FIRST GRADE
6 lessons

1

HELPING HANDS SCIENCE

Joint project
Fremont Unified School District
and Math Science Nucleus

Comments or correction please contact
msn@msnucleus.org

These are suggestions on how to use the materials with your students. The materials are set up so you can easily put out the materials. Make sure the students do not destroy materials. Many times the material can stay in the bag and a hand lens can be used for observation. Please put materials back the way you found them so all children at your school can enjoy them.

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Curriculum customized for FUSD by MSN

HELPING HANDS SCIENCE (FUSD) - FIRST GRADE

1

LIFE

Chapter	***Lab description and/or box label***	***Materials***	***Storybooks or slideshow (on http://msnucleus.org)***
Plants	1.1. Seeds – dispersal of seeds in environment Life Cycle – Plants 1A	3 bags of 8 specimens	*What is a tree?* (storybook) Plants General (pdf) (slideshow)
Animals			
Living Things meet their needs			*Working on the Food Chain (*storybook)
Kinds of Environments	1.2 Land and Water – comparing environments Life Cycle – Natural Environment 1B	3 bags of branch, clams, moss, mammal, seaweed, seastar, insect	*Phoca the Traveling Harbor Seal* (storybook)

EARTH

Weather	1.3 Reading a thermometer	Thermometers cups	*Drippy the Hippie* (storybook) *Weather Lores Clouds*
Seasons	1.4 Seasons/Day and Night	Inflatable World Globes	Searching the Universe (section on planet movement)

PHYSICAL

Solids, Liquids, and Gases	1.5 States of Matter - how lava changes to different states	Baking soda, vinegar, droppers	*Lucy Lava* (storybook) What is matter? Slideshow
Changes in Materials	1.6 Water Changes – ice, steam, and liquid water	small play dough, 1 dice, 1 sticky substance, 1 liquid timer, 1 bubble per 5 stations Ice cubes, baggies	*Give Water a Second Chance* (storybook)

SEEDS– FIRST GRADE

1.1

OBJECTIVES:

1. Comparing different types of seed dispersal.
2. Distinguishing the components of

VOCABULARY:

germination
seed coat
seed
spore

MATERIALS:

Seeds – First (LIFE CYCLE - PLANTS 1A)
Hand lenses

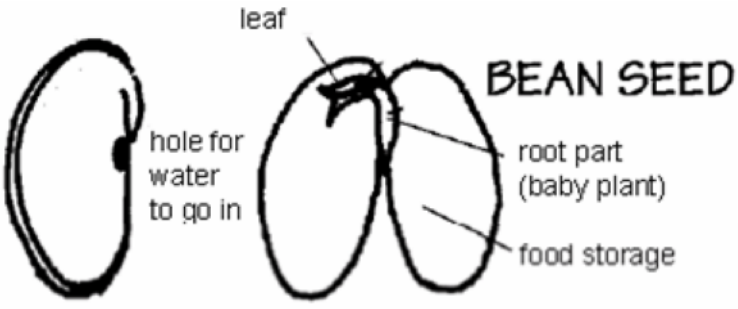
STORYBOOK: What is a tree?
SLIDESHOW: Plants (only parts) (pdf)

BACKGROUND:

Seeds are wonderful little incubators for new plants. It seems like seeds know which way should face the sun and which way the roots should grow. Children are amazed when they actually follow a seed germinating to watch the leaves and roots grow. However, this observational task requires patience and time. As the plants grow, it is very instructive for students to look at the sides of the glass to see the roots and leaves start to grow.

Plants are an important food source for animals. Plants, like all other organisms, have developed unique strategies for reproduction. Most plants produce seeds, which are plants waiting to grow but which have the capacity to wait a long time before they begin the growth cycle. The first step in seed germination is the absorption of water through a small opening called the micropyle. The introduction of water through the pore causes the seed to swell. Placing a bit of candle wax over the pore will demonstrate that the seed will not swell when introduced into water. Many seeds will swell dramatically as the water enters, and you will notice a sweet, almost fermenting odor in the water after seeds have been soaked overnight (this is from enzyme action).

Seeds insure that plants will continue to live on this Earth. It may take years before a seed will germinate, but this is a survival strategy. Plants have developed different methods to make sure their seeds find a suitable location to grow. Since plants themselves are not mobile they must have a



mechanism to disperse, otherwise, all plants would grow in one area.

There are four basic methods of seed dispersal including by wind, by attachment to fur or feathers, by passing through an animal's gut, or by animals moving the seeds. Wind dispersal allows seeds to travel with the wind. Sometimes the distance that seeds travel can be long. For instance, if a seed gets into the upper atmosphere it can travel along the jet stream and travel hundreds, if not thousands of kilometers. Attachment to the fur of mammals or the feathers of birds helps seeds to "walk" or "fly" to a new location. The seeds may drop and fall into a suitable location to grow. When an animal eats a seed, sometimes its stomach cannot digest the outer portion of the seed and the seed is passed through the animal's digestive system intact. Some animals move seeds purposely for storage and later consumption. Animals can drop seeds by mistake resulting in germination at that spot.

Seeds may be scattered by wind, water, animals, or propulsion. Animals may spread seeds by a variety of ways such as by eating hard seeds which pass through the animal's digestive system unharmed or by picking up seeds on their coats and feathers. The propulsion method results when the seed covering opens in such a way that the seed shoots out. In many cases it is possible to look at a seed and figure out which method is used. For instance, if a seed has feathery extensions (like dandelions), then it can be sail through the wind, looking for a suitable place to germinate (grow).

PROCEDURE:

1. Use the Plants General to go over what is a plant. You do not need to use the entire slideshow, just portions.

2. Ask students how many have grown a seed. If there is not many in your class you might want to do the following. If you feel the students understand a seed go to step 4.

