What Are You Bringing Us?"
Teacher's Page: Directions for Wind Wizard Wind
Speed Indicator

MATERIALS PROVIDED BY TEACHER

2 sheets of heavyweight paper per student
Rulers for each student
Protractors for each student
Scissors for each student
Brad nails for each student
Overhead projector
Electric fan

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY V: Rising Warm Air and Thermals

DURATION OF ACTIVITY: 30 minutes

LESSON OBJECTIVE

Students will watch an experiment with water to see how warm air rises.

GUIDING QUESTIONS

Why does warm air rise?

TENNESSEE STATE STANDARDS

- 3.PS1.2 Differentiate between changes caused by heating or cooling that can be reversed and that cannot.
- 3.PS1.3 Describe and compare the physical properties of matter including color, texture, shape, length, mass, temperature, volume, state, hardness, and flexibility.
- 3.ESS2.1 Explain the cycle of water on Earth.
- 4.ETS2.1 Use appropriate tools and measurements to build a model.
- 5.PS1.1 Analyze and interpret data from observations and measurements of the physical properties of matter to explain phase changes between a solid, liquid, or gas.
- 5.PS1.2 Analyze and interpret data to show that the amount of matter is conserved even when it changes form, including transitions where matter seems to vanish.

MATERIALS INCLUDED

Poster, "The Water Cycle, Nature's Recycling System"
Enamel pan
Small ceramic cup
Food coloring
Plastic wrap
Rubber bands
Plastic canister
Handout, "Rising Warm Air" from **Weather Watcher**,
in Supplementary Materials

MATERIALS PROVIDED BY TEACHER

Pitcher or bottle of cold water
Pitcher or bottle of hot water
Scissors and knife (for teacher's use only)

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

SUITCASE EXHIBIT INVENTORY CHECKLIST

School: _____

Check Out: _____

Return Date: _____

MoSH Check In:	Teacher Check In:	Item	Books/Videos/Posters	Teacher Return:
		A	Teacher's Manual	
		B	Book: Milliken Transparencies	
		C	Book: Eyewitness Books Weather	
		D	Book: The Kid's Book of Clouds	
		E	Book: The Kid's Book of Weather Forecasting	
		F	Book: Feel the Wind	
		G	Book: Down Comes the Rain	
		H	Book: Weather!	
		I	Book: Nature Activities Weather Watcher	
		J	Pamphlet: Weather Boy Scouts of America merit badge series	
		K	Book: Magic Tree House-Twisters	
		L	Poster: The Weather	
		M	Poster: Water Cycle: Nature's Recycling System	
		N	Poster: Cloud Chart	
		O	Poster: Types of Clouds	
		P	Poster: Weather Forecasting maps	
		Q	Poster: Types of Precipitation	
		R	Poster: Earth's Atmosphere	
		S	Poster: Water Cycle	
		T	Poster: Clouds	
		U	Chart: School Days Forecast	
		V	Chart: Today's Weather	
		W	Booklet: Wild Weather (goes with NOVA videos)	
		X	Video: NOVA Tornado	
		Y	Video: NOVA Hurricane	
		Z	Video: NOVA Lightning	

SUITCASE EXHIBIT INVENTORY CHECKLIST

MoSH Check In:	Teacher Check In:	Item	Books/Videos/Posters	Teacher Return:
		1	Demonstration thermometer	
		2	Six-way weather meter	
		3	Clamp (for six- way weather meter)	
		4	2 sets of plastic canisters with lids	
		5	Science model: Cloud (book plus)	
		6	Compact scale	
		7	2 enameled rectangular pans	
		8	10 Metal thermometers (water cycle kit)	
		9	10 clear containers with slotted lids (water cycle kit)	
		10	5 Metal cans (water cycle kit)	
		11	2 plastic spoons (water cycle kit)	
		12	sponge (water cycle kit)	
		13	Hygrometer	
		14	Tongs	
		15	Weather symbols (set of 61)	
		16	5 Sheets of removable stickers	
		17	Inflatable catch ball	
		18	Balloons (bag)	
		19	Marbles	
		20	Bubbles	
		21	Red food coloring	
		22	Rubber gloves	
		23	Bamboo skewers	
		24	Chopsticks- 1 set	
		25	Dry erase markers- set of 4	
		26	Stopwatch	
		27	Glass bowl	
		28	Small ceramic cup	
		29	Barometer	
		30	10 Sling psychrometers	
		31	Compasses	
		32	8 Digital thermometers	
		33	2 Black jar lids	
		34	Container of wire nuts	
		35	10 laboratory thermometers on white plastic	
		36	Tornado tubes	
		37	Anemometer	
		38	Box of rock salt	
		39	5 plastic plates	
		40	32 clothespins	
		41	Talcum powder	
		42	Package of paper plates	
		43	Box of baggies	
		44	Bag of rubber bands	
		45	Wind Wizard wind speed indicator	
		46	Saran Wrap	