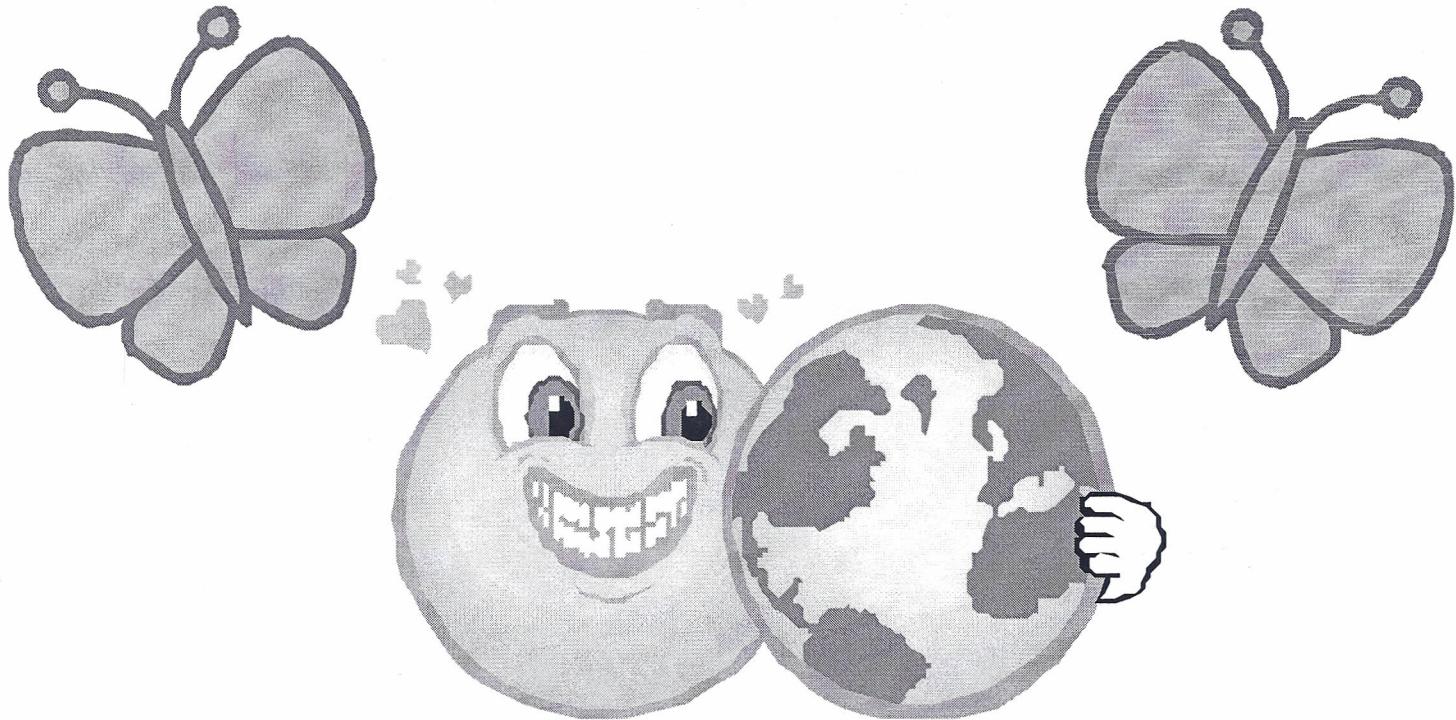


Alabama Ag in the Classroom



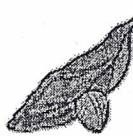
Teaching about the
Environment Can be Fun!

Kathy Walker
Madison County Soil & Water
Conservation District Coordinator



Life Cycle of a Butterfly

1



Egg Stage

2



Larva Stage

3



Pupa Stage

4



Adult Stage

1

Egg Stage

The female butterfly lays an egg on a plant.

2

Larva Stage

The egg hatches and the larva (caterpillar) comes out.

3

Pupa Stage

The caterpillar feeds on the plant and grows. When its skin becomes too small, the old skin splits open and the caterpillar pops out with a new skin on. This happens four or five times. When the caterpillar is fully grown it makes a little silk pad on a leaf or twig and attaches itself to it. The caterpillar's skin splits for the last time. It is now in the pupa stage.

Under the skin is the chrysalis. Many changes happen to the chrysalis. The wings, legs and rest of the butterfly are formed inside the chrysalis.

4

Adult Stage

The last stage is the adult stage when the chrysalis splits and the butterfly comes out.





Where do butterflies come from?

Ever wonder where a butterfly comes from? It comes from a chrysalis (KRIS-uh-liss) which is also called a pupa. A chrysalis looks like a tiny leathery pouch. You can find one underneath some leaves in the summer.

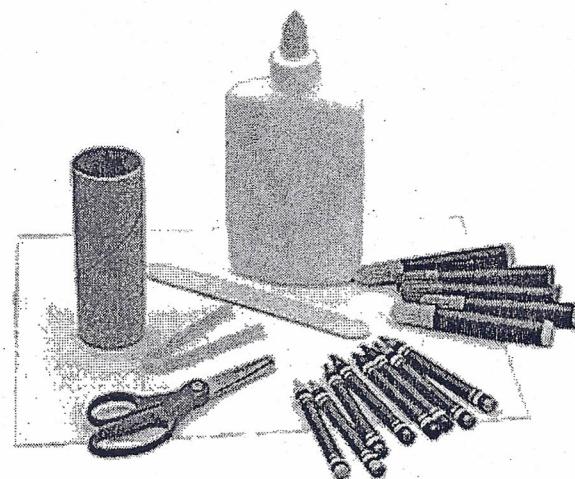
Some animals don't change much as they grow up. Think about it: someone your age looks a lot like a grown-up. Grown-ups have more wrinkles and gray hair. But they still have two arms, two legs and one head—just like you.

We're going to meet an animal that's very different—the butterfly. Butterflies go through four life stages, and they look very different at each stage.

