

Understanding
Water
Activity Book

UNDERSTANDING WATER ACTIVITY BOOK

This activity book is one of the agricultural literacy projects produced by the Colorado Foundation for Agriculture. Individual copies or classroom sets are available. Materials may be reproduced for educational use.

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Note to educators: This book includes a variety of ready-to-use activities that integrate learning about water and academic subject areas. The activities are ideal for use in classrooms. Children can work through many activities in the book on their own, although some science experiments will require the assistance of an adult. We have tried to indicate when such help is essential to performing a task.

Why does an agriculture group want to teach about water?

Water is a finite natural resource. Demands on available water continually increase. It is essential that today's young people, who will be tomorrow's leaders, understand as much as possible about this vital resource. This activity book is intended to stimulate interest and awareness.

In the past, people were aware of the role agriculture played in their lives. It meant survival. Nearly everyone – men, women and children – worked the land. On average, today's youth are five generations removed from the land. No longer is there a grandfather or aunt on the farm. No longer do young people have first-hand contact with farms and farming. You may want to survey your class. How many of your students have a parent, grandparent, aunt or uncle who is living and working on a farm or ranch? Through projects like this activity book, students can begin to understand the effect agriculture has on our society and way of life. Water is a natural resource that requires our care and conservation for a bountiful future. Water is essential for growing our food. Seeds and soil will not feed the nation; seeds, soil and water can.

Importance of Agriculture

Agriculture, with its related occupations, is the nation's and the world's largest industry. It generates billions of dollars each year and one out of every five American jobs depends on agriculture in some way. Agriculture has a huge effect on the American economy and on the prices we pay for food, clothing and shelter. Agriculture positively influences the U.S. balance of trade and directly affects the number, as well as kinds, of jobs throughout the world.

An estimated 20 percent of our population is employed in agriculturally related occupations. However, only about two percent of U.S. citizens work in production agriculture. Production agriculture is the growing and harvesting of food. This small group meets the food and fiber needs of the entire nation as well as many people in other communities. Agriculture faces huge challenges to meet the needs of a growing world population. Tomorrow's citizens must be agriculturally literate in order to make responsible, moral decisions about the giant global lifeline. Building that literacy and awareness is the goal of the Colorado Foundation for Agriculture through its agricultural education projects and Agriculture in the Classroom programs.

You can survive for many weeks without food but less than a week without water. We see and use water every day. It is a common item. We drink it, bathe in it, play in it and grow our food with it.

This activity book takes you on a voyage to learn more about water.

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Educator,

We are pleased to provide your *Understanding Water* Activity Book. Please feel free to make copies of activities for use with your students.

Water is an important topic for students to understand. This volume introduces basic water concepts, supply, uses, water treatment (cleaning), pollution, conservation and wastewater treatment. The intent of this activity book is to help you prepare knowledgeable decision-makers. Vocabulary, reading, writing, geography, math, science and art are reinforced. We've included a page that shows the Colorado Academic Standards and Core Curriculum State Standards this book helps you and your students achieve. You will see that learning about water, like learning about agriculture, incorporates many academic subject areas. Each book contains the answers. An evaluation sheet is also included. Please take the time to answer the questions and drop it in the mail to us. Your thoughts and suggestions are helpful to us in our efforts to produce and supply additional educational materials.

We hope you and your students enjoy and benefit from this resource.

ADDITIONAL PUBLICATIONS AVAILABLE:

Wool and Sheep Activity Book (limited quantity)

Cattle in Colorado History

Colorado Reader subscription includes 30 readers and one teacher's guide in packets mailed monthly during the school year. The readers address different agriculture, food system and natural resource topics.

CFA Comics ~ Watershed Defender is a 16-page publication for middle school students to learn about polluted runoff and how they can work to prevent it.

Need a quick lesson? Go to our website: www.growingyourfuture.com and check out the Curriculum Matrix and E-lessons.

You can also learn about new resources by signing up for our E-newsletter distributed three times during the school year.

ON-GOING PROGRAMS:

Food, Fiber & More Agri-CULTURE in the Classroom Summer Institute. Earn 3 continuing education credits while learning about agriculture and innovative ways to incorporate agriculture topics with academic curricula. This is a one week course in June and takes you out of the classroom for hands-on learning.

Colorado Literacy Project brings someone involved in agriculture into your classroom to read a book about agriculture to your students. You will learn what they do to help provide you with food, fiber and much more.

Learn more about these programs at www.growingyourfuture.com.



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Water

Let's find out about water!
Put a check mark in the
box of the statements
that are TRUE

Water is

- wet (when it falls as rain)
- cold (when it is ice)
- hot (when it is boiling)
- hard to see (when it is **vapor**)

Water is found

- in the ground
- in the sky
- in lakes and streams
- in the oceans
- in water fountains
- in **glaciers**



Water is used by

- everyone
- my neighbors and me
- farmers and ranchers
- schools
- animals
- businesses
- wildlife
- plants



DIARY



Today I have used water to

I have seen water being used
by someone else to

*A diary is like a journal.
You write and draw in it.
You can put lists, pictures,
plans, thoughts, feelings,
ideas, dreams – pretty much
anything – in a diary.*

Bold words, like **vapor**, are defined on pages 64 & 65.

My family uses water

- to drink
- to cook
- to bathe
- to flush the toilet
- to grow vegetables



- to water the lawn
- to wash dishes
- to wash clothes
- to wash the car
- to water house plants



- to fill a fish tank
- for fun, like playing in the sprinkler, swimming, filling water balloons
- to brush teeth

- to wash faces and hands
- to make ice cubes
- to fill a bird bath
- for pets to drink



A farmer uses water

- to water crops (sugar beets, corn, vegetables, flowers)
- for livestock to drink
- for wildlife to drink
- to clean equipment



Water is important to life. We need water to live. When we look at a **globe** we see that most of Earth is covered by water. Most of the water on Earth is found in the oceans. Ocean water is **salt water**.

We cannot drink ocean water because of the salt. Plants grown by farmers cannot use water from the ocean because it is too salty for plants.

Water is a **NATURAL RESOURCE.**



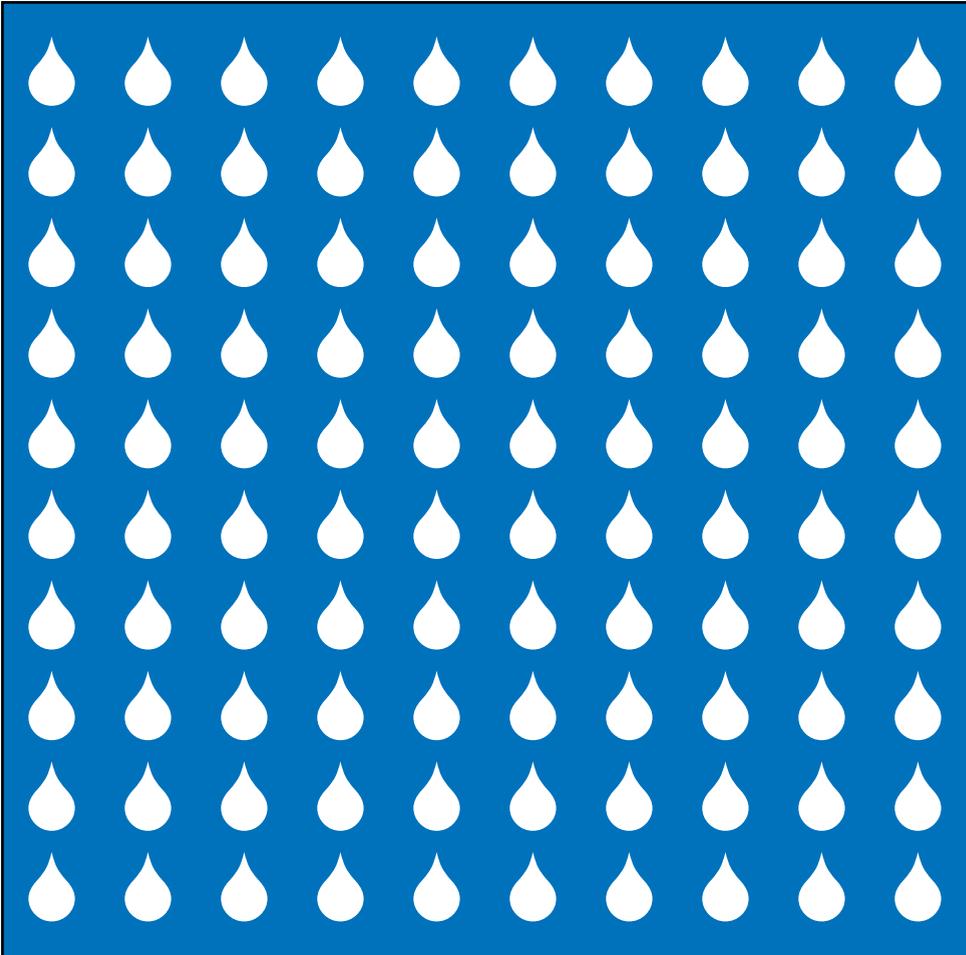
FRESH WATER

Plants and animals that live on land need **fresh water**. Fresh water is water that does not have salt mixed with it. We can drink fresh water after it is cleaned or goes through a treatment process. Fresh water is found in lakes and **reservoirs**, streams and **rivers**. It falls as **rain** from storm clouds and is in the **snowpack** in mountains. Fresh water is found under ground as **groundwater** and frozen as ice in **glaciers**.

All of something is 100%.

97% of the water on Earth is salt water.

3% of the water on our planet is fresh water.



Here are
10 rows
of 10
water
drops.