Instruct students to bring in some seeds from home (dried beans, corn, or seeds that might be found outside). Lentils will grow germinate in a week with appropriate warmth. Have them put the seed in a moist environment and try to get the seed to germinate. You will need clear plastic cups. Wet the cotton and put seed so you can see it through the cup and tape it to the cup. Keep the seeds moist, if they have too much moisture they will rot. They just have to be in a warm area, not sunlight. Have students look at it grow with a hand lens. It may take a while to germinate.

It will help the children to focus on what is actually happening if they are asked to answer a few questions as they observe the growth. The following are suggestions:

a. What kind of seed begins growing first?
b. Does the root or the stem begin growing first? (The root is first, normally, although sometimes they seem to grow at the same time.)

c If the seed is planted upside down, will the plant grow upside down? (No, the plant can sense gravity. The roots will grow down, eventually, and the stem will start up. You may be able to see some initial growth in the opposite direction.)

d. When do the root hairs appear? (Variable)

e. What happens to the food supply? (The part that stores the food will shrink as the food is used up and the root takes over feeding the plant.)

f. Does the part that stores the food stay below ground? (On corn and peas, yes. On beans, supposedly not.)

g. Can you see the leaves when the stem first appears? (Not really. The corn leaf is encased in a sheath to protect it on its trip through the soil. This sheath is actually the seed leaf. The bean leaf should be hidden between the two seed leaves until it gets above ground. Pea leaves you can see.)

h. Are the seed leaves shaped like the other plant leaves? (Not usually. They are not as well developed and specialized as regular leaves.)

i. Do the shoots come straight up or are they hooked to protect the growing tip? (Straight up on corn, hooked on beans and peas.)

j. Are the leaves green when they first appear? (Usually yellow until they are exposed to light.)

k. What happens to the seed coat? (It's discarded.)

Remember growing seeds is an observational lesson and should be done over a period of weeks. At the beginning the children should observe their beans every other day. Once the seed coat has been broken, the miracle of growth should be watched everyday.

4. Discuss the four major methods of seed dispersal including by **wind dispersal, by attachment to fur or feathers, by passing through an animal's gut, or by animals moving the seeds.** Give the children at least one seed using each method of dispersal and see if they can guess which one uses which method. Remember some can be more than one.

corn seed (passing through gut, animal moving seed)

dandelion or other fuzzy seed (wind dispersal)

spores (wind dispersal)

maple, sycamore, conifer (food for animals, wind, gut)

elm seeds (wind dispersal)

burrs or other seeds that can attach to fur or feathers (or socks) (attachment)

berry, cherry, apple and/or orange seeds (pass through animals, or stick to beak of birds, like berries)

acorns, other nuts (squirrels hide them and forget)

dried pea pods and other propulsive seeds (the two sides of the pod dry unevenly, so that the pea flips out)

5. In the lab: Place the contains of the bags in 3 areas and have groups of 6-7 children work on each group. Divide the materials depending on how many students you have and tables.

6. Have students look at specimens and determine why they are labeled. You may want to have the students look at them first and then have a group discussion. For example. We do not recommend opening the baggie. The students can use a hand lens to look at them in more detail In the material there are 3 bags of 8 specimens.

a. Animal - these are usually seeds that are large and an animal would have to break them to get the "meal"

b. Wind dispersal - these seeds usually are small with some kind of apparatus that would allow the wind to move them

c. Attachment – these seeds would attach to something like fur or even a person, these are the easiest to determine because they would get stuck to you or a pet

d. passing through gut – these are usually seeds that are too heavy for the wind but small enough that an animal would eat many of them, and some will survive the journey through the animal

7. Read *What is a Tree?* (electronic storybook on line http://msnucleus.org..(click on Storybooks) and go over the purpose of a seed

8. On the way back from the lab, see if you can identify any kinds of seeds. You may want to walk around the playground if you have appropriate vegetation. If you have the students starting to look for seeds, they will see them for the rest of their life. You can extend the lab by having students bring back a seed that they found.

LAND AND WATER - FIRST GRADE

1.2

OBJECTIVES:

1. Comparing land and water organisms.
2. Distinguishing characteristics of land and water organisms.

VOCABULARY:

aquatic
environment
land
marine

MATERIALS:

Lab sheet
Land and Water (Life Cycle - Natural Environment 1A)
hand lens

STORYBOOK: Phoca the Traveling Harbor Seal

BACKGROUND:

There are many different places on Earth where organisms can live. These areas can be called an organism's environment. There are mountains, valleys, trees, snow, and water environments as well as hot and cold climate environments. Different types of organisms can live in similar environments. Animals, plants, and other organisms are adapted for living in certain areas of the world. For examples, whales have blubber so they can withstand cold temperatures and other mammals grow fur which protects them from the cold.

Different organisms have physical limits that make them more adapted to an environment. Birds fly so they have hollow bones and feathers which help them to fly. Large animals need support to walk so they have backbones and legs. It seems that all organisms have a place in this world and are adapted to fit into their own special place. Imagine a whale having legs or an animal having roots, this just doesn't happen.

There are two very different environments on this Earth, land and water. The organisms that live in these environments have very similar requirements. Organisms that live on land need to develop a way to combat gravity. They need legs or wings if they want to move. A tree develops a way to get water to move upwards (against gravity). Organisms in water use water to support their body so they tend to be more hydro1dynamically designed.

Students have learned that there are different types of environments, but mainly

fewer than two big divisions land and water. An environment in which an organism lives can be described by temperature, wind, and other physical components as well as the biological components.

The aquatic or water environment has many divisions including fresh, salt (marine), and brackish (fresh and salty) water. The land environment has many subdivisions also, including air, rock, sand, and soil. Some of the land environments must include being close to a source of fresh water.