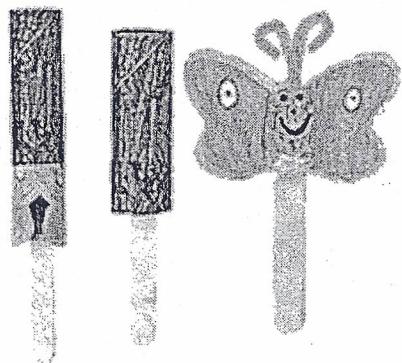
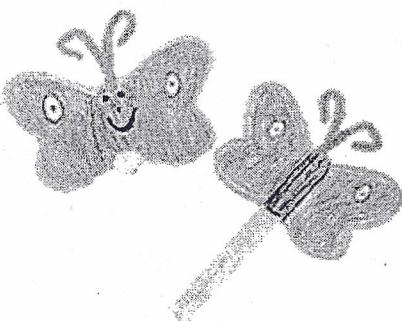
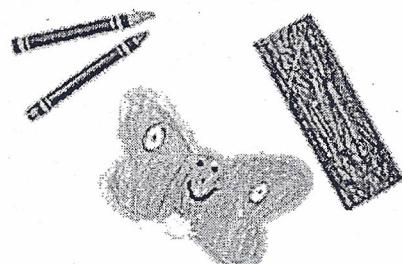


Here's what you need:

- Toilet-paper tube
- Tongue depressor or ice-cream pop stick
- Heavy paper
- 6" (150 mm) piece of pipe cleaner, folded in half
- Markers or crayons
- Scissors and glue



Here's what you do:



1. Cut out and color a butterfly from the heavy paper. Use any colors, but make both halves look the same. Put a small hole at the top of the butterfly's head.

2. Color the toilet paper tube to look like a chrysalis. (A monarch butterfly's chrysalis is green, but you can use any color.)

3. Take a piece of pipe cleaner and shape it like the letter "V". Put one point through the little hole in the butterfly's head and then twist it to look like antennae. Butterflies use these "feelers" to learn about their environment.

4. Glue the butterfly to one end of the tongue depressor or ice-cream pop stick. Let the glue dry.

5. Curl the butterfly's wings and slide it into the chrysalis.

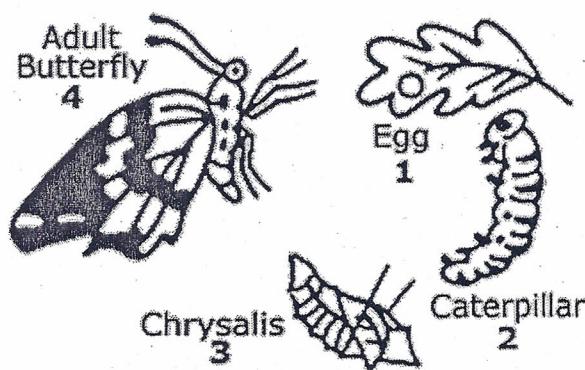
6. Pull the stick to make the beautiful butterfly come out of the chrysalis.

Fly your butterfly like a real one!

The butterfly's life cycle

Butterflies go four stages of life, but they only look like butterflies in the final stage. Birds, frogs, snakes and insects also change as they grow.

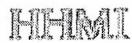
1. An adult butterfly lays an **egg**.
2. The egg hatches into a **caterpillar** or larva.
3. The caterpillar forms the **chrysalis** or pupa.



4. The chrysalis matures into a
butterfly.

Courtesy of the Scotia-Glenville Children's Museum, Scotia, New York

Cool Home Plant-Parts Air Junk Critters Butterflies Inch Square



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4000 Jones Bridge Road Chevy Chase, MD 20815-6789 | (301) 215-8500 | e-mail: webmaster@hhmi.org



Pasta Butterflies

OUTDOOR CLASSROOM SEED ACTIVITY

Grade Levels

K-2

Overview

Students will 1) listen to a story about the life cycle of the butterfly, 2) act out the life cycle stages, 3) look for the life cycle stages in your outdoor classroom, and 4) create the life cycle stages on paper plates using pasta and markers/crayons.

Subject Areas

Science, Art, Math

Duration

Prep: 15 minutes

Activity: 45 minutes

Learning Objectives

Students will be able to identify the four stages of the butterfly life cycle.

Materials

- Children's Book about the life stages of a butterfly (see p.2 for suggestions)
- Pasta (orzo, rotini, shell, and bowtie)
- Ziploc bags for the pasta
- Markers/crayons
- Paper plates
- Glue
- Construction paper (optional)
- Magnifying glasses, or loupes, for each student

Outdoor Classroom Connection

Students will observe outdoor classroom areas for different stages of the butterfly life cycle.

Background Info

Butterflies and moths undergo complete metamorphosis through their four different life stages:

Egg - A butterfly starts its life as an egg.

Larva - The larva (caterpillar) hatches from an egg and eats leaves or flowers almost constantly. The caterpillar molts (loses its old skin) many times as it grows.

Pupa - The caterpillar then turns into a pupa (chrysalis); this is a resting stage.

Adult - A beautiful, flying adult butterfly emerges from the pupa. There is no growth during this stage. This adult will continue the cycle and reproduce.

For more details about the butterfly's life cycle, see page 4. Through literature and hands-on experiences, students will learn to identify these four stages of growth of a butterfly. For more identification information about butterflies in Alabama including photos of each butterfly, its larva, chrysalis, or egg, visit www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/al/toc.htm or www.whatsthis caterpillar.co.uk/america/.

Preparation

Put several pieces of each type of pasta in a ziploc bag for each of your students. Have markers or crayons and enough paper plates for each child to have one.

Procedure

1. Read a children's book about the life cycle of the butterfly (see Literature Connection list on page 3 or choose one of your favorites).
2. After reading the book, review the life cycle stages of the butterfly. For example: What is the first stage of the butterfly? (egg) What comes out of the egg? (a caterpillar) How does a caterpillar change into a butterfly? (goes through changes during the pupa stage)
3. Ask students where they could find the stages of the butterfly. Examples: Where do butterflies lay their eggs? (on leaves, on the underside of leaves) Where do we find caterpillars? (on plants, eating leaves).
4. Have students stand up and tell them they will act out the four stages of a butterfly. Everyone becomes a butterfly egg by squatting down as small as possible. Now everyone becomes caterpillars as students crawl around "munching"—you may need to remind them to munch. Now everyone become a pupa as they lie down in a fetal position with their arms and legs tucked in tight—they can wiggle but not move. Now the students begin to "emerge" from their pupa by getting into stooped positions, and then they stand up slowly stretching their arms as high as they can as they "open their wings" and slowly move them up and down. Now everyone is a beautiful butterfly, and they can "fly" around the room.
5. Tell students they will now become butterfly scientists – *lepidopterists* – and will go out into the outdoor classroom to look for the different stages of the butterfly. See page 2 for "Helpful Hints." You will keep a count of how many times we find eggs, caterpillars, pupas, and butterflies. Give each student a magnifying glass, or loupe, and go out to the outdoor classroom area. Give students 5 or so minutes to observe. Gather students together and talk about the different stages they saw. Discuss where they saw the different stages.