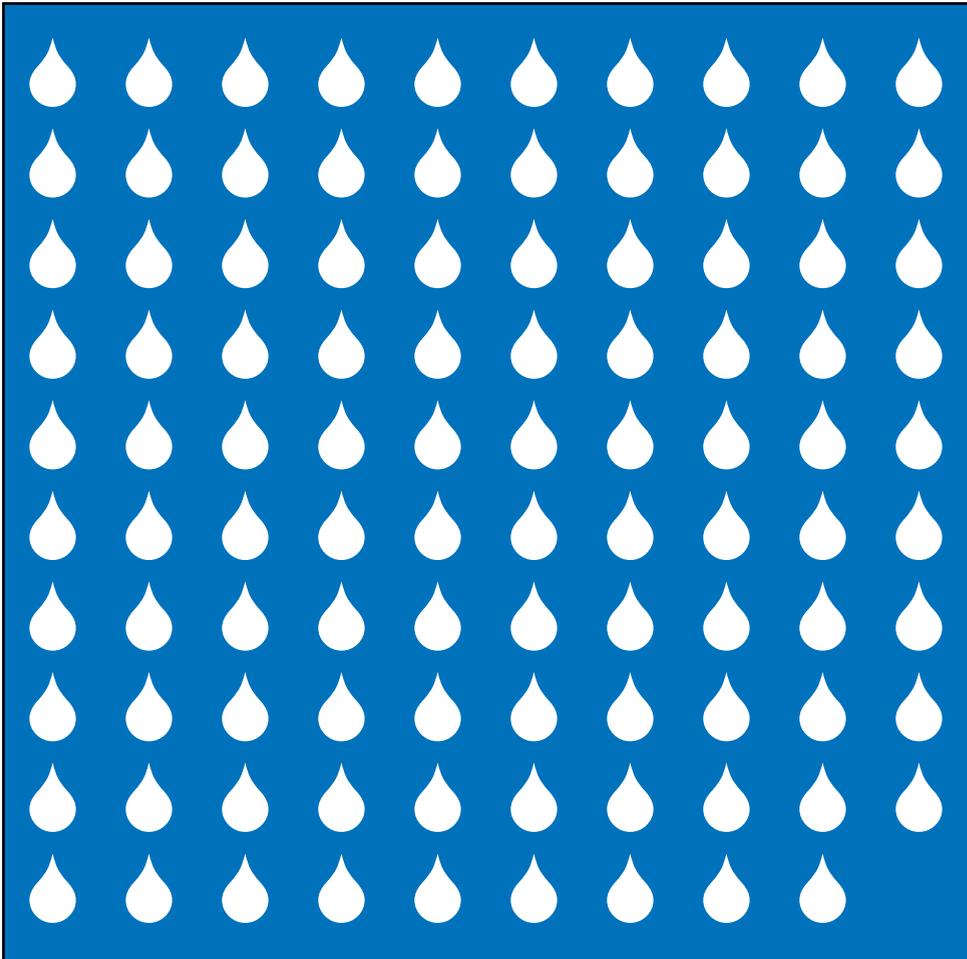
How
many
water
drops are
there?

$$\begin{array}{r} 10 \\ \times 10 \\ \hline \end{array}$$

Color 97 of the drops red to show salt water.

Color 3 of the drops green to show fresh water.

Three percent of Earth's water is fresh water. Of the fresh water, two percent is frozen in polar ice caps and glaciers; one percent is available for our use.



The water drops represent all the fresh water on Earth.

Color the drops to show how much fresh water is available to use.

You will use two colors again – one color for ice, one color for water that we can use.

Color frozen water red. Two of every three drops will be red. Color usable water green. One of every three drops will be green.

Most scientists believe there is the same amount of water on earth today that there was at the time of the dinosaur.



Do the math!

All fresh water = 99 drops or 100%

Two percent or $\frac{2}{3}$ of the 99 water drops are frozen.

One percent or $\frac{1}{3}$ of the 99 water drops are water that we can use.

Frozen water = ____ drops

Fresh water = ____ drops

A sentence is a complete thought.

A complete sentence needs a noun and a verb.

Snow is cold. “Snow” is the noun. “Is” is the verb.



Write an “S” on the line in front of each *complete sentence* you find in the list.

- _____ Earth has a lot of water.
- _____ Three percent of water on Earth is fresh water.
- _____ Salt in ocean water
- _____ Less than one percent of fresh water is available for people, plants and animals.
- _____ Animals and plants water
- _____ There is water in lakes and streams.
- _____ Water wet

Rewrite the sentences from the list that you left blank. Make them into complete sentences.

Water is found as **liquid, solid** or **gas (water vapor)**. These are three states of matter. Liquid water is what comes out of your faucet, flows down rivers and is found in lakes. Solid water is ice. Ice is frozen water like ice cubes, the surface of a lake in winter, snow flakes or hail. Water can also be **vapor**. Vapor is created when water evaporates. You can make water vapor by boiling water.

Fill in the blanks in the sentences to name water pictured.



Water

condenses to
form clouds.



Liquid water freezes into snowflakes.
It is then a _____.

What is wrong
with these
snowflakes?

Water that flows from a
faucet is

Snowflakes have six
sides or points.
They are hexagonal
structures.



SCIENCE EXPERIMENT

Identify water as liquid, solid or vapor.

To do this activity you need:

- a measuring cup
- 2 small paper cups
- a paper towel
- water
- an adult with a hot plate or stove
- a pinwheel

1

Put 1/4 cup of water in the measuring cup.



2

Pour the water into one of the small paper cups.

3

Write three words that describe a liquid.

Water from a faucet is liquid.
Water in a lake is liquid.
Rain is liquid.



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4 Put the cup in a freezer. Check it every two hours to see the stages of changing from a liquid to a solid. Once the water has changed to ice, remove it from the freezer.

5 Put a paper towel on a table and peel the cup away from the ice.



This is a **solid**.

Write three words that describe the solid form of water.

6 Use the ice cube, the second cup and the paper towel. Try to turn the solid water back into a liquid.

Write about what you did.

7 Ask the adult helping you to set up a hot plate and tea kettle filled with water.

Place the pinwheel above the tea kettle when the water begins to boil.

What happens to the pinwheel?

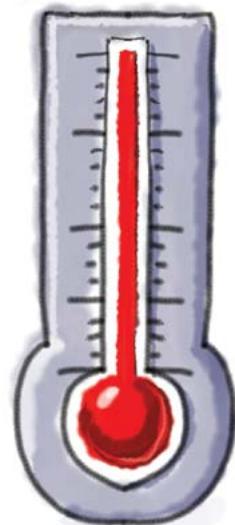


What made the pinwheel turn?

Water vapor.

Write three words that describe vapor.

What caused the changes in the water?



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Water is the most common **compound** on earth. A compound is made up of **elements**. Everything is made of **atoms**. Elements are different arrangements of atoms. An atom is the smallest particle of an element. Water is made up of three atoms: two atoms of **hydrogen** and one atom of **oxygen**. It is two hydrogen atoms and one oxygen atom. It is written **H₂O**.



PROPERTIES OF WATER

Water can make things wet. It can dissolve things. Water can “carry” things and flow through things.

Water acts differently with different materials. Water beads up on wax paper because of **surface tension**. Surface tension allows water to form a skinlike surface. Other materials allow water to flow through them or be absorbed. Paper towels and sponges absorb water. Sand and gravel are two earth materials through which water can flow.

Water can change almost any material. Everything from dissolved salts to huge boulders can be moved by water.

Water’s ability to dissolve substances has an effect on water quality. Water carries dissolved solids. The characteristics of water make it a great “cleaner”. Since many things dissolve in water, water can be used by itself or be combined with other products to clean surfaces and items.

Some things float on water.
Some things dissolve in water.
Some things sink in water.

*Finish the sentence next to the picture.
Will the item float, dissolve or sink in water?*

leaves will _____



salt will _____



an anchor will _____

Write a sentence about one of the objects pictured. Explain why you think it does what it does when it's put in water.

Density is why objects do what they do with water.

Density is the measure of the weight and volume of an object.

The anchor, made of metals, is heavy. It is heavier than water. It will sink.

The leaves are light. They are lighter than water. They will float.

The salt, like sugar, will dissolve in water.



SCIENCE EXPERIMENT

You will need:

- ✓ A large bowl of water
- ✓ Paper clips
- ✓ Aluminum foil

Put water in the large bowl of water. Drop a paper clip in the bowl. Watch it sink. Make “boats” using the aluminum foil. Make different shaped boats from the same size pieces of foil. Put the foil boats in the bowl of water. They will float. Drop one paper clip at a time into a boat.

How many paper clips can the boat hold?

Why does a paper clip sink by itself in water yet several can float in a boat?



Why doesn't the paper clip float by itself?



What will happen when an ice cube and a marble that weigh the same are dropped into water?

A S L T W A T E R

S A L T W A T E R

Unscramble the water words!!

S I L O D

— — — — —

N A I R

— — — —

V A P R O

— — — — —

I D E S Y N T

— — — — —

C E I

— — —

V I R E R

— — — — —

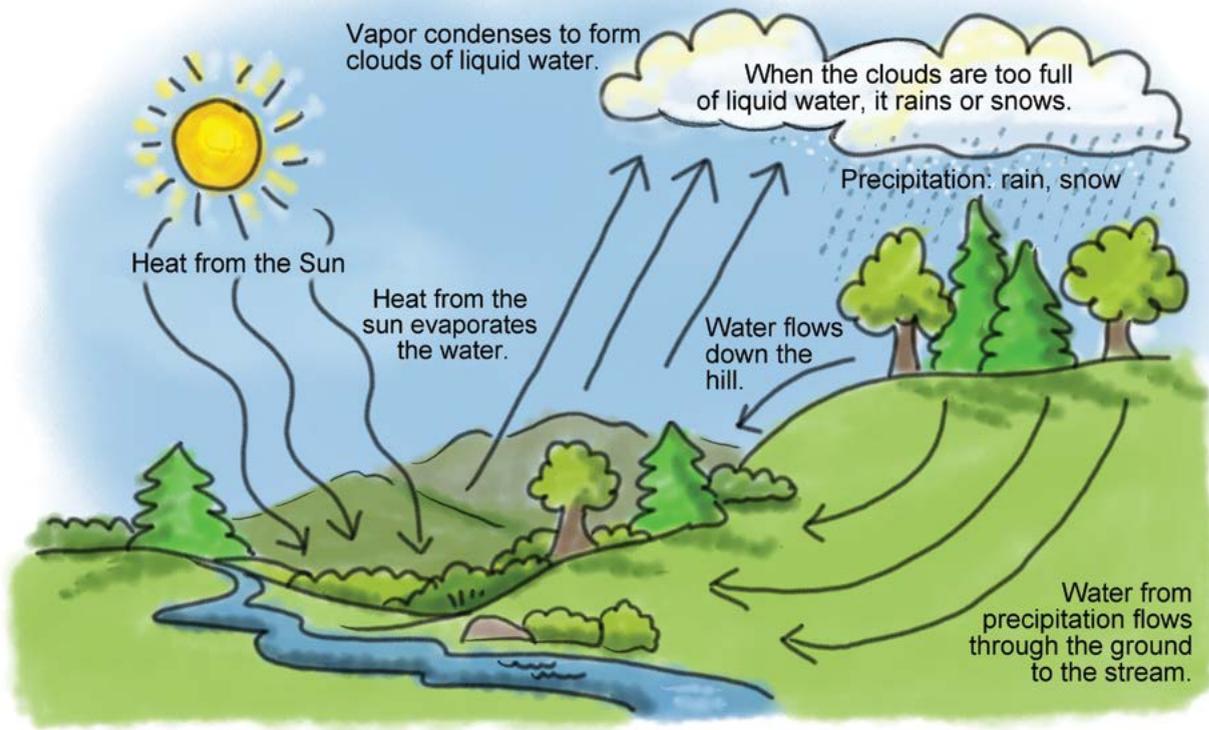
I L D U I Q

— — — — —

O E A N C

— — — — —





Water goes through three states of matter (liquid, solid, gas) in the water cycle.

The water cycle is the movement of water from Earth to the **atmosphere** and back again.