PROCEDURE:

1. Make a list of those animals that live on land versus those that live on water. Name some of the animals and have them locate where they live. You will notice that many animals on land need to be near water.

2. Read *Phoca the Traveling Harbor Seal*

3. Instruct the students to look again at the animals and try to see how the organisms are fundamentally different. Try to get their ideas on the board, which should resemble the table below.

LAND	WATER
* large animals have backbones	* smaller organisms
* fur and hair	* have gills
* plants with roots/leaves	* blubber
* big animals	* small plants
* legs	* streamlined
	* flippers

4. Make sure you go over the words with students and discuss each of the items before and after you give students their packets. You many want to include other pictures that students can classify.

In this lab the students will look at their packets included in the module and try to determine if the organisms came from aquatic or land environments and then they will try to figure out why the organism lives in his particular environment.

5. Students should use their hand lens to observe the organisms. Instruct students to draw a picture of the type of environment in with the item comes from. If they think it is the marine environment, have them make a picture of the ocean.

6. The following background information on each of the components can help you give clues to the students.

Branch: This is part of a tree. Trees are adapted to the land environment. They can get their nutrients and water from the soil, and then transport them through the tree.

Clams: Live in the marine environment. The shell helps protect clams from organisms that eat them and to keep them clean from mud in which they live. Clam shells also have different shapes that help them burrow more efficiently.

Moss: A land plant that needs to be wet all the time with fresh water. Notice that the roots are small.

Mammal: (Plastic Model) Has a backbone that supports its body while walking. Legs are present only on land mammals so they can walk.

Seaweed: Present in the water environment, usually with gas bubbles to help it float. There is no need for roots. Many seaweeds are green, but some are red or brown. They are all able to make their own food.

Seastar: Live in the marine environment, usually in clear water.

Insect: is small, can fly in land environment, appendages for walking

LAND AND WATER - FIRST GRADE

	DRAW TYPE OF ENVIRONMENT
BRANCH	
CLAMS	
MOSS	
ANIMAL	
SEAWEED	
SEASTAR	
INSECT	

READING A THERMOMETER -FIRST GRADE

1.3

OBJECTIVES:

Discovering how to use a thermometer.
Recording information on temperature.

VOCABULARY:

temperature
thermometer

MATERIALS:

thermometers
cups
Weather Lores (storybook)
Clouds (storybook)
Drippy the Hippy (storybook)

BACKGROUND:

There are four key elements of weather including temperature, moisture, pressure and wind. **Temperature** refers to how the Sun rays warm up our atmosphere. In the winter the angle of the Earth is tilted away from the Sun. During the summer the Earth is titled toward the Sun, making the rays of Sun more powerful to heat the atmosphere. **Moisture** would include rain, snow, hail, and dew. **Air pressure** can either be low pressure or high pressure. Low or light pressure usually signals rainy weather while high or heavy air signals sunny weather. **Wind** is created when different air pressures are near each other. This creates a movement of low pressure moves to high pressure.

The elements work together to give us different weather conditions. A change in one element usually causes a change in the weather.

Changes in temperature can be felt when any living organisms touches an ice cube or feels fire burning. It wasn't until the 17th century in Italy that **meteorology** became a science. **Galileo Galilei** made the first thermometer around 1600. **Gabriel Fahrenheit**, a German instrument maker invented in 1714, put mercury in a glass tube and created a scale of temperature and called it a thermometer. His name is still used for the English system of reading temperature. In devising a scale he used zero as the lowest temperature obtainable with a mixture of ice and common salt, and first proposed to divide the interval between this temperature and that which is normally found to characterize the blood of a healthy man into 12 divisions. In other words, some arbitrary points which had significance in a real world.

The **Celsius** (historically **centigrade)** thermometer, which most countries now use is based on freezing of water and boiling of water as its end members. **Anders Celsius** (1701-1744) a Swede, first proposed the use of the intervals that are now in wide use on the Centigrade thermometer. The thermometer is based on 0º for freezing and 100º for boiling of water. Water is used because of its importance to our everyday lives.

Thermometers are useful in our everyday life. Students are familiar with their parents watching the morning news for information on the temperature. It helps them decide what to dress for the day. Temperature is a practical thing to know!

Many thermometers use mercury in a glass chamber. Mercury is an element that is liquid at normal temperatures and very sensitive to heat and cold. However, many thermometers today may have different substances in them. For instance, mercury with a little bit of nitrogen in it, will be more accurate and longer lasting. In schools, mercury thermometers have been banned by many school systems. Mercury, if ingested by children, can cause long term nerve damage. So many school thermometers have what many refer to as "spirit thermometers." The spirit is usually methyl alcohol, which is also sensitive to heat and cold.

PROCEDURE:

1. Ready Drippy the Hippy and go over the elements of the water cycle. Water is important to the weather. Have a glass of water out so students can taste, smell, feel, and hear water. Just have about 1/8 full of water, so they can swirl it. When they smell it have them cup their hands and push the smell to their nose. This is how chemist smells unknown substances. It is one of the most unique substances known to humans. Try to dramatize

2. Read Clouds to students and then go outside. Have the students identify the clouds. If there are no clouds, have them report when there are clouds.

3. Ask students where they would normally measure temperature around the house. Make a list of these places which should include the following: oven, heater temperature, refrigerator, and fevers.

4. You may want to tell students that the thermometer used to find your body temperature should not be used to measure ovens or refrigerators. Thermometers are made to measure different things.

5. Measuring temperature can be exciting for students. Just to see the "red" liquid move up and down is somehow magical for children. In this exercise have the students will use a thermometer and measure temperatures in areas. You can use Celsius or Fahrenheit, but scientists use Celsius. Have students label the degrees that are on the thermometer they are using.