Pasta Butterflies continued...

OUTDOOR CLASSROOM SEED ACTIVITY

Grade Levels

K-2

Overview

Students will 1) listen to a story about the life cycle of the butterfly, 2) act out the life cycle stages, 3) look for the life cycle stages in your outdoor classroom, and 4) create the life cycle stages on paper plates using pasta and markers/crayons.

Subject Areas

Science, Art, Math

Duration

Prep: 15 minutes

Activity: 45 minutes

Learning Objectives

Students will be able to identify the four stages of the butterfly life cycle.

Materials

- Children's Book about the life stages of a butterfly (see p.2 for suggestions)
- Pasta (orzo, rotini, shell, and bowtie)
- Ziploc bags for the pasta
- Markers/crayons
- Paper plates
- Glue
- Construction paper (optional)
- Magnifying glasses, or loupes, for each student

Outdoor Classroom

Connection

Students will observe outdoor classroom areas for different stages of the butterfly life cycle.

Helpful Hints for Spotting Butterflies:

Eggs

Eggs can most often be found on the under-side of the host plant in your butterfly garden. For monarchs, eggs can be found on the under-side of the milkweed leaves. Again, sometimes you can find eggs on the top side of the leaves but the monarch normally lays eggs underneath the leaves unless the butterfly is disturbed or feels rushed for one reason or another. If the eggs fall off the leaf, it is very difficult to re-attach, so be careful not to touch the eggs.

Caterpillars

Again, look around the host plants in your butterfly garden for signs of the caterpillars. For monarchs, look for milkweed plants with little dark green pellets on them—those are caterpillar droppings and they usually give away a location if the caterpillar hasn't moved on to a different milkweed plant. Caterpillars normally like to stay shaded from the sun and will usually be on the under-side of a leaf, along the stem-line of the milkweed plant itself or within the tiny gathering of leaves at the top of the milkweed plant. On rare occasions, you may find one here or there exposed out in the open. But generally they like to be shaded since direct sunlight, for long periods of time, can kill them.

Some good host plants to find eggs and caterpillars include:

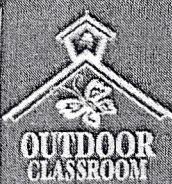
Host Plant	Butterfly Species
Milkweed	Monarch Butterfly
Thistle, Daisy	Painted Lady
Paw-Paw	Zebra Swallowtail
Parsley, Dill, Fennel	Black Swallowtail
Alph alpha, Clover	Clouded Sulphur
Willows, Poplars	Viceroy

Butterflies

The adult butterflies are most often seen drinking nectar from flowers in the butterfly garden.

Some good nectar plants to find butterflies include:

Nectar Plant	Butterfly Species
Butterfly weed	Monarch Butterfly
Zinnia	Painted Lady
Blueberry, Blackberry	Zebra Swallowtail
Red Clover, Thistle	Black Swallowtail
Butterfly bush	Clouded Sulphur
Golden Rod, Aster	Viceroy



Pasta Butterflies *continued...*

OUTDOOR CLASSROOM SEED ACTIVITY

Grade Levels

K-2

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- Paper plates
- Glue
- Construction paper (optional)
- Magnifying glasses, or loupes, for each student

Outdoor Classroom Connection

Students will observe outdoor classroom areas for different stages of the butterfly life cycle.

Procedure continued...

6. Take students back to the classroom and create a bar graph of your observations of the life cycle stages (one bar graph for kindergarten class and individual bar graphs for second grade). Tell students that they will now create their own butterfly life cycles using pasta to represent the different stages. First give each student a paper plate. For kindergarten and possibly first grade you may want to draw the sections. (see Figure 1) Have students copy the name of each stage into one section. The paper plate allows the children to place the stages in a cyclical form and not linear. (see Figure 2) Students decorate each section before gluing the pasta on the plate.

Figure 1

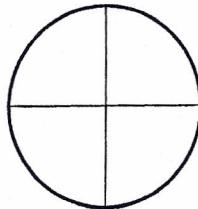
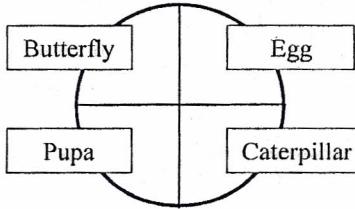


Figure 2



Assessment

Students should be able to choose the appropriately shaped pasta for each life cycle stage and create the appropriate habitat picture:

Life cycle	Pasta	Habitat (or similar)
Egg	orzo	underside of leaf
Caterpillar	rotini	munching leaves
Pupa	shell	hanging from something—leaves, tree branch, etc.
Butterfly	bowtie	flying through the air or drinking from a flower

Extensions

- Some students may choose to use construction paper to help illustrate the habitat of each life cycle stage.
- Have students create a journal of their observations in the outdoor classroom site.
- Students could draw &/or write about their observations.