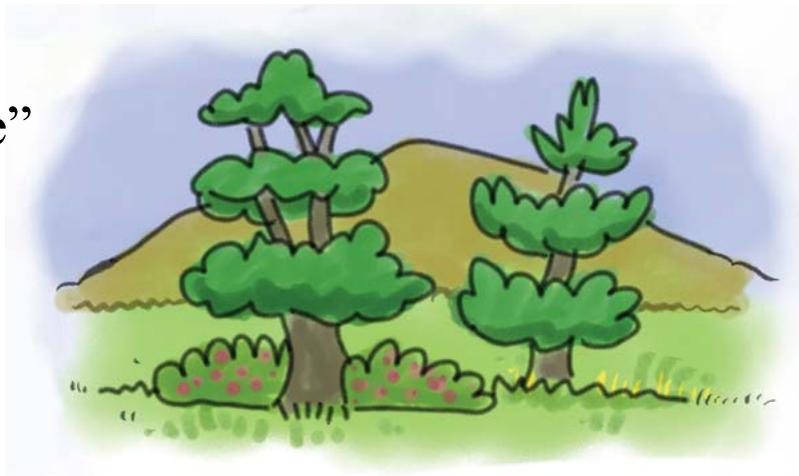


Surface water is any water flowing or standing on the surface of the ground.



Water from lakes, rivers and oceans is warmed by the sun. The liquid water turns into water vapor (gas). When vapor is warmer than air, it rises up into the atmosphere. This is called **evaporation**.

Plants and trees also “breathe” water into the atmosphere in a process called **transpiration**.



Sunlight striking falling rain makes a colorful effect.

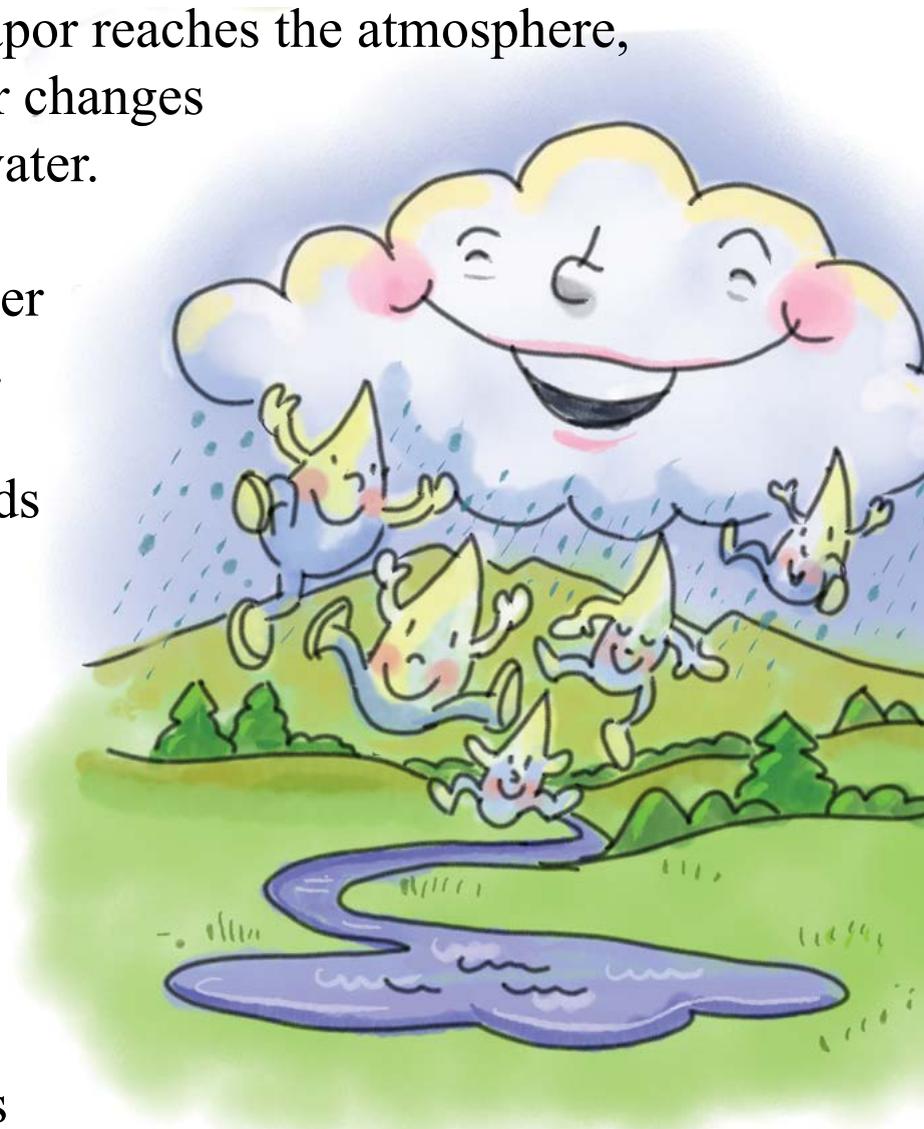
What is this called?

When water vapor reaches the atmosphere, it **condenses** or changes into drops of water.

The drops gather to form clouds.

When the clouds let go of the water as rain or snow, it is called **precipitation**.

The water falls back to Earth. Some of it falls into oceans. Some water runs off the land into lakes, rivers and streams. This is called **runoff**. Some water trickles beneath the surface of the ground to become **groundwater**, feeding into wells, springs and streams.



WATER CYCLE

Then the cycle goes around again.

MATCH 'EM!

Match the words and the meanings

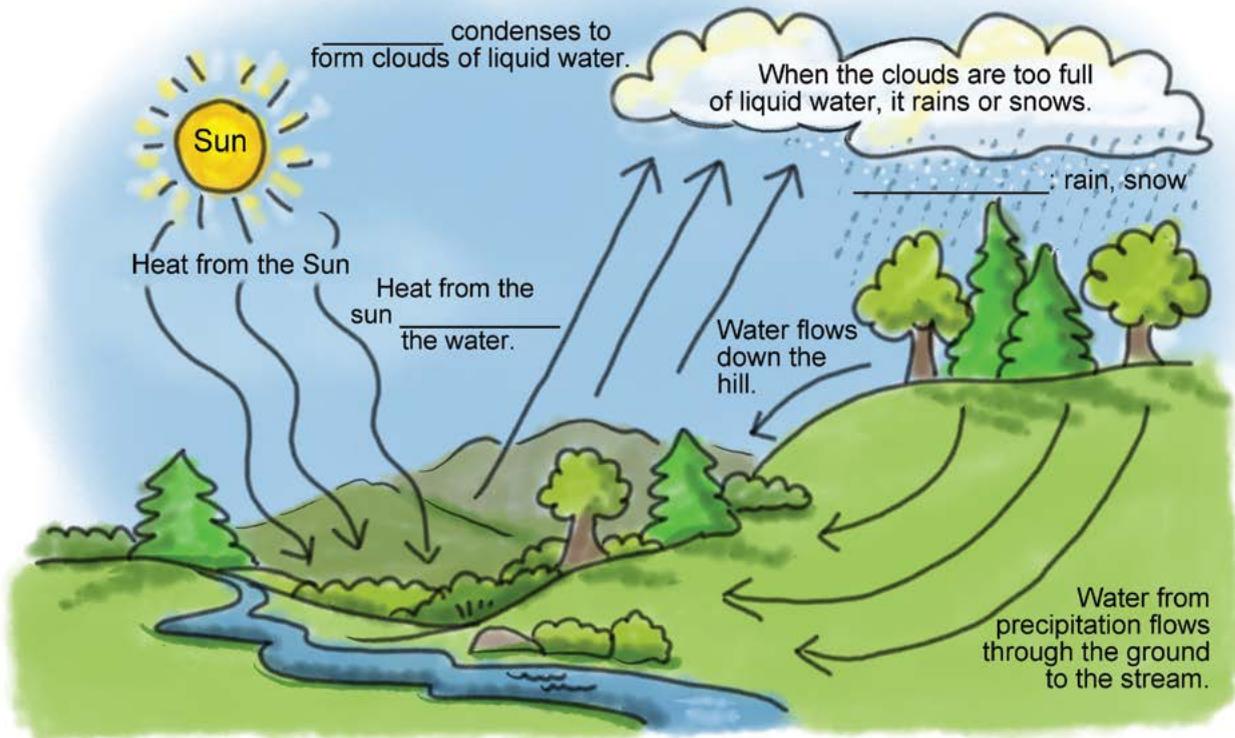
- _____ EVAPORATION
- _____ CONDENSATION
- _____ LIQUID, ICE, VAPOR
- _____ PRECIPITATION
- _____ RUNOFF
- _____ TRANSPIRATION



WRITE THE LETTER
OF THE DEFINITION
ON THE LINE

- A** When the rain reaches Earth it flows across the land into lakes, streams and oceans.
- B** The sun heats water. The water becomes vapor that rises into the atmosphere.
- C** Liquid is heavier than vapor. Gravity pulls the liquid down to Earth as rain or snow.
- D** Water vapor condenses to form clouds. When the clouds cool, the vapor becomes liquid.
- E** Plants take in water, then “breathe” the water out as vapor.
- F** Three states of water.

WATER CYCLE



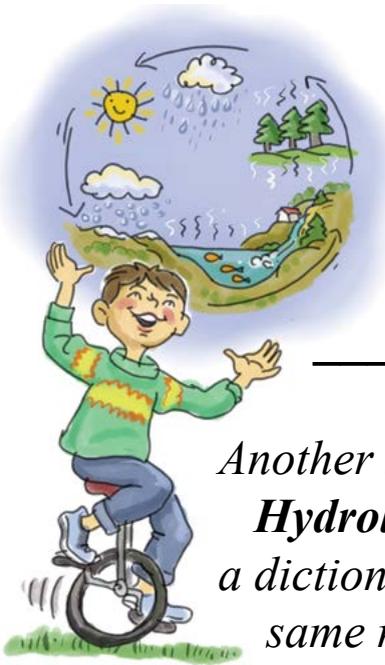
WATER WORDS:

PRECIPITATION

VAPOR

EVAPORATES

Describe what happens in the water cycle:



Another name for the water cycle is **Hydrologic Cycle**. Look for this word in a dictionary. Why do both terms have the same meaning?

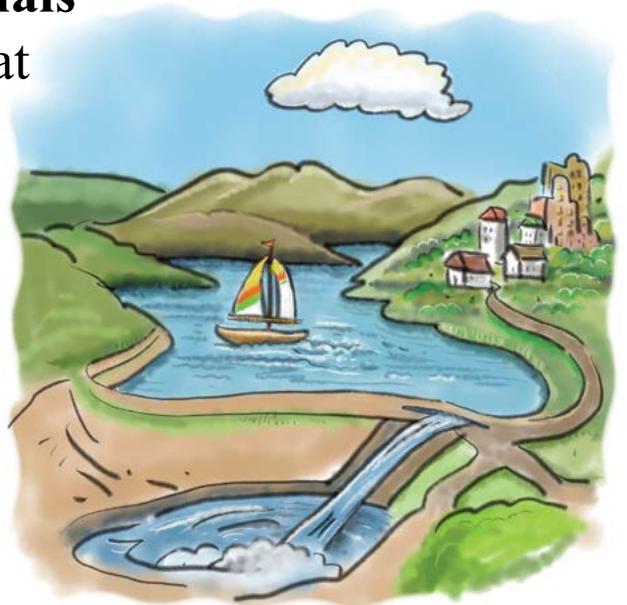


Snow falls in winter. Snow is frozen water. In states with mountains – like Colorado, Wyoming, Montana and California – snow piles up in the mountains in winter. This buildup of snow is called **snowpack**. The amount of snow and the water content in the snowpack determines how much water we will have in the summer and fall.