6. You may want the students to predict which one is hot and which ones are cold before they start measuring with the thermometers by putting their fingers in the cup. We do not suggest using hot boiling water

7. Tell the students to put the thermometer in the different containers and watch the red line go up or down. They should record the information on their lab sheets. On the worksheet there are 3 thermometers that the students can record. You determine what the student's measure. Students should write in

the numbers, so you can use either Fahrenheit or Celsius. Use a crayon to color the correct temperature. If you want more than 3 stations you may want to provide students with more worksheets.

We suggest you have the students put the thermometer under their arm. If you have a refrigerator, put it in there for about 3 minutes and have the students read it. If you have ice, you can put it in a cup and have the students put the thermometer next to it. Please note if you submerge the thermometer it might break with the ice.

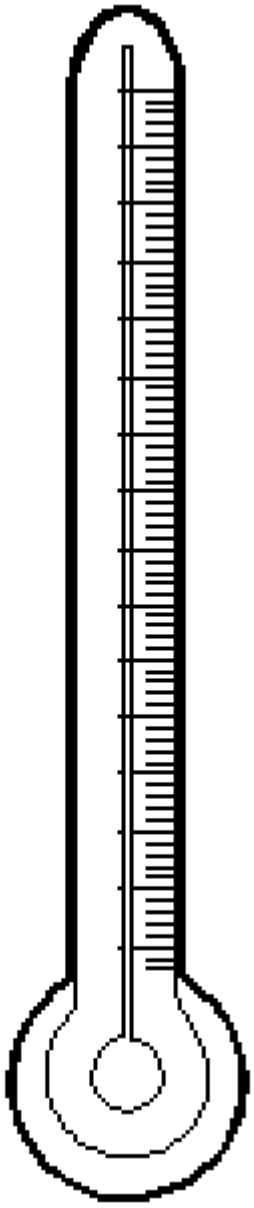
8. If you have an outside thermometer you should measure the temperature outside over the next few days. Make sure the measurements are taken at the same time each day. Talk about which days were coldest, which were warmest, and which were the most comfortable.

9. You will probably use a glass thermometer for this exercise. Caution the children to be careful. Do not push the thermometer into anything. But if a child does break one, tell them to tell you immediately. If the thermometers are alcohol, they will not cause any damage. In most place mercury thermometers for elementary age students are prohibited.

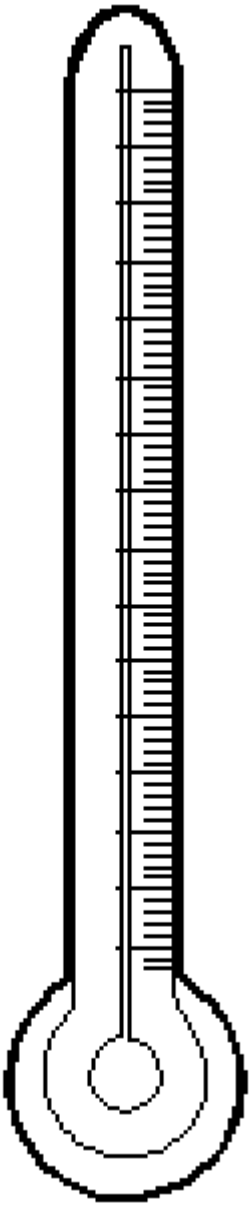
10. You may want to use the worksheet to go over the 4 elements of weather, emphasizing that temperature is one of the elements. We have included 2 versions of a thermometer, depending on your students. Read "Weather Lores" so students can see different types of weather.

NAME _____

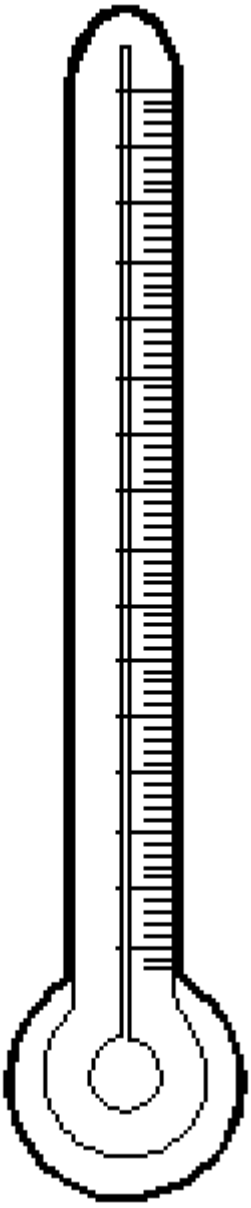
ROOM TEMPERATURE



UNDER ARM



REFRIGERATOR



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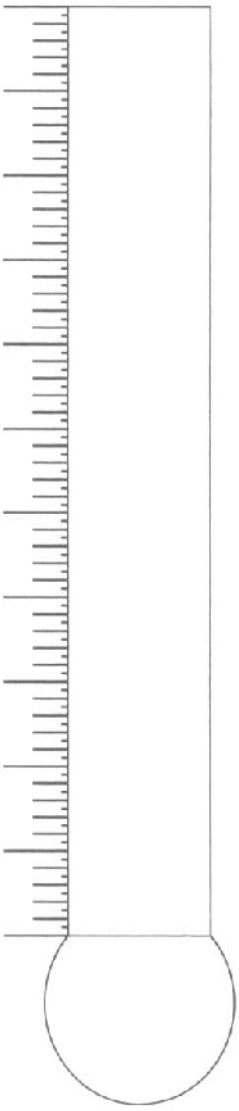