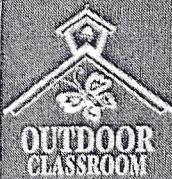
Literature Connection

From Caterpillar to Butterfly by Deborah Heiligman

Where Butterflies Fly by Joanne Ryder

Monarch Butterfly by Gail Gibbons

Are You A Butterfly? by Judy Allen



Pasta Butterflies *continued...*

OUTDOOR CLASSROOM SEED ACTIVITY

Grade Levels

K-2

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Materials

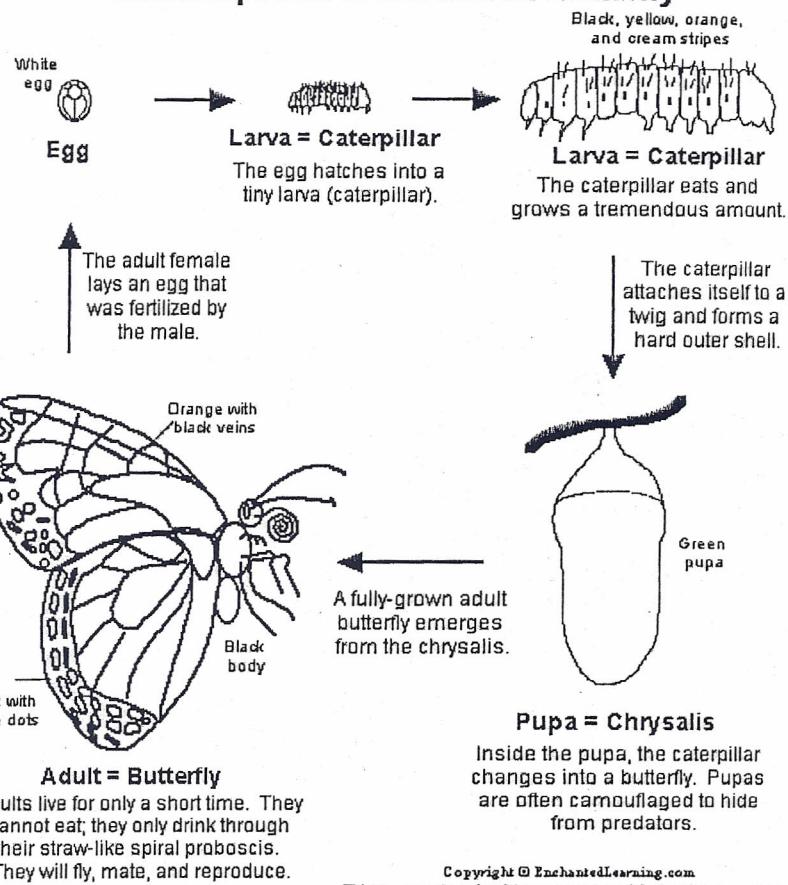
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Outdoor Classroom Connection

Students will observe outdoor classroom areas for different stages of the butterfly life cycle.

SUPPLEMENTAL INFORMATION

Butterfly Life Cycle Metamorphosis of a Monarch Butterfly

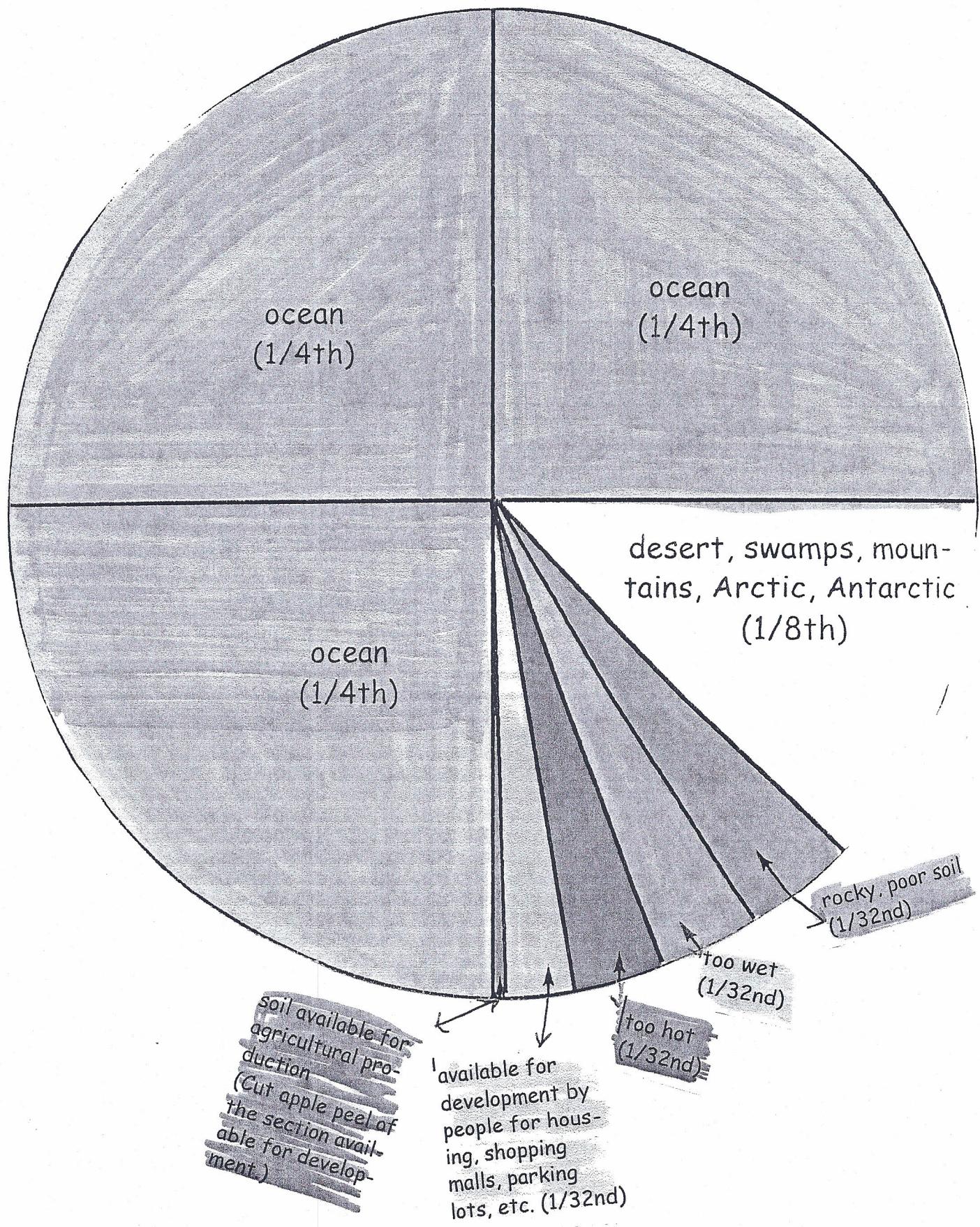


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Female butterflies lay many eggs during their short life to insure that even a small number of these eggs will survive. Eggs are usually laid on the under surface of a leaf of the host plant (butterflies and moths use specific host plants for their eggs and larva). For example, the Monarch butterfly lays its eggs on the bottom of the milkweed plant. There is a yolk inside each egg that nourishes the developing larva. When it is time to hatch, the larva (caterpillar) gnaws open the egg shell with its jaws. Afterwards, many species will only eat the leaves of their host plant for nourishment. The caterpillar is then in the larval stage for two-four weeks, eating almost constantly and molting four or five times as they grow very rapidly. When larval growth is done, the larva stops eating and attaches itself to a sheltered spot such as on a twig or leaf. It then splits open, loses its exoskeleton, and is encased in a chrysalis (pupa) as it undergoes metamorphosis. It does not eat during this stage. After a few days (or many months for some), an adult butterfly emerges full-grown from the chrysalis. The primary purpose of the adult stage is to mate and reproduce.