The snowpack begins to melt in spring when it gets warmer. The water from the melted snow flows into streams. The streams flow into rivers. Some of the water is caught and stored in **reservoirs**. The stored water can be used throughout the year.

Water stored in reservoirs and lakes is released when it is needed. The places needing water may include cities, businesses, homes or farms. Water can also flow to another state. Water is moved by letting it flow down rivers, through man-made **canals** or ditches, or through huge pipes that may sit above or below ground.

A **DAM** IS A STRUCTURE BUILT TO STOP THE FLOW OF WATER DOWN A STREAM. THE DAM CREATES A **RESERVOIR**. THE **RESERVOIR** IS BOTH THE CONTAINER THAT HOLDS THE WATER AND THE WATER THAT FILLS THE CONTAINER.



Your turn to be an artist!

Over the winter months snow has fallen; snowpack has built up. It is spring and the sun is shining and the days are longer. The temperatures are warmer both during the day and at night.

Show what happens to the water from the snow and where it goes...

W
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D
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Did your drawing show water going downhill? Did your water flow into a stream then into a lake or reservoir? If you drew water going downhill you drew a picture of a **watershed**.

A watershed is an area of land. It is the land area that drains water into a river. Another name for watershed is **drainage basin** or **basin**. A watershed is the land that drains water to a river or lake. A watershed can be large, like the Mississippi River drainage basin, or very small, like 20 acres that drain to a farm pond.

We ALL Live Downstream

No matter where you live, you are in a watershed.

Your watershed may be made up of mountains, farmland, houses, businesses, towns or rangeland.



Name a major river near you:

Are there any small rivers near where you live?

Does the small river run into a larger river?

Watersheds are often named after the river that runs through an area. What is the name of your watershed?

IN COLORADO:
The watershed in which you live might be named after one of these rivers:

South Platte River
Colorado River
Arkansas River
Rio Grande River
Yampa River
Cache la Poudre River

There are many more rivers and streams in Colorado. Use a map of the state to make a list of rivers and streams.

How many did you find?

Water is not always where we want it to be. It does not always come in the amount we want. Sometimes there is not enough water; other times there is too much water. Storage reservoirs have been built to hold water to keep a constant supply.



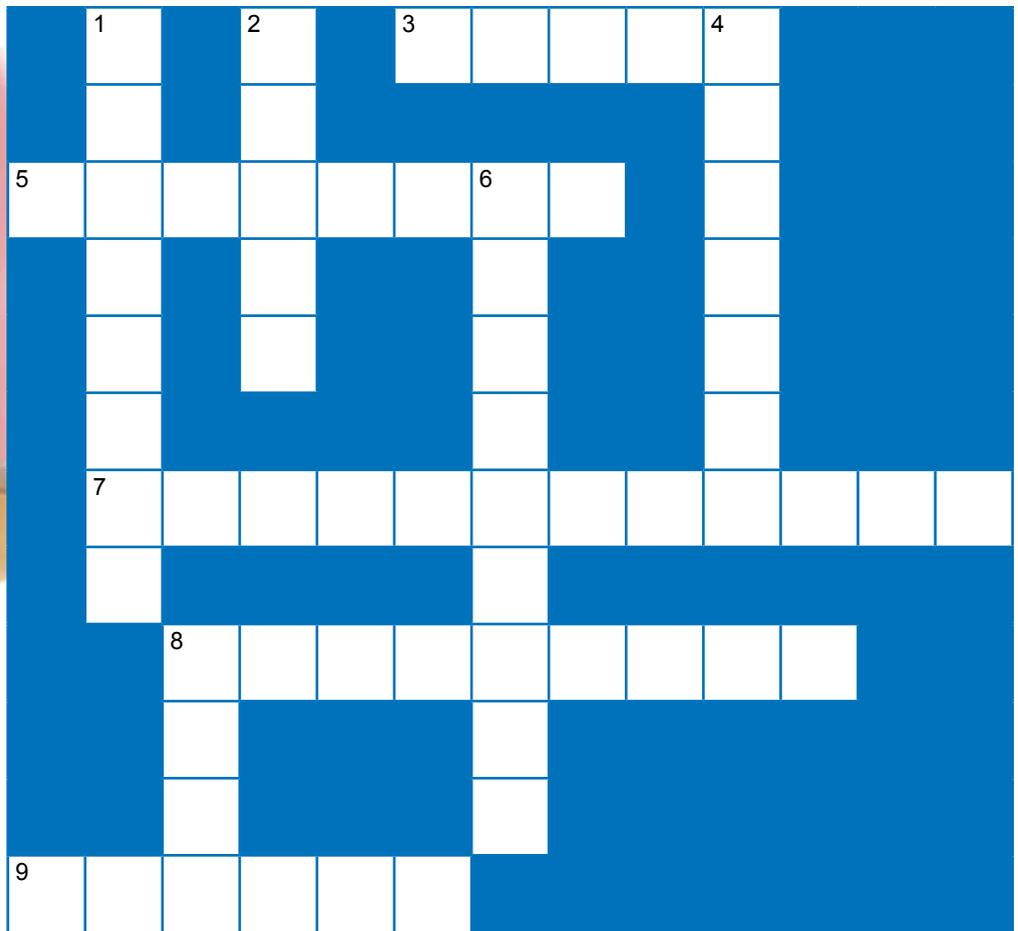
Everything gets dry when there is not enough rain. Not enough rain can cause a **drought**. When an area has a drought, plants and the ground dry out.



A drought can result in water **rationing**. This means everyone uses no more than a set amount of water. Many towns and cities practice water **conservation**. The cities and towns themselves use less water and encourage residents to take steps to use less water.



Other times there is too much rain. When there is too much rain and the ground cannot soak it up, water will **flood** areas. The water that cannot soak into the ground will run into rivers and streams. When the rivers and streams are too full, water will run over the banks and flooding can happen.



Down

1. The buildup of snow that falls in the mountains in the winter.
2. Another name for a watershed is a drainage _____.
4. A dry condition from not having enough water.
6. A body of water held by a dam. This is one way to store water.
8. A kind of precipitation.

7. Using less water in order to save it for later use.
8. When everyone uses a smaller, fixed amount of water instead of the usual amount of water.
9. Kind of man-made ditches that carry water from place to place.

Across

3. Too much water all at once will cause this.
5. Wetness; i.e., the amount of _____ in the snowpack determines if there will be enough water in the summer and fall.



WATER WORDS

- | | | |
|---------------------|------------------|------------------|
| BASIN | FLOOD | RESERVOIR |
| CANALS | MOISTURE | SNOWPACK |
| CONSERVATION | RAIN | |
| DROUGHT | RATIONING | |

Water is used over and over – as many as five to seven times – before it flows out of Colorado.

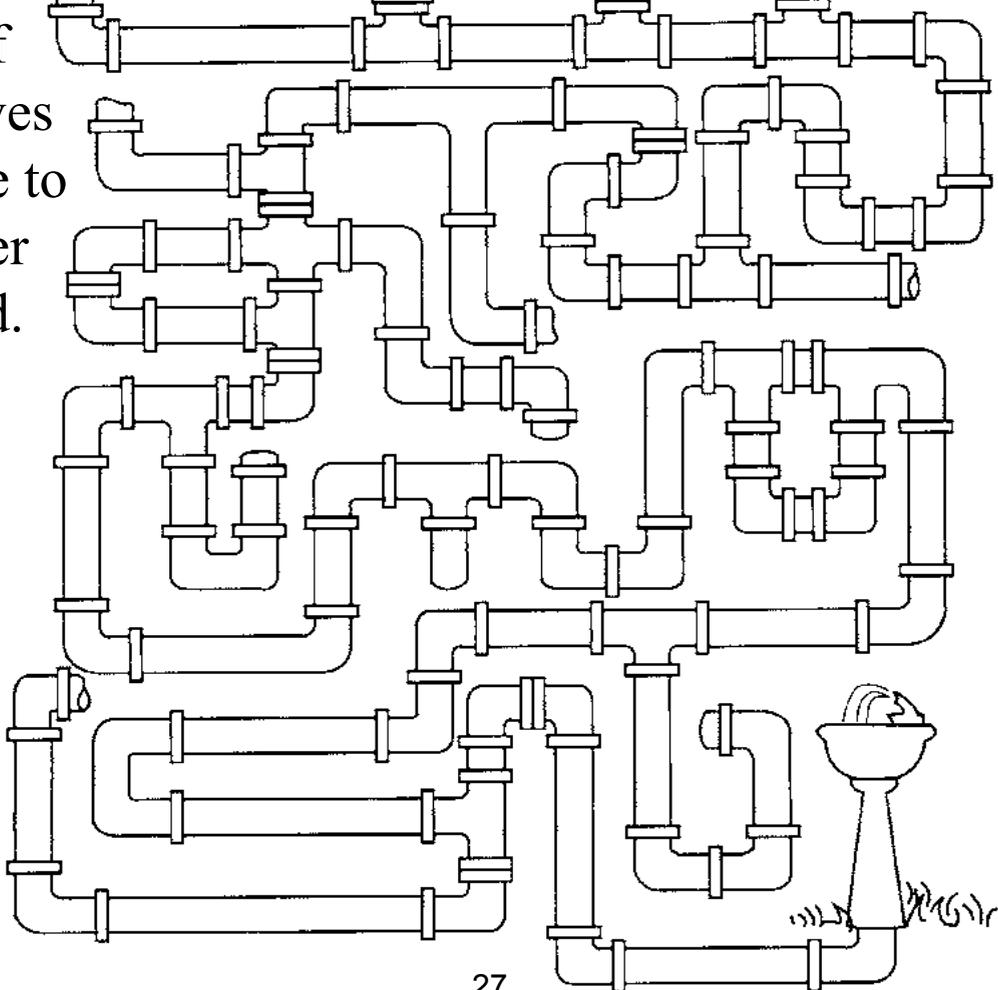
Communities will use water in many ways. Water that is used inside our homes, schools and businesses will be cleaned at a treatment plant and put back into the streams for other uses.

Most communities have a storage system, a delivery system, a wastewater system and a treatment plant.



A lot of water moves from place to place under the ground.

Find the right pipes to take the water from the storage tower to the fountain.