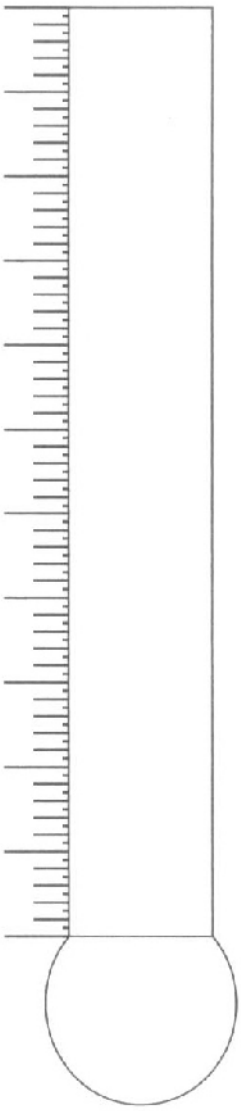

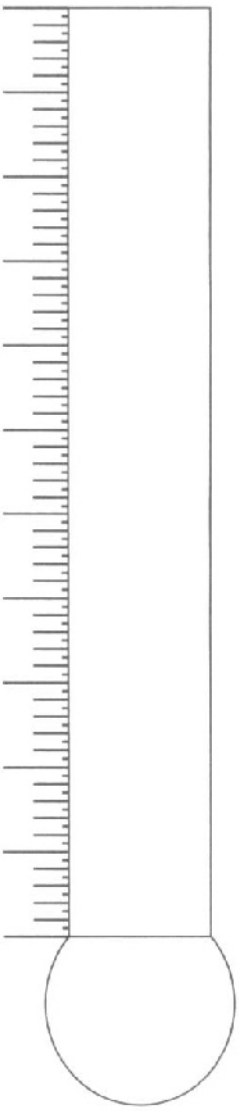

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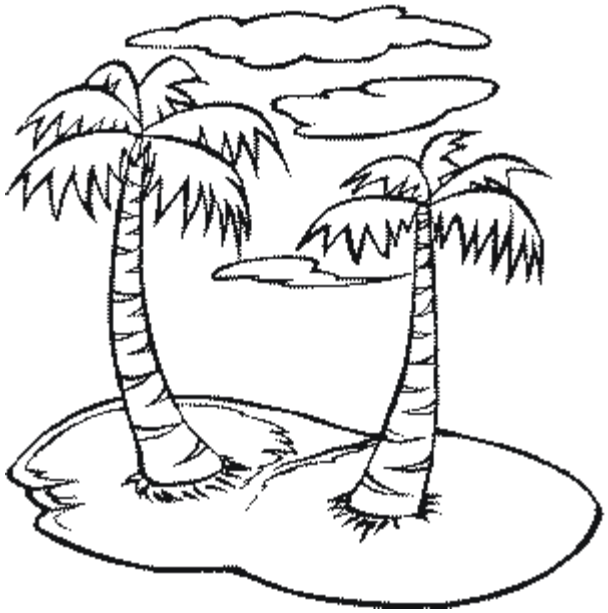
FOUR ELEMENTS OF WEATHER

TEMPERATURE

WIND

AIR PRESSURE



MOISTURE

SEASONS -FIRST GRADE

1.4

OBJECTIVES:

Discussing what creates seasons.
Comparing seasons with day/night cycle.

VOCABULARY:

axis
east
north
season
south
tilt
west

MATERIALS:

inflatable globes
Searching the Universe (slideshow – portions)

BACKGROUND:

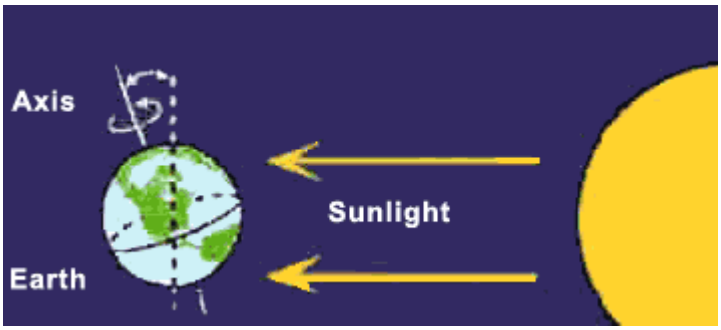
The Solar System and all its planets are in constant motion. Each of the planets revolves around the Sun. The planets also rotate, or spin, around an internal axis. One manifestation of rotation is the cycle of night and day. Day after day, month after month, year after year, the alternation of night and day continues. Sometimes it is sunny outside, and other times it is dark. In addition to rotation, day and night occur because the Earth is spherical. When a portion of the Earth faces the Sun, it is daytime. When the same are rotates away from the Sun, it is nighttime. The cycle of light and dark is continuous except near the North and South Pole. During the Northern Hemisphere summer, the North Pole always faces the Sun, so daytime is continuous for several weeks. At the same time, the South Pole faces away from the Sun (Southern Hemisphere winter) and is in continuous night.

The origin of night and day is very difficult for children to understand. The idea that the dark side is really a shadow of the planet as it rotates away from the Sun's rays is difficult to imagine. The rotation of the Earth on its axis, is also not easy to understand, because we cannot feel this motion.

The Earth is always rotating, spinning eastward. We do not sense this motion, however, because everything else on the Earth's surface is moving as well. There is no independent frame of reference for observing rotation. Viewed from space, however, the Earth is clearly spinning. A point on Earth takes 24 hours to complete one rotation and come back to its starting point. The Earth spins completely once in 24 hours or in 1 day. The axis is the internal line around which the Earth rotates. The axis is tilted 23.5^{o} from an imaginary vertical line drawn through the Earth.

Light rays from the Sun touch only the side of the Earth that is facing the Sun. While the Earth is spinning on its axis, it is also revolving around the Sun.

Rotation on the Earth's axis at 23.5^{o} from vertical and revolution also cause the seasons. This means that solar energy strikes the Earth unevenly. It is summer in the Northern Hemisphere when the North Pole tilts toward the Sun. This puts the Sun more overhead, so solar energy strikes the Earth most directly. In half of a revolution the North Pole tilts away from the Sun, making solar energy least direct, so it is winter.