Supplemental information provided by Enchanted Learning,
www.enchantedlearning.com.

This Land is Our Land



CIRCLES OF THE EARTH BRACELET
COURTESY OF ILLINOIS FARM BUREAU
AG IN THE CLASSROOM
www.agintheclassroom.org



Circles of the Earth bracelets are great craft items, and using them is a great lesson for your students as they prepare for Earth Day celebrations and discover the circles of the Earth.

Materials for Circles of the Earth bracelets can be purchased at most craft stores.

1 12"-14"	Brown leather strap	People (1)
1 Small	Clear adjuster bead	Water (2)
1 Small	Blue adjuster pony bead	Plants (3)
1 Small	Green pony bead	Soil (4)
1 Small	Brown pony bead	Day (5)
1 Small	Orange pony bead	Night (6)
1 Small	Black pony bead	Air (7)
1 Small	White pony bead	Sun (8)
1 Small	Yellow pony bead	

Tie a knot on one end of the leather strap at about 4"-5". String the colored beads to represent the circles of the Earth. Take the end of the leather strap without a knot and lace it through the clear "People" bead. Tie a knot at the end. (Now your clear "People" bead is an adjuster for the bracelet.)

(1)

People move in circles. The earth provides us with everything we need to survive. We must take great care of our valuable resources!

(2)

Water is a circle. Water rains down on land. Water collects in oceans, rivers, lakes, and streams. It evaporates back up into the sky and collects in clouds. The clouds become heavy, and rain falls down to land again.

(3)

(4)

Plants and soil are circles. Plants grow from soil. Plants provide food for animals. Animals provide food for other animals. Animals die and decompose. New soil is made. New plants grow.

Earth is a circle. Earth is spinning through space, rotating on its axis, revolving around the Sun. The Earth and Sun give us the circle of the seasons and the circle of night and day. (5)

(6)

Air is a circle. Animals breathe in oxygen and exhale carbon dioxide. Plants take in carbon dioxide, use it to make food, and give off oxygen. Animals breathe it in again.

(7)

The Sun is a circle. The Sun provides warmth for light for all of the Earth's circles. Without the Sun, plants and animals would not survive. The Sun binds us together.

(8)

PASS THE ENERGY PLEASE!

By Barbara Shaw McKinney

Illustrated by Chad Wallace

Lesson Plan Prepared by Kathy Walker

LINK #1 – Born in the Sun

Smiley Face Sun

Smiley Face Plant

Butterfly/on Bush

Underwater Plant

Fish

CHAINS OF TWO – THE BIG HERBIVORE CREW

Buffalo

Gorilla (Stems)

Panda (Bamboo)

THREE IN A CHAIN ON THE AFRICAN PLAIN

Elephant (Adult/Child)

Rhino

Gazelle or Elk

Giraffe

Lion

Cheetah

A CHAIN OF FOUR ON THE MEADOW FLOOR

Mouse

Seed Plant

Snake

Owl

ARTIC FIVE LINK UP TO SURVIVE

**Underwater Plants
Small/Larger Fish Together
Blue Larger Fish Chasing
Seal
Ice Ring
Polar Bear**

WOODLAND MIX MAKES A CHAIN OF SIX

**Goldenrod with Worm
Spider
Blue Bird
Weasel
Fox**

DECOMPOSERS ON THE GROUND -NUTRIENTS GO ROUND & ROUND

**Lion Decomposing
Black Bird
Beetle
Worms
Ants/Flies/Spiders
Mushroom**

ECOSYSTEMS WILL ONLY SURVIVE IF WE KEEP SPECIES ALIVE

**BRING ALL ANIMALS BACK
AND CONNECT TO CHAIN TO
MAKE CIRCLE OF LIFE!**

AG DAY BIRTHDAY

On the First AG DAY BIRTHDAY this farm gave to me

A FARMER IN FADED BLUE JEANS.

On the Second AG DAY BIRTHDAY this farm gave to me

TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS.

On the Third AG DAY BIRTHDAY this farm gave to me

THREE TURKEYS GOBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Fourth AG DAY BIRTHDAY this farm gave to me

FOUR DUCKS QUACKING
THREE TURKEYS GOBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Fifth AG DAY BIRTHDAY this farm gave to me

FIVE NOISY KIDS
FOUR DUCKS QUACKING
THREE TURKEYS GOBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Sixth AG DAY BIRTHDAY this farm gave to me

SIX ROOSTERS CROWING
FIVE NOISY KIDS
FOUR DUCKS QUACKING
THREE TURKEYS GOBBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Seventh AG DAY BIRTHDAY this farm gave to me

SEVEN HENS CLUCKING
SIX ROOSTERS CROWING
FIVE NOISY KIDS
FOUR DUCKS QUACKING
THREE TURKEYS GOBBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Eighth AG DAY BIRTHDAY this farm gave to me

EIGHT FISH SWIMMING
SEVEN HENS CLUCKING
SIX ROOSTERS CROWING
FIVE NOISY KIDS
FOUR DUCKS QUACKING
THREE TURKEYS GOBBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Ninth AG DAY BIRTHDAY this farm gave to me

NINE PIGS ROOTING
EIGHT FISH SWIMMING
SEVEN HENS CLUCKING
SIX ROOSTERS CROWING
FIVE NOISY KIDS
FOUR DUCKS QUACKING
THREE TURKEYS GOBBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Tenth AG DAY BIRTHDAY this farm gave to me