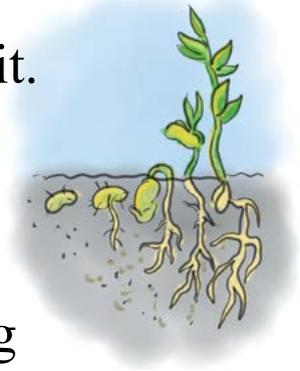
A lot of water, however, will be used and not go through a treatment plant. Water that is used on our lawns and gardens will flow back into the streams. The water we use to wash our pets or cars and to water our lawns flows through storm drains into rivers and streams for other uses downstream.



Another use...

Farms and ranches can be downstream or upstream from communities. Farms and ranches need water for animals and plants. Farmers **irrigate** crops.

Irrigation is a way to bring water to crops. Irrigation is giving water to plants when they need it. After seeds are planted in the ground, they need water to **germinate** into seedlings. The seedlings need water and sunshine to grow into big plants.



Water is given to plants throughout the growing season. It is important to give growing plants as much water as they need, but too much water can hurt them. Farmers watch the weather. If it rains a lot, they don't want to irrigate because plants can drown.



There are many ways to irrigate.



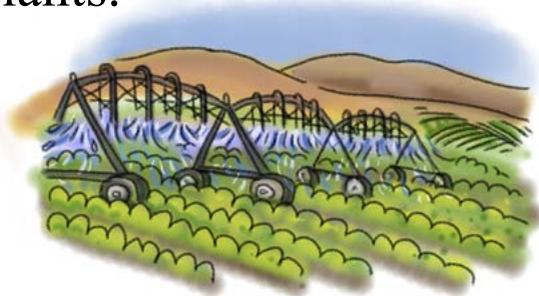
One way is to dig little ditches between rows of crops and let the water run between the rows. This is called **furrow irrigation**.

Another way to irrigate is to **flood** an area with water. Hay fields and pasture land are often flooded with water.

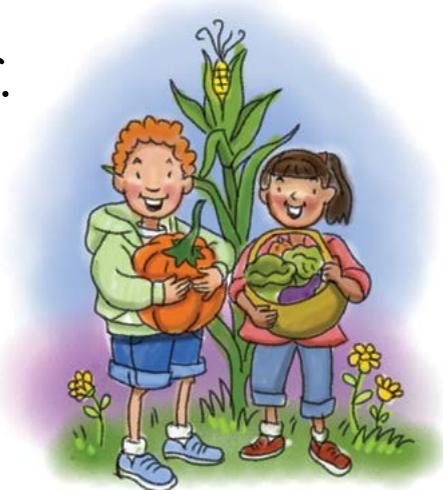


A third way to irrigate is to use a “**drip**” system of hoses. This is where water comes out of holes in the hose next to the plants.

A fourth way to irrigate is to use a **sprinkler** system.

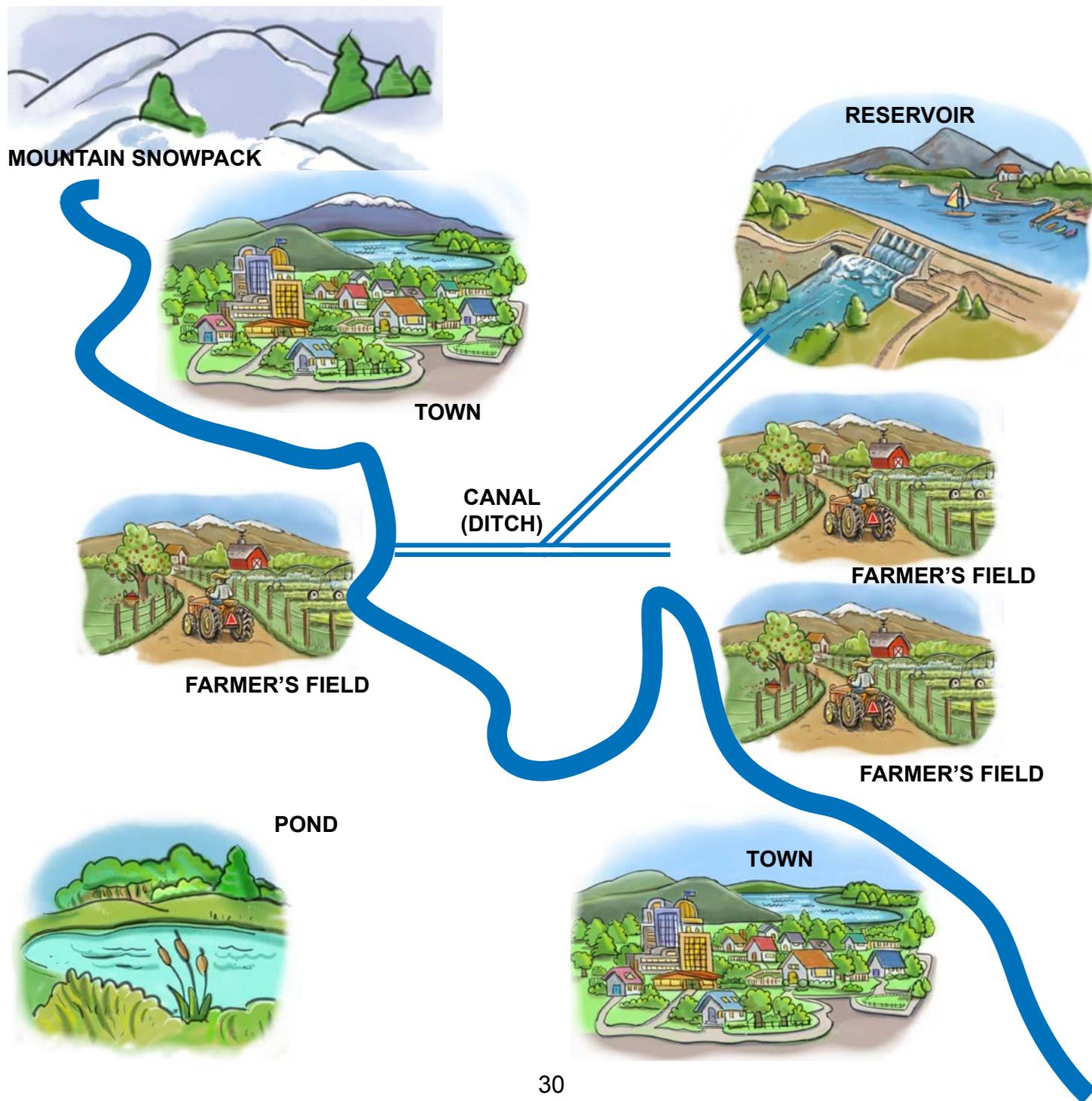


Yet another way to irrigate is **surge irrigation**. A computerized valve turns the water supply to furrows on and off. This system is designed to allow water to soak into the ground before more is applied.



If we start where the crops are in the fields and go backwards we will find a web of ditches and canals that carry water to the fields. Supply ditches get their water from reservoirs or lakes. Reservoirs and lakes get their water from rivers, streams, rain and runoff from storms. Rivers get their water from melting snow, rain and runoff from storms.

Draw arrows where the water goes to make a “water web.”



What are other ways a farmer or rancher might use water?

Write answers on the line next to the picture.

WATER WORDS

WATERING LIVESTOCK
DRINKING
CLEANING
PROVIDING WATER FOR WILDLIFE
HAVING FUN



W
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Businesses use water. Every business needs water. Different types of businesses will need different amounts of water. The amount of water a business needs depends on what they do or what they make. Every business has one or more people working and people need water.

*Think about the businesses listed here.
List three ways they might use water.*

Restaurant



Recreation Center (with basketball courts, skating rink, swimming pool and weight room)



Supermarket



Car Dealership

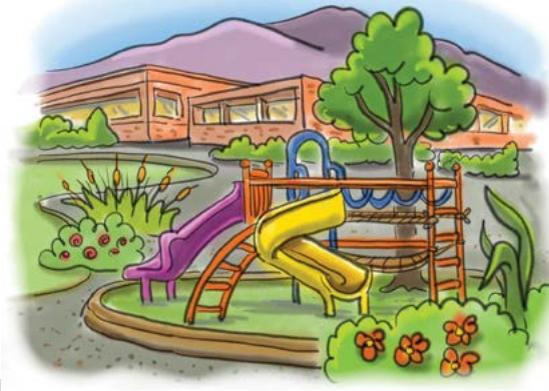


Farmer



Water is used in schools every day.

Think of all the different ways water is used in your school. Some places to think about are the cafeteria, restrooms, and areas outside the school buildings where plants and grass grow.



W A T T E R U S E S

1 If each student in your class drinks 16 ounces of water a day when you are at school, how many ounces of water will your entire class drink, at school, in a day?

2 How many ounces of water will your entire class drink in one school week (5 days)?



128 ounces = one gallon

Now, convert your answers to “gallons” of water!

1

2

Let's look at the entire country. Find your state and color it red.

Use an **atlas** (a book of maps) to find the large bodies of water that border the United States. Color them blue. Label oceans, the lake between Michigan and Wisconsin and the Gulf of Mexico.

Find the major rivers that flow through the United States. Draw them on the map in blue.



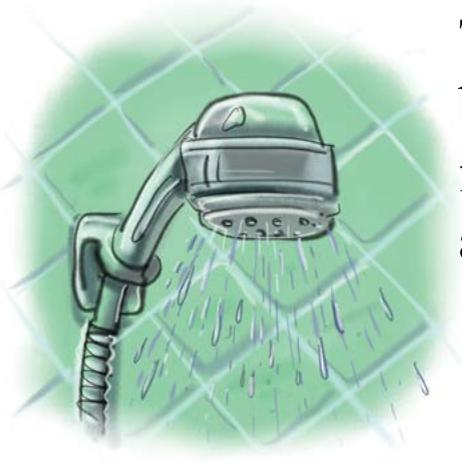
Nevada has the least amount of precipitation of all the states.

Hawaii receives the most precipitation.

Hawaii is the only state that water flows out of but not into.

*Do rivers flow into other rivers?
Does the water ever reach the oceans?*

The Mississippi River is the **LONGEST** river in the United States on which boats & ships can travel.



The water we use in our houses, schools and businesses is cleaned at a water treatment facility before we use it. Dirt and bacteria are removed from the water.

Let's explore how water is cleaned and learn some **BIG WORDS!**

The words we are going to learn are

coagulation (co-ag-u-lá-tion)

sedimentation (sed-i-men-tá-tion)

filtration (fil-trá-tion)

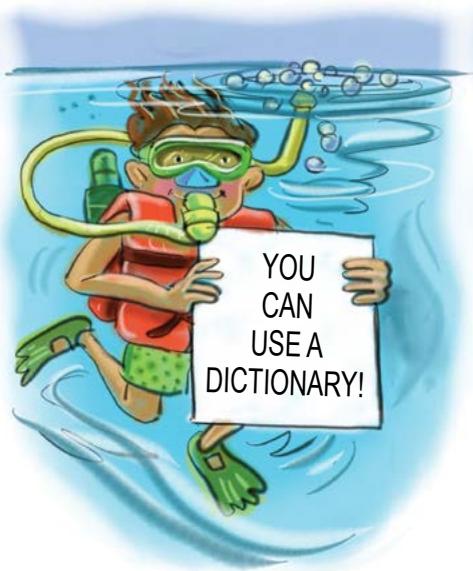
disinfection (dis-in-féc-tion)

storage (stór-age)

Four of our words end in “**-tion.**” This is a **suffix.**

It has a meaning that attaches to the root word.