Summer in the Southern Hemisphere, winter in the Northern Hemisphere

A season is one of the four periods of the year including spring, summer, autumn, and winter. Seasons are defined in two ways. Climatic seasons reflect changes in temperature, weather, and the length of daylight. The length of climatic seasons varies, for example at high northern latitudes winter is relatively long and summer is relatively short.

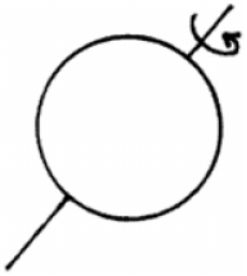
Astronomical seasons are defined by the position of the Sun with respect to the Earth. Because the Earth's rotational axis is tilted 23.5^{0}, the overhead position of the Sun changes throughout the year. The Sun appears to migrate more overhead in summer, and less so in winter. For the Northern hemisphere, the astronomical summer begins on the summer solstice, which is the day the Sun reaches its most northern, most overhead position. As the Sun moves back south, it comes directly over the equator. This marks the autumnal equinox, or the start of astronomical autumn. When the Sun reaches its southernmost point below the equator, it is the winter solstice, or the start of the winter season. Finally, as the Sun moves back north, it again crosses the equator. This is the vernal equinox, and the start of spring.

The climatic seasons correspond to the astronomical seasons because the Northern hemisphere is warmed when it is close to the summer solstice, because the Sun is more directly overhead. Likewise, the Northern Hemisphere grows cool as the Sun moves south, and the seasons transition through fall and into winter.

PROCEDURE:

1. To illustrate rotation and revolution, draw the following pictures on the board. Explain that the Earth rotates on its axis, but revolves around the Sun at the same time. Explain that night and day is caused by rotation, and that the seasons are caused by the tilt of the axis and the revolution around the Sun.

Revolution (around another body)



Rotation around an axis

3. Have the students stand up, and rotate or spin. Make sure they understand that this is rotation.

   Have students work in pairs. Have one student revolve around the other. Explain that this is revolution.

4. Tell the students that the Earth rotates as it revolves around the Sun. Ask them to figure out what these motions will look like, using one pair of students. Don't let them do these activities for too long or else you will have many dizzy students!

5. Show the inflatable globe to the class. The globe shows the oceans and land masses. Have them find the general area where they live. Ask students questions using the globe and have them locate with their finger: You may want to make a game, and the first group that finds the area gets a point… at the end the group with the most points wins. For example:

   Find the Pacific Ocean, Atlantic Ocean, Indian Ocean
   Find the different continents (please note that Europe and Asia is really 1 continent - Eurasia)
   Find the United States, find California

   Point out that the globe is tilted, and explain that this is because the Earth is tilted on its axis relative to the Sun. Explain how this causes the seasons. Some students may notice that when the northern hemisphere tilts away from the Sun, the southern hemisphere tilts toward the Sun. Explain that our summer season is the winter season in the southern hemisphere.

   Ask the students where the Sun comes up every morning. They should have the sense that it always rises in the east. Ask them about sunset. Again, they may know that the Sun sinks in the same general area all the time. Explain that in reality, it is not the Sun that moves, but the Earth. As the Earth rotates toward the Sun, we experience sunrise, and as it rotates away, we experience sunset.

MATTER - FIRST GRADE

1.5

OBJECTIVES:

Exploring the states of matter.
Experimenting with a chemical change.

VOCABULARY:

chemical change
gas
liquid
matter
solid

MATERIALS:

baking soda
vinegar
eyedroppers
red food color (optional)
clay (optional)
Lucy Lava (storybook); What is matter? (slideshow)

BACKGROUND:

Matter exists in 4 states that can be commonly observed including solid, liquid, gas, and plasma. There is a fifth state of matter that occurs at extremely cold temperatures called the Bose-Einstein condensate. However, the Bose-Einstein condensate is difficult to show because it occurs only at extremely low temperatures that are nonexistent on the Earth's surface. We suggest that you tell students that they will see only four states of matter and observing Bose-Einstein condensate requires special equipment.

Each state has its own special characteristics.

SOLID STATE:
Characterized by: (1) definite shape, (2) definite volume, (3) higher density than liquids, and (4) very slight contraction and expansion.

LIQUID STATE:
Characterized by: (1) lack of a definite shape, (2) definite volume, (3) high density, and (4) slight expansion and contraction. (Children may notice that a liquid takes the shape of the container holding it, as does a gas.)

GASEOUS STATE:
Characterized by (1) lack of definite shape and volume, (2) low density (airy), and (3) easy contraction and expansion. (Children may describe gases as being light, colorless, invisible, or floating.)

PLASMA STATE:
Characterized by (1) lack of shape and (2) not able to classify it as a gas, liquid or solid.

Lava is molten rock (a liquid) that flows on the earth's surface. Lava is formed inside the crust of the Earth by extreme heat; it erupts to form a volcano. During an eruption, many changes occur to the lava. First, as it cools, the lava changes state, from liquid to solid. Another change is the escape of gasses such as carbon dioxide, hydrogen sulfide, and water vapor, from the lava into the atmosphere.

In this lab, the students will model a volcanic eruption in order to simulate the chemical changes that occur in an erupting volcano. The children will see a solid (baking soda) and liquid (vinegar) mixing to form a gas (carbon dioxide) and a liquid.

STATES OF MATTER IN AN ERUPTING VOLCANO		
LIQUIDS	**SOLIDS**	**GASES**
lava	rocks	carbon dioxide, hydrogen sulfide, steam

PROCEDURE:

1. Before class, make sure you have 4 states of matter available.

2. Go over the four common states of matter. Use the slideshow "What is Matter." Ask the students for examples of each state in the classroom. Write their examples of the different states of matter on the board in a chart form; see the example below. They may not be familiar with plasma, so tell them plasma is very common in the universe. Look up to a fluorescent bulb that is plasma inside.