TEN SHEEP BLEATING
NINE PIGS ROOTING
EIGHT FISH SWIMMING
SEVEN HENS CLUCKING
SIX ROOSTERS CROWING
FIVE NOISY KIDS
FOUR DUCKS QUACKING
THREE TURKEYS GOBBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Eleventh AG DAY BIRTHDAY this farm gave to me

ELEVEN RABBITS RUNNING
TEN SHEEP BLEATING
NINE PIGS ROOTING
EIGHT FISH SWIMMING
SEVEN HENS CLUCKING
SIX ROOSTERS CROWING
FIVE NOISY KIDS
FOUR DUCKS QUACKING
THREE TURKEYS GOBBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

On the Twelfth AG DAY BIRTHDAY this farm gave to me

TWELVE EAGLES DIVING
ELEVEN RABBITS RUNNING
TEN SHEEP BLEATING
NINE PIGS ROOTING
EIGHT FISH SWIMMING
SEVEN HENS CLUCKING
SIX ROOSTERS CROWING
FIVE NOISY KIDS
FOUR DUCKS QUACKING
THREE TURKEYS GOBBLING
TWO COWS MOOING
And A FARMER IN FADED BLUE JEANS

Earth Day Birthday

sung to the tune of
The Twelve Days of Christmas

Traditional melody
words by Pattie L. Schnetzler

guitar capo 3 plays: □

8

F
D

C R

1. On the first Earth Day Birth - day the wide world gave to me a bald eagle in a blue sky.

On the sec - ond Earth Day Birth - day the wide world gave to me
On the thi - rd Earth Day Birth - day the wide world gave to me
On the fou - rth Earth Day Birth - day the wide world gave to me

Two grizz - lies sleep - ing ↗ and a bald eag - le in a blue sky
Three pan - thers creep - ing ↗
Four sal - mon leap - ing ↗

Go To Measure 5

On the fi - fth Earth Day Birth - day the wide world gave to me

Five spot - ted fawns, Fo - ur sal - mon leap - ing Three pan - thers creep - ing

Two grizz - lies sleep - ing and a bald eag - le in a blue sky

Go To Measure 15

On the	6th	Earth Day	Birth - day the	wide	world gave	to	me
	7th	-	-	-	-	-	-
	8th	-	-	-	-	-	-
	9th	-	-	-	-	-	-
	10th	-	-	-	-	-	-
	11th	-	-	-	-	-	-
	12th	-	-	-	-	-	-

Six	owls	a -	hoot - ing
Seven	whales	a -	breach - ing
Eight	cranes	a -	dan - cing
Nine	tur - tles		hatch - ing
Ten	bi - son		graz - ing
Eleven	seals	a -	swim-ming
Twelve	wolves	a -	howl - ing

Who is Polluting our River?

The jar in front of you represents water flowing into a river not unlike Deep Creek. If you had to, would you drink this water? Would you swim in it? Would you fish in it? As the creek water leaves the protection of the park many things begin to influence its quality. As I read the story, listen carefully for the words written on the outside of your container. When you hear your label, take the lid off and pour the contents into the jar. This way, maybe we can learn the story of what is happening to this fictional river that is not unlike rivers all over the world.

STORY

The weather is changing, it's beginning to rain and soil from a nearby **construction site** (dirt and rocks) is washing into the river. (Stop the story and ask – *What is it called when soil washes off the land and into the water?* Erosion. *Why is it a problem?* Muddy water blocks the sunlight that the plants need to photosynthesize so they can grow, if no plants grow then the food chain is disrupted.) As the storm gets worse, the wind in the **trees** (leaves) blow leaves into the water. Would you drink this water? Play in it? Is it safe for the wildlife?

In nearby mountains there is a **mining** (vinegar) operation. In the process of removing rocks from the earth, acids are produced that runoff into the river. Along the river in the mountains there are houses that use septic tanks instead of the sewer system. These tanks hold wastewater from the house. The **homeowners** (small piece of toilet paper and water w/ yellow food coloring) don't know it but their septic tanks leak and untreated sewage is seeping into the river. Down the dirt road from the homes, there is a farm that has a lot of **cattle, horses and pigs**. (yellow and green food coloring in water to make a brownish color) The manure from these animals washes into the river with each rain. Would you want to drink the water from this river now? Would you swim in it? Would you fish in the river?

On the side of the river is another small farm. The farmer uses chemical **pesticides** (baking soda/powder) on his crops to keep the bugs away. A powdery **fertilizer** (baking soda/powder) is also used on the plants he grows. Every time it rains, some of the se chemicals are washed in the river. Further down the river there is a **papermill**. (red food coloring in water) Chemicals called dioxins are used in the paper making process, some of these poisons are released by the mill through pipes from the plant. Would you want to drink this water? Swim in it? Eat fish from it? Canoe in it? Is it safe for the wildlife?

Downstream, the river runs through a town. People in the town drive to and from work each day. These **cars** leak small amounts of oil into the street which runs down the storm drain and into the river. The **exhaust** (vinegar) from the cars goes into the air as a colorless gas. The gases combine with moisture in the air to form acid rain. Some of the town people work in a **factory** (vinegar) and smog from the factory adds to the acid rain problem. At a home, a father is teaching his daughter to **tune up** (vegetable oil) the family car. They pour the used oil and **antifreeze** (yellow and blue food coloring in water to make a bluish-green color) down the storm drain. Across the street, the neighbors are **washing the car**. (soapy water) The soapy water runs down the curb and into the storm drains. Further down the street a woman is putting **flea powder** (baking soda/powder) on her dog along side a stream that flows into the river. The powder is being blown into the river where it kills some of the aquatic insects. Would you drink this water? Go rafting in it? Is it safe for the wildlife?

Another family is cleaning out their garage. They find an old rusty can with some sort of **mysterious liquid** (water with red food coloring) in it. They aren't sure what it is but they want to get rid of it. They decide to get rid of it by pouring it down the storm drain. People in town often throw their trash onto the ground. This **garbage** (small pieces of paper, etc.) gets blown into the river or down the storm drains. Near the mouth of the river is a **power plant**. (water with bits of ashes in it to simulate coal) This plant creates electricity by burning coal. Coal is stored outside the plant in huge piles. Every time it rains, some of the coal dust is washed into the river increasing the acid level. Smoke from the **smokestacks** (vinegar) combine with gases and moisture in the air to form acid rain. Can we drink this water? Is it safe for wildlife? Can you still use the river for recreation?