The suffix “-tion” added to a word makes a noun, meaning an act; a thing done, a process.



What are our root words?

coagulation = coagulate

sedimentation = _____

filtration = filtrate

disinfection = _____

storage = store

Water to be cleaned is brought to a treatment plant. It flows into a container. Heavy **particles** settle to the bottom of the container.

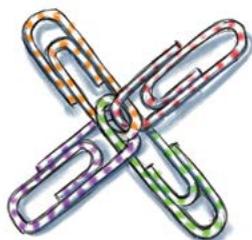
There are fine particles that don't settle to the bottom of the container. These particles need to become heavy enough to sink. **Coagulation** is the process of combining small particles with other small particles to create larger solids. **Alum**, a chemical which makes the particles stick together, is added to the water. The water is mixed with rotating mixers at high speed.



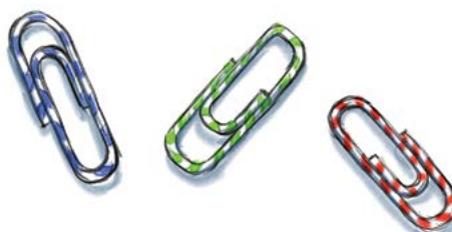
It is easier to remove big things from water than tiny things. If you can make the little things in water stick together or make them heavier than water so they sink, it will be easier to gather them together.

Which of the groups of paper clips will be easier to remove from the water?

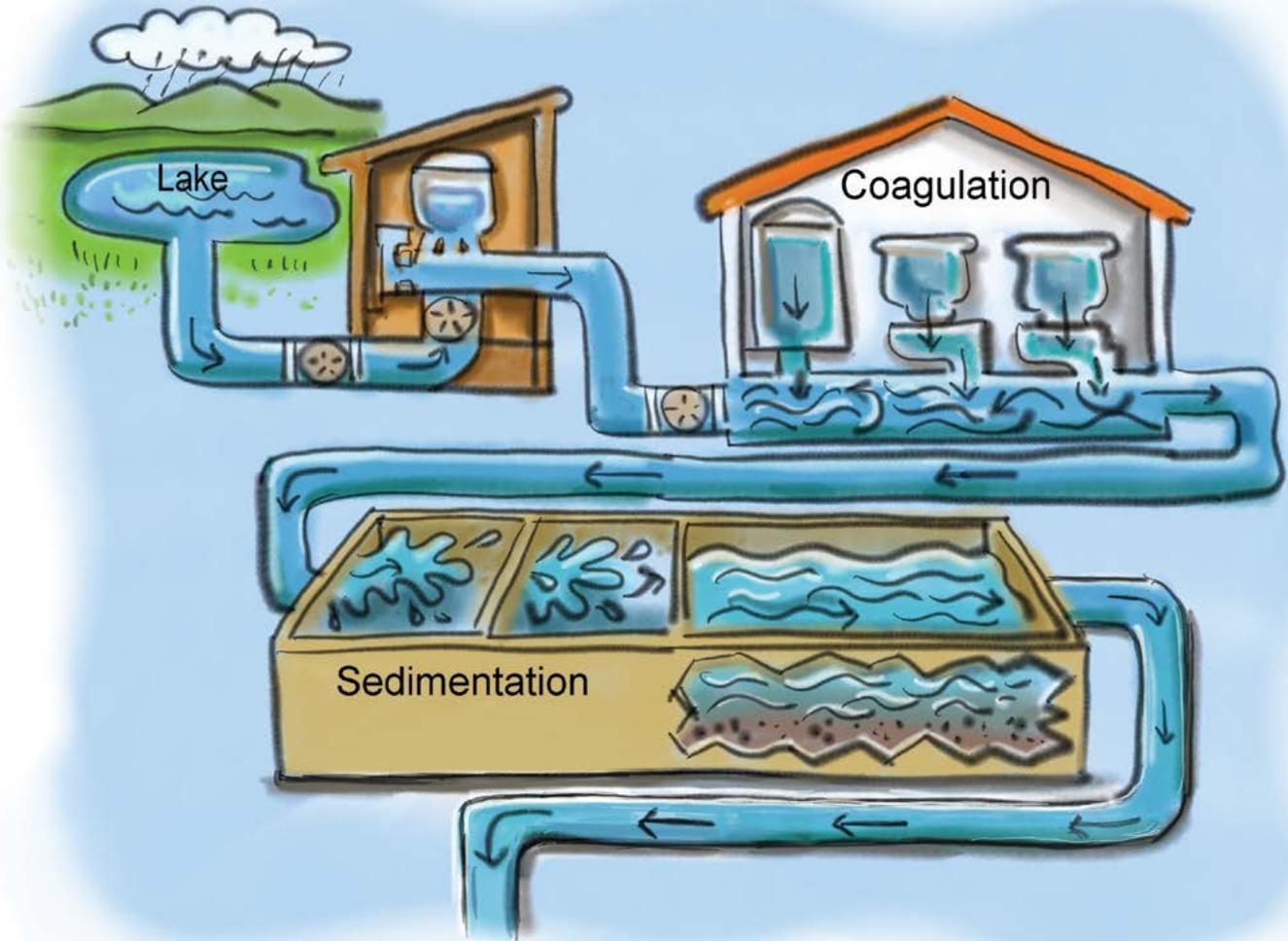
1



2



The larger and heavier particles settle to the bottom of the container. They form **sediment**. The process is called **sedimentation**. The clean water moves to filtration.



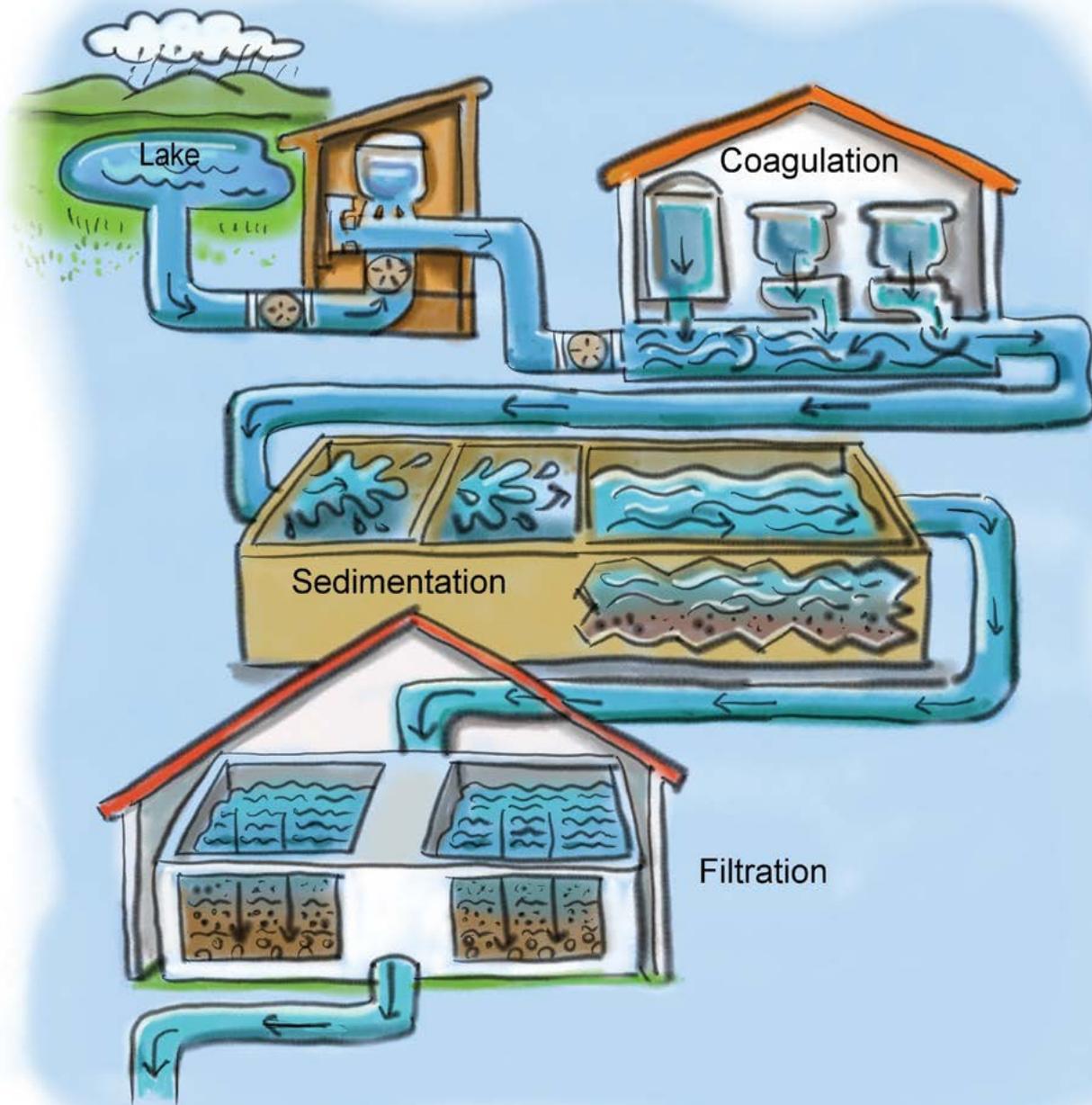
Another name you might hear for this process is “**flocculation.**”

Coagulation causes the particles to stick together and form larger particles called **floc**.

kō-ăg' yə-lā'tion

fłök' yə-lā'tion

The water passes through filters made of layers of sand, gravel and charcoal. The filtering of the water helps remove smaller particles. This process is called **filtration**.