LIQUIDS	**SOLIDS**	**GASES**	**PLASMA**
water blood	book eraser desk	air	Fluorescent bulb

3. It may be difficult to come up with many examples of gases, plasma, and liquids in the classroom. Ask children to describe the states of matter in a kitchen. There are more liquids in the kitchen than in the classroom.

LIQUIDS	**SOLIDS**	**GASES**	**PLASMA**
water milk	knife stove	air propane	fluorescent bulbs

coffee	floor	steam	

4. Have your students give you examples of the four states of matter from different settings. You might suggest a birthday party with helium balloons. They will learn that all four states of matter are all around *us.*
5. Before lab, assemble the vinegar, baking soda, clay, and red food coloring. If you do not have clay available, you can conduct the experiment in a plastic cup, flask, or test tube. If you are unfamiliar with the vinegar-baking soda reaction, you may wish to try it a few times, until you get a feel for the quantities of reactants necessary. Shape the clay into a "volcano" as a model for your students. Make sure you leave room at the top to place a*bout a spoonful of baking soda.*
6. The students should be familiar with images of erupting volcanoes. You may want to show students pictures from the unit on Volcanoes *from the Plate Tectonic Cycle.*
7. Explain to the students that during the eruption of a volcano, all the states of matter are present. Rocks are solids. Liquid is represented by lava. Many gasses are emitted by the lava during an eruption. Plasma may even be present, in the form of electrical discharges in the *sky above the erupting volcano.*
8. Tell the students that today they will make a play volcano and observe three states of matter: solid, liquid, and gas. Read Lucy Lava so students can see how a volcano has 3 states of matter solid (rock); liquid *(lava, magma), and gas (steam).*
9. Instruct the students to build a small volcano with clay, leaving a small crater-like opening on the top. The students will be able to clean the clay volcano, so the clay can be reused.
10. Students should first place about 2-5 ml teaspoons of baking soda in the crater at the top of the volcano. Next, mix 100 ml of vinegar with a few drops of red food coloring (to make it look like a real volcano). Ask the students to pour the vinegar slowly on the baking soda. The resulting mixture will fizz as the vinegar reacts with the baking soda. Make sure they realize that the fizz is the release of a gas (carbon dioxide).
11. Discuss with the students that what they have demonstrated is a chemical change. When vinegar (a liquid) is poured on baking soda (a solid), it produces a change to carbon dioxide (a gas).
12. Explain that the gas escapes into the atmosphere, but some liquid and solid remain in the "volcano".

WATER CHANGES - FIRST GRADE

1.6

OBJECTIVES:

Defining the states of matter.
Exploring how water changes.

VOCABULARY:

gas
liquid
solid
water

MATERIALS:

In kit: small play dough, 1 dice, 1 sticky substance, 1 liquid timer, 1 bubble per 5 stations

zip lock bag
ice
worksheet
Give Water a Second Chance
What is matter? (slideshow)

BACKGROUND:

Water is a **transparent**, **odorless**, **tasteless** liquid composed of the elements **hydrogen** and **oxygen.** It is a very good solvent, meaning that many substances can dissolve in it easily. Water is important to our lives, and without it we could not live. In fact, there are no living creatures that can live without water.

There are **four states of matter** commonly found in the Universe. There are **solids, liquid, gases,** and **plasma**. There is also a fifth state of matter, the Bose-Einstein Condensate which is seen at extremely low temperatures. All matter is found in these states. Water is one of the few substances that can easily change into three of the states, liquid, gas, and solid. Water goes through three states of matter easily. Ice is when water is solid, steam is when water is gas, and water usually refers to its liquid state.

Water illustrates the three states of matter: solid (ice), gas (steam), and liquid (water). The form it takes depends upon the temperature. At low temperatures, the molecules do not move around as much and form a **crystalline** structure that is rigid (ice). In the liquid state, water molecules move more freely. Water molecules in the form of steam are moving very fast with large spaces between the molecules. Although ice is crystalline, it tends to have the molecules in a rigid structure that is spaced farther than the molecules of liquid water and this is quite important, for if ice were denser, it would sink in water. Imagine what would happen if icebergs grew from the bottom of the ocean instead of floating on the surface.

PROCEDURE:

1. Review the states of matter by using the slideshow “What is Matter.” Remind them that on Earth, solid, liquid, and gases are the most common. Ask them if the states

of matter change? Are states of matter easy to determine? Sometimes not. Sometimes states of matter can have the properties that might make it difficult to determine. In lab they are going to look at 5 objects and try to determine if they are solid liquid or gas.

2. Each of the bag per station contains play dough, dice, sticky substance (do not remove from bag), liquid timer, and a small vial of bubbles. Have the students experience each and have them determine the state of matter. You can time students (1-2 minutes each to look at the substance). Roll the dice, look at the timer make drops, only one blow of the bubbles (you can fill it with Dawn detergent when empty); and squeeze sticky substance.

3. After they do this have a discussion with students. Which one is really a solid? The dice… it does not change shape and is hard. Which is a liquid or gas? This is when the discussion gets difficult. The timer is liquid, but when the colored liquid goes into the clear liquid it has a definitive shape? Is it then a solid. Same with sticky material, if you put pressure on it, it can flow. You want to draw out the different qualities, and find out there is not always one answer. States of matter can change with different conditions.

4. Water is a **unique** substance. Hold up a glass of water to your class. Ask students what is in the plastic glass, and how do they know. Ask them if they have seen water in other forms. Hopefully some of your students will know that ice and steam are other forms of water. Water can take on 3 states of matter, liquid, solid, or gas.