The river empties into a big lake where there are **jet skiers** (vegetable oil) out having fun. As they zoom around some oil and gas from the engine leak into the river. On the beach, there are some **picnickers** (small pieces of straw, candy wrappers, etc.) and some teenagers having a **party** who leave their trash behind on the shoreline. This trash gets washed into the river. Nearby there is a **person fishing** (small piece of fishing line) who gets her nylon fishing line tangled around a log in the water and the line breaks off.

So, what do you think about the quality of the water in our river? Who is it who polluted the river? Why should we care? Is there anything we can do in our day to day activities to help solve some of these problems?

Construction Site Dirt/Rocks/Sand	Oil & Antifreeze Blue/Green/Oil	Mysterious Liquid Choc Syrup/Rust/Red Color
Leaves From Storm Dead Leaves	Car Washing Soap/Water/Choc Syrup	
Mining Operation Vinegar/Rocks/Soil	Flea Powder Talc or Baby Powder	
Septic Tanks Overflow Tissue/Yellow/Water	Garbage Can Overflow Plastic/Paper/Oatmeal	
Livestock Operation Yellow/Green/Ammonia	Power Plant Emission Purple Kool Aid/Ashes	
Agricultural Pesticides Baking Soda	Smokestacks Coal Soot/Ashes	
Fertilizers From Farms Red Kool Aid	Jet Skiers Veg Oil/Choc Syrup/Water	
Papermill Ammonia/Water	Picnickers Straws/Paper/Oatmeal	
Automobile Exhaust Cigar Ashes/Water	Teenager Lake Party Décor/Straws/Paper/Oatmeal	
Factories Vinegar/Water	Fisherman Fishing Line/Dental Floss	

A SALT WATER-Y WORLD

OBJECTIVES

The student will do the following:

1. Observe a model of the distribution of the earth's water.
2. Compare the relative volumes and percentages of types of water on earth.
3. Demonstrate solar distillation.

BACKGROUND INFORMATION

Humans must have fresh water to live, but about 97 percent of the earth's water is too salty to use. The remaining 3 percent is fresh water, but most of it is in polar icecaps, remote glaciers, and icebergs and is not easily accessible. Accessible fresh water, therefore, comes from surface water and ground-water sources. These sources represent less than one-half of one percent of all water on the earth.

SUBJECTS:

Science, Social Studies, Math

TIME:

50 minutes

MATERIALS:

two 1,000-mL graduated cylinders (or 1-L clear containers)
four 100-mL graduated cylinders (or small jars)
medicine dropper
food coloring
teacher sheet (included)
acetate sheet
overhead projector
large bowl or pan (1 per group)
small drinking glass (1 per group)
small rocks
plastic wrap
2-gallon bucket
water
soil
student sheet (included)

Terms

groundwater: water that infiltrates into the earth and is stored in usable amounts in the soil and rock below the earth's surface; water within the zone of saturation.

surface water: precipitation that does not soak into the ground or return to the atmosphere by evaporation or transpiration, and is stored in streams, lakes, wetlands, reservoirs, and oceans.

ADVANCE PREPARATION

- A. If you do not have two 1,000-mL graduated cylinders, use other clear liter containers. If you have access to laboratory glassware, fifteen 100-mL graduated cylinders will work. If you use the small cylinders, ten of them will hold 972 mL of salt water, while the remaining five will hold fresh water. A clear plastic jug (soft drink container) holding one liter of colored water can be used. Other clear glasses or jars can hold the smaller divisions. The following table shows the distribution of water for this demonstration.

Earth's Total Water Supply
972 mL Ocean (salt water)
<u>28 mL Fresh water</u>
1,000 mL Total Water on Earth

Earth's Total Fresh Water Supply
23 mL Icencaps and glaciers
4 mL Groundwater
2* drops Surface water
1* drop Water in air and soil
<u>28 mL Total Fresh Water on Earth</u>

1 liter = 1,000 mL

*3 drops = 1 mL

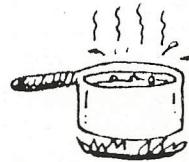
- B. Make a transparency from the teacher sheet "Water Distribution on Earth." (NOTE: You can make a chart rather than using a transparency and overhead projector.)
- C. Duplicate copies of the student sheet.
- D. Get a liter of water in the cylinder or bottle. Put food coloring in it so the students can see it.
- E. Gather the materials to have 5-6 groups each build a distillation apparatus. Make muddy water by filling a 2-gallon bucket with water and mixing in about 2 cups of soil.

PROCEDURE

- I. Setting the stage
 - A. Share with the students the background information.
 - B. Display the transparency or chart, "Water Distribution on Earth." Discuss this briefly with the students. Tell them you are going to show them what these proportions look like.
- II. Activity
 - A. Place all the materials on a table in front of the class.
 1. Fill one graduated cylinder with colored water to the 1,000 mL line. Tell the students that this represents the earth's entire supply of water. Pour 28 mL of this water into a second 1,000-mL graduated cylinder. The 28 mL of water represents the earth's total fresh water supply. The remaining 972 mL of water is salt water that occurs primarily in oceans.
 2. Divide the 28 mL of fresh water by pouring portions of it into smaller containers: 23 mL for icencaps and glaciers, 4 mL for groundwater, 2 drops for surface water, and 1 drop for the water in the atmosphere and soil.
 3. Refer the students again to the table on surface water distribution.
 - B. As the students examine and compare the different volumes of water in the graduated cylinders, ask the following questions:
 1. Which of the four fresh water graduated cylinders represents the most fresh water on earth? (23 mL, representing icencaps and glaciers)

WATER FACT CARDS

WATER WILL BOIL
AT 180° F



(1)

TRUE OR FALSE

STEAM IS
INVISIBLE.