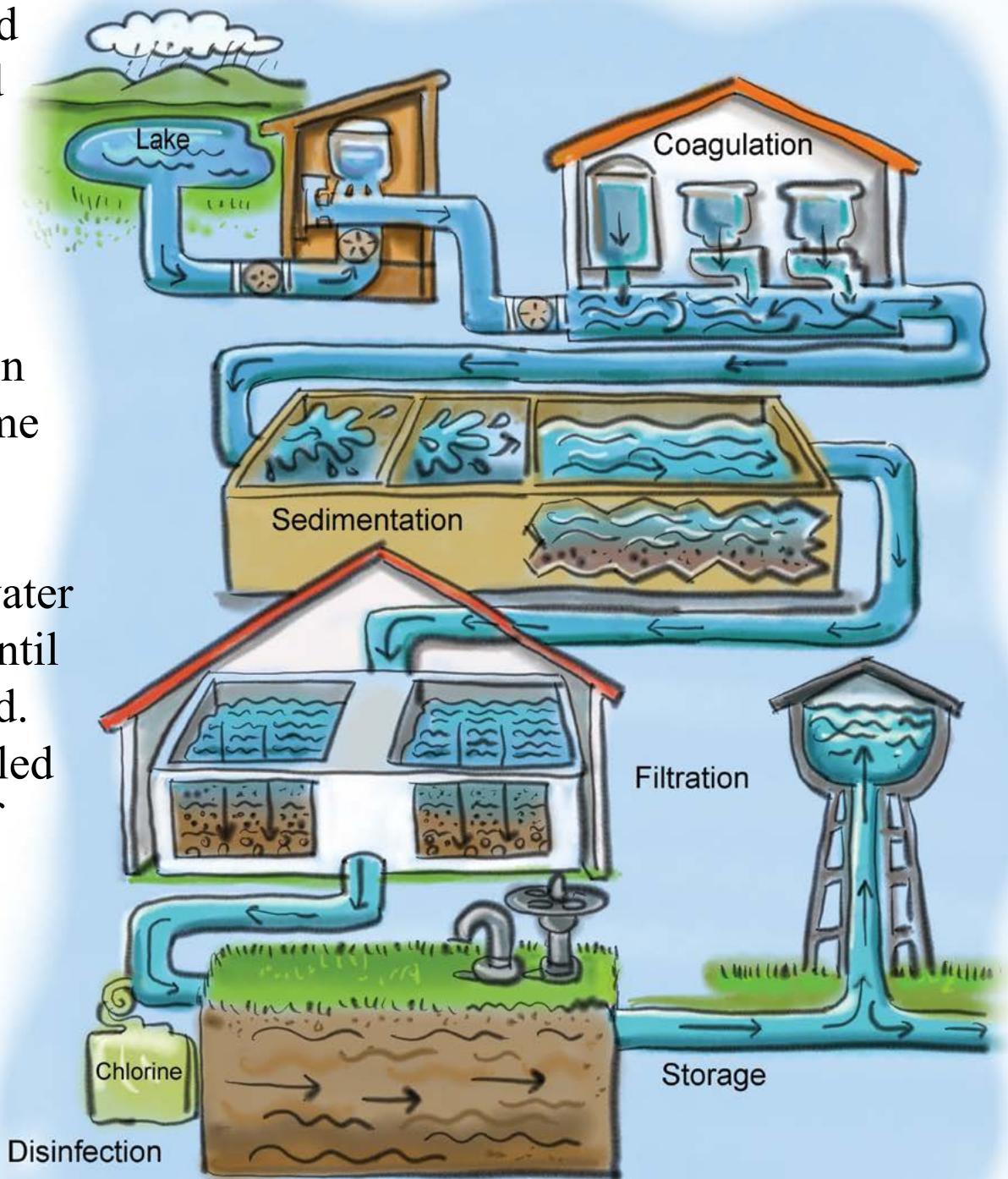


TREATMENT

A small amount of chlorine (or another **disinfectant**) is added to the water to kill any bacteria or microorganisms that may still be in the water. This process is called **disinfection**.

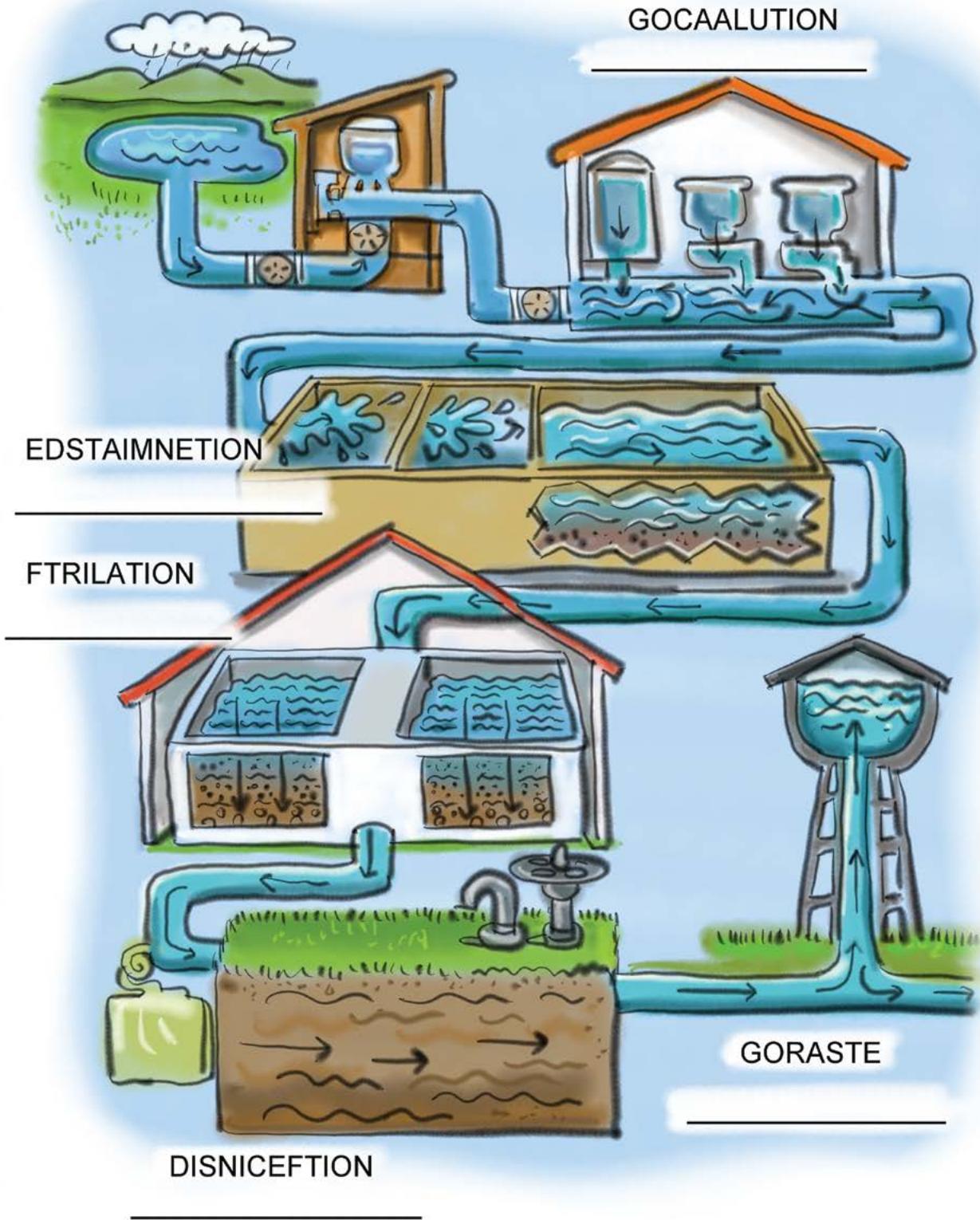
Water is then placed in a closed tank or reservoir. This gives the disinfection process time to work.

The water is stored until it is needed. This is called **storage** of the water. The water then flows through pipes to homes and businesses.



Use your new words to show how water is cleaned so we can drink it.

Stop at each treatment point and unscramble the words.

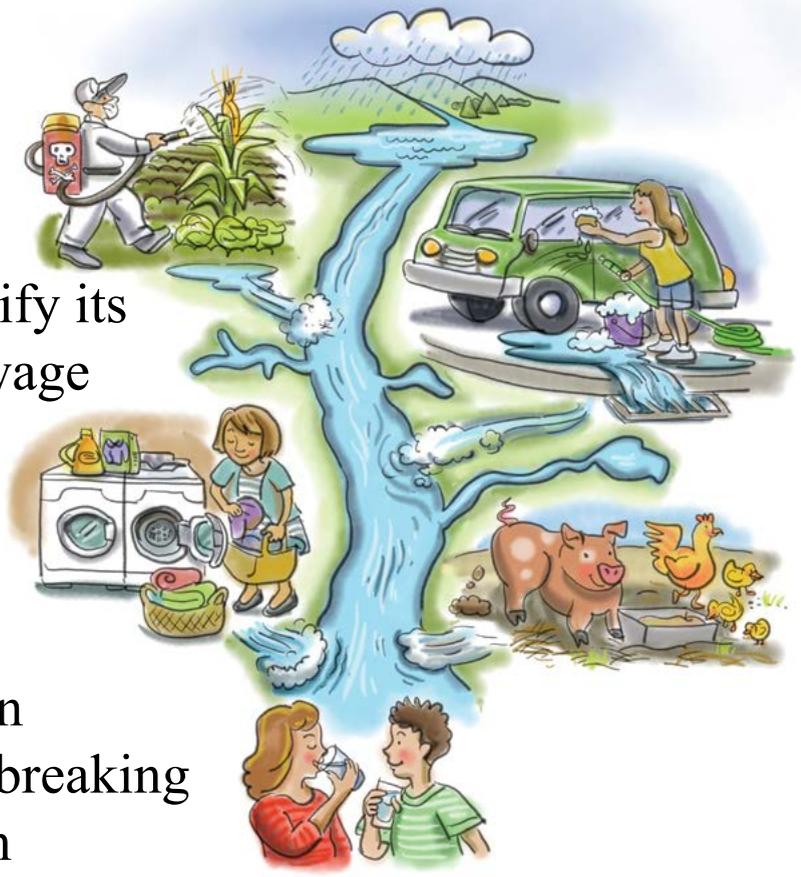


TREATMENT

What do you think of when you hear or read the word **POLLUTION?**

There are two types of water pollution:
Point source pollution and
nonpoint source pollution.

Point source pollution can be traced to one source. You can easily identify its source. You can point at sewage flowing from broken pipes or see waste materials coming from a factory. Laws have been passed to stop this type of pollution. In addition to paying fines for breaking the law, polluters must clean polluted water before it goes back into rivers.



Nonpoint source pollution, also called runoff pollution, comes from many different sources. There are many possible sources of the dirty “stuff” in streams and lakes. For example, each time it rains, runoff from streets picks up litter, motor oil, pet (animal) waste, leaves, grass clippings and spilled chemicals. These things are washed into storm drains and make their way to our rivers and streams.

Nonpoint source pollution (NPS) is also runoff from rainfall and snowmelt moving over and through the ground. The runoff carries natural and human-made pollutants into lakes, rivers, streams, wetlands and other water systems.

Nonpoint source pollution existed even before people started building roads, houses and businesses. Heavy rains carry dirt, soil and other things into rivers and streams.

Circle the items that can pollute water.

- | | | |
|----------|-----------|----------------|
| SOIL | MOTOR OIL | BOTTLES |
| PAINT | LITTER | PET WASTE |
| GASOLINE | LEAVES | CHEMICALS |
| PAPER | CANS | ABANDONED CARS |

An extra word has been added to each sentence below.
Draw a circle around the word that does not belong in the sentence.

All living things need we water.

Dirty water is not need good.

It clean can make you sick.