5. Read "Give Water a Second Chance" to help students see how drops go through the water cycle and also get clean in the process. It also discusses how humans can clean our waster water.

6. Discuss with students that there are 3 states of matter that water takes, liquid, ice, and steam. In order to change from one state of matter to another type of energy, heat in this case, needs to be used. The problem that the students will explore is how much heat it will take to convert a solid (ice) to a liquid. On the worksheet there are several forms that water takes in nature. Snow and hail is a solid, sleet has solids within a liquid mass, and rain is liquid. Ask students if they can find the gas phase of water. They may not recognize that a cloud contains components of water in the gas phase. Clouds also have particles in it, which are in the solid phase.

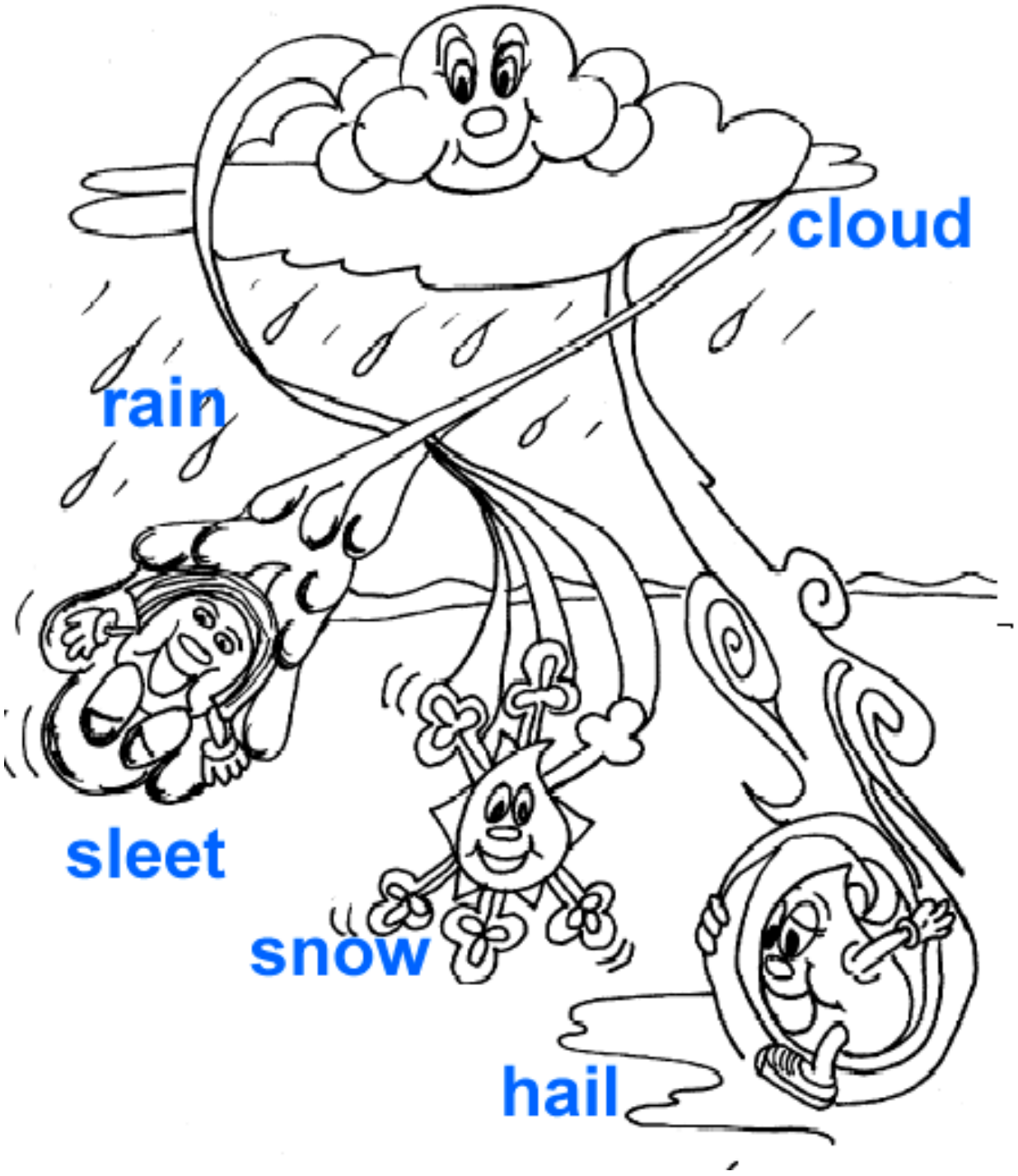
7. If students are unfamiliar with these types of weather phenomena, you may want to go over each type. Hail is frozen water that moves up and down in clouds, so it freezes as it is moving, giving it the spherical shape. Snow is water that crystallizes when the temperature gets below freezing. Sleet is when the temperature freezes, but then as it falls from the clouds it partially melts. Clouds actually contain 2 states of matter, solid and gas. Rain is liquid.

8. First discuss with students what takes on the different forms of water in nature.

SOLID	LIQUID	GAS
ice	rivers	steam
icicles	oceans	clouds
snow	rain	
hail		

9. If you have ice cubes, you may want to do the following. Give each student a baggy with one ice cube inside. Have the students feel the coldness. Tell them that they can use anything in the classroom, including themselves to find a temperature that will melt the ice cube, but make sure students don't use fire. You may want to disqualify a heater because that will take some of the fun away. The one who melts the ice cube the fastest is the winner. Students will discover that certain places, like armpits will melt the ice cube quickly. As students are doing this activity, make sure you go over the change of states *of matter (solid to liquid).*

10. After the students melt the ice cube you may want to put the water into a dish and put it near a window, and have the students look at what happens to the liquid. This can help emphasize that water goes through another state of matter to form gas (steam).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