(2)

TRUE OR FALSE

YOUR BODY IS
ABOUT 75 %
WATER



(3)

TRUE OR FALSE

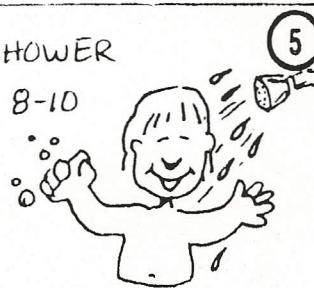
ONE OXYGEN ATOM
AND TWO HYDROGEN
ATOMS CAN FORM A
WATER MOLECULE



(4)

TRUE OR FALSE

TAKING A SHOWER
USES ABOUT 8-10
gallons of
water.



TRUE OR FALSE

A Person needs
to take in
2½ quarts
of water a
day.

TRUE OR FALSE

(5)

Water is the only substance
on Earth that is naturally pre-
sent in 3 forms - SOLID, LIQUID, GAS.

TRUE OR FALSE

(7)



85% of the water
on Earth is in
the
salty oceans.

TRUE OR FALSE

(8)



IT TAKES 10
GALLONS OF WATER
TO PRODUCE $\frac{1}{1}$ can
of COLA

TRUE OR FALSE



THE TOILET TANK
USES 30% of your
home's water.

TRUE OR FALSE



Every
AMERICAN
uses 30 gallons
of water a day
in their home.

TRUE OR FALSE

SNOW
is a form
of
PRECIPITATION



TRUE OR FALSE

WATER IS THE MOST
COMMON SUBSTANCE
ON
EARTH.



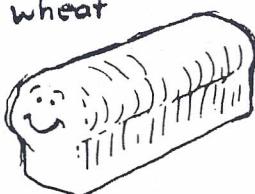
TRUE OR FALSE



WATER WILL
FREEZE AT
 32°C .

TRUE OR FALSE

It takes 115 gallons of water
to grow enough wheat
to make a
loaf of BREAD.

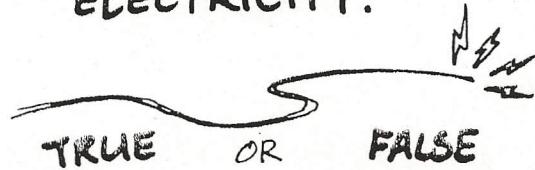


TRUE OR FALSE

Water will
expand
when heated.

TRUE OR FALSE

WATER IS A GOOD 17
CONDUCTOR OF
ELECTRICITY.



WHILE FALLING,
A DROP OF
WATER IS
SHAPED LIKE
A TEARDROP.



TRUE OR FALSE

WATER CONTRACTS
WHEN
FROZEN.



TRUE OR FALSE

WASHING A CAR
USES ABOUT
100 GALLONS
OF WATER.



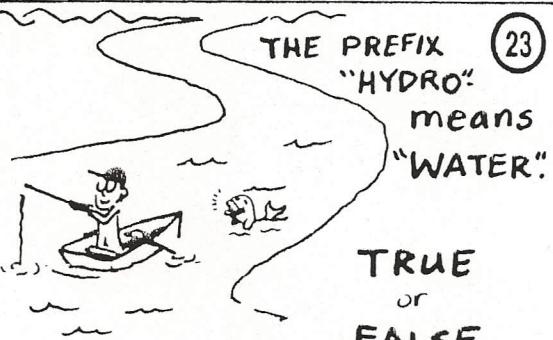
TRUE OR FALSE

ANIMALS CANNOT
WALK ON LIQUID
WATER.



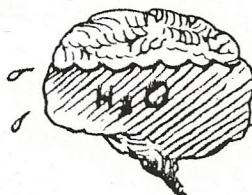
TRUE OR FALSE

THE PREFIX
"HYDRO"
means
"WATER".



TRUE
or
FALSE

YOUR
BRAIN IS
 $\frac{3}{4}$ WATER.



TRUE OR FALSE

A GALLON OF
OIL IS
HEAVIER THAN
A GALLON OF
WATER.



TRUE OR FALSE

IT TAKES 2000 gallons of water to MANUFACTURE a Car. (25)

TRUE OR FALSE

IT IS BEST TO WATER THE LAWN WHEN IT IS HOT AND WINDY. (29)

TRUE OR FALSE

WATER IS MADE UP OF TWO COLORLESS AND ODORLESS gases. (26)

hydrogen + oxygen = TRUE OR FALSE

Adding Salt to water will cause it to BOIL at a higher TEMPERATURE. (30)

TRUE OR FALSE

WATER CAN FLOW UPHILL. (27)

TRUE OR FALSE

DEW IS A FORM OF CONDENSATION. (31)

TRUE OR FALSE

THE AMOUNT OF WATER VAPOR IN THE AIR IS CALLED HUMIDITY. (28)

TRUE OR FALSE

A PERSON COULD LIVE WITHOUT WATER FOR ABOUT A WEEK. (32)

TRUE OR FALSE

WATER FACTS

Answer Key

1. False* — at sea level water boils at 212°F. The boiling point of water decreases as air pressure decreases. High in the mountains water will boil at a lower temperature.
2. True — steam is invisible. The vapor seen is condensed water. Steam would be the invisible portion of the air between the tea kettle and the vapor cloud.
3. True or false — books list the percentage anywhere from 60% to 90%.
4. True — H₂O — However it is very rare to find a single water molecule.
5. False — 15–30 gallons are used.
6. True
7. True
8. False — 97% is in the salty oceans.
9. True
10. False — 40% is used.
11. True
12. True
13. False — 70 gallons per day.
14. True
15. False — 32°F or 0°C.
16. True
17. False — water itself is not a good conductor. When a person is wet the person loses his resistance and becomes a good conductor.
18. False — it expands — it is rare for a substance to expand when frozen.
19. False — due to surface tension, many insects can.
20. True
21. False — due to surface tension, a free falling drop is round.
22. True* — if you leave the hose running.
23. True
24. False — water is denser than oil, and an equal volume is heavier.
25. False — it takes 100,000 gallons to manufacture a car.
26. True — hydrogen and oxygen — H₂O.
27. True — in capillary action in plants, water molecules are attracted to one another and are pulled up to the top of the plant.
28. True
29. False — much of the water will evaporate and the water will not reach the plant's roots.
30. True — this is why you add salt to water when boiling pasta.
31. True
32. True* — however this depends on the temperature of the environment.

*Accept answers, true or false, if the answer is based on some logical explanation.