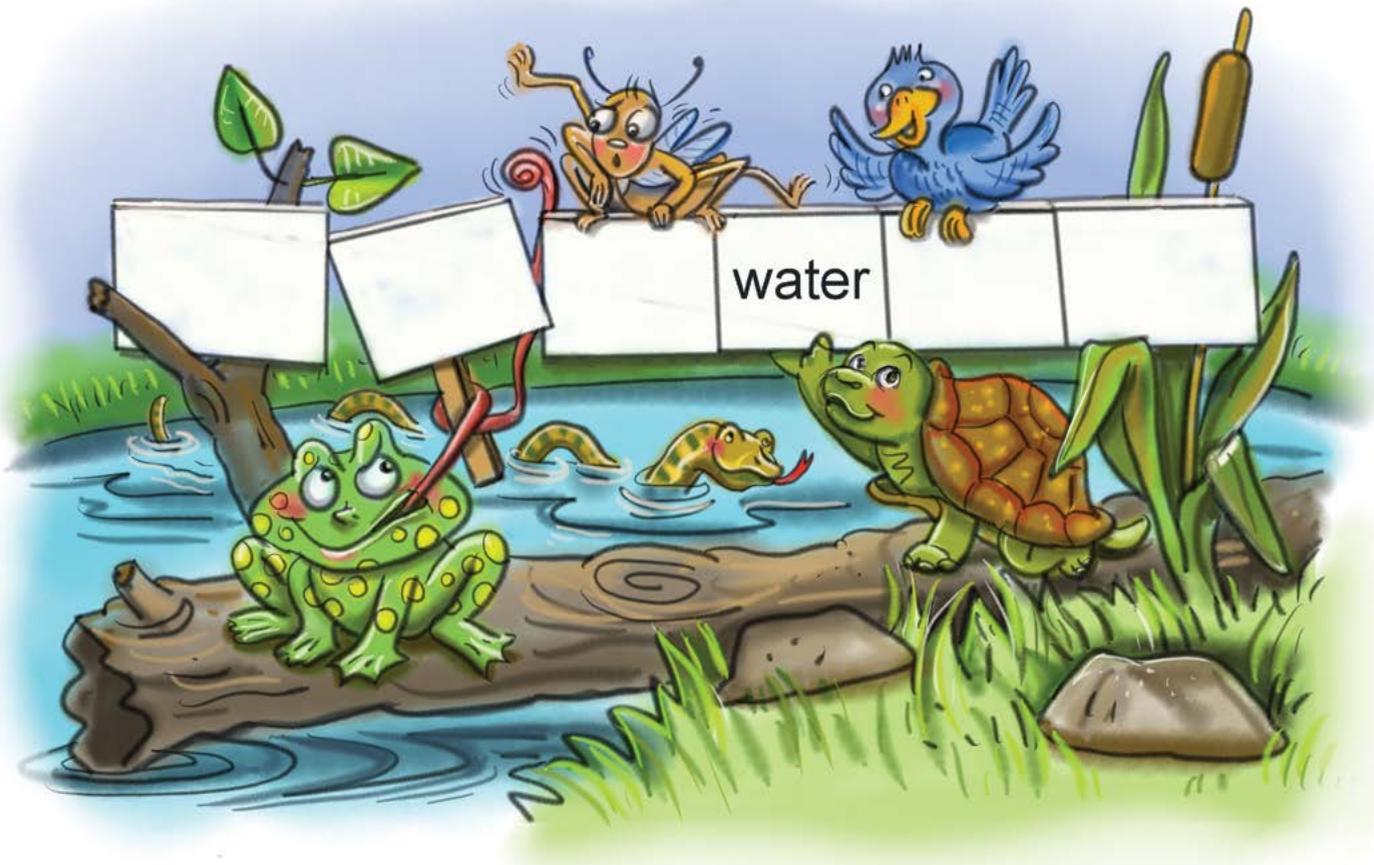
Keep our water water clean.

We clean water to at water treatment plants.

The steps for cleaning water are coagulation, sedimentation,
drink filtration and storage.



*Write the words you circled in the boxes below
to make a complete sentence.*



What do you see in the picture?



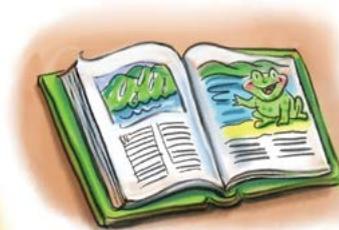
How can we help the fish?

The Environmental Protection Agency (EPA) says that nonpoint sources are the main cause of our water pollution.

Water is **essential** to our lives. It is important to keep it clean. We use water in many ways. Some ways we use water are easy to name. These uses of water include growing food and raising livestock, drinking, washing dishes and bathing. Some uses are not so clear because we don't see them happening.

Water is used to make many products, like clothes and cars. We use water as a means of transportation (shipping products across the ocean or down rivers). Water is used to build homes. It is used to light light bulbs. Water is used to make electricity which brings power to our homes.

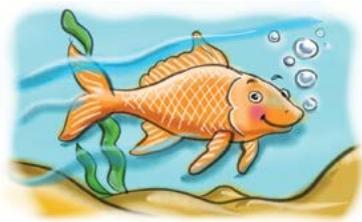
Circle the items that need water to grow or be made.



NATURE

Some plants and animals need more water than other plants and animals.

Generally, where there is a lot of water, there is a lot of life. Different types of animals live in different places. Deserts are home to plants and animals that use water differently than other



plants and animals. Oceans and seas are home to plants and animals that need the environment provided by these large bodies of water.



Colorado is a semi-arid state. It experiences more rain than a desert area but less than a tropical area. Mountains, rangeland, wilderness areas, wetlands, parks and agriculture land



are home to wildlife. Irrigation systems in Colorado move water from the western slope to the front range. Water stored in ponds, lakes and reservoirs have created

new habitats for wildlife. Ditches and canals carry water to fields. Runoff can create wetland areas.

Wetland areas provide homes and food to wildlife.

Wetlands filter water and are

one of nature's ways to clean water.



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We know that nature can move dirt and sediment. Nature can normally, over time, take care of itself. However, we know that things people do can pollute water. Nature can clean its water by filtering it through different soils and by evaporation. We can also do things to keep water clean.

“Land use activities” is a phrase that is used to group man-made sources of pollution. Land use activities include any activities that disturb soil. These activities can provide pollutants that can be carried by runoff into rivers.

Study the “Land Use Activities” on the facing page, then circle any of the six categories of land use activities you have seen.



(Ah, good news! You may not have seen pollution being created because the people doing these activities used good management practices to prevent pollution!)

Agriculture activities that can add to nonpoint source pollution are plowing, bug control, plant food, irrigation and raising livestock.



Construction

activities – land clearing and grading – can add pollutants to the water system unless care is taken to prevent runoff.

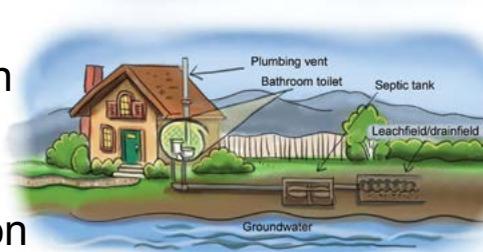
Forestry, which includes timber harvesting, building roads, fire control and weed control can add pollutants to streams and rivers.



Mining moves dirt and gravel. The amount of minerals in an area can change. Toxic materials can result from mining methods. Care must be taken

when mining minerals from the ground.

Septic systems are a form of human waste disposal that use land as a filter. Septic systems need to be managed and maintained to prevent adding pollution to our water system.



Urban storm runoff can include oil, animal waste, gas, antifreeze, fertilizers, pesticides, paints, etc. Lawns, gardens and landscaping are major sources of pollution. Rubber from our tires is left on roads every time we drive. Spilled household cleaners, paints, car fluids, etc., or their containers, can add to pollution.



But since we know pollution can happen, we can do things to help. We can learn which practices prevent pollution of our water resources.

Let's **review**

a few of the new words we've seen so far.

Find the words listed on the chalkboard in the word search puzzle.



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

THERE ARE SOME "EXTRA" WORDS IN THE PUZZLE. FIND THE **WATER WORDS** THAT ARE NOT INCLUDED IN THE LIST ON THE CHALKBOARD!

Besides the air we breathe (oxygen), water is the most important element in the human body. An average person can survive over a month without eating; but less than a week without water. The human body is 65 to 70 percent water.

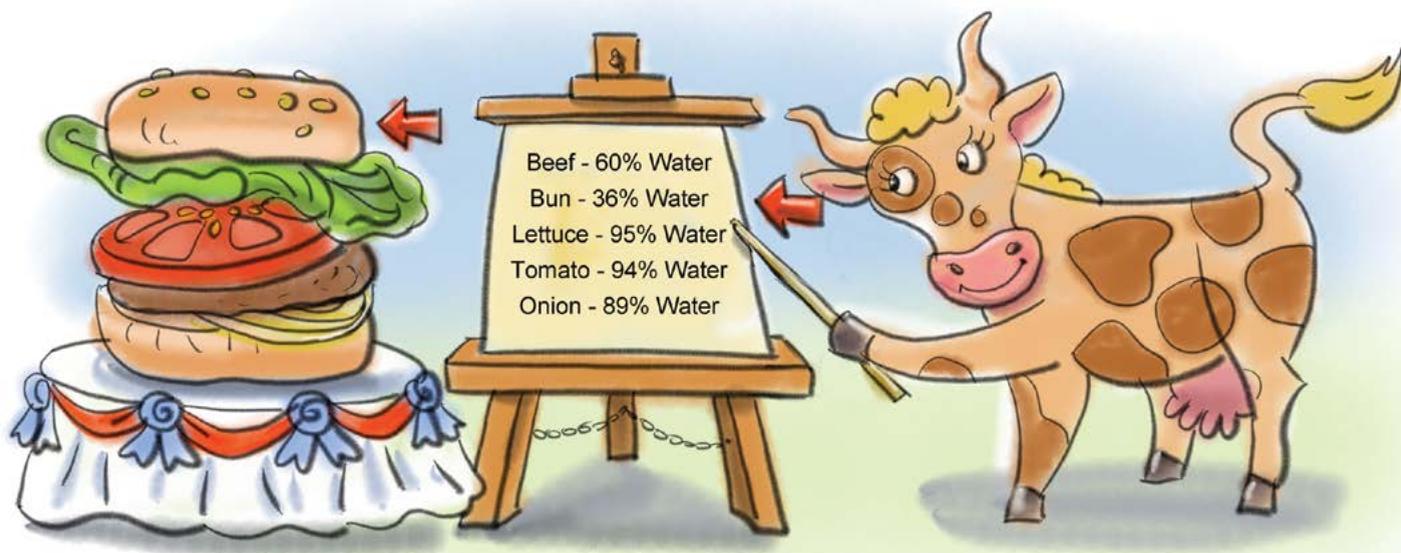
The basic ingredients of everything we eat comes from soil and water. Farmers raise crops and livestock that change soil and water into food.

Water is an important part of food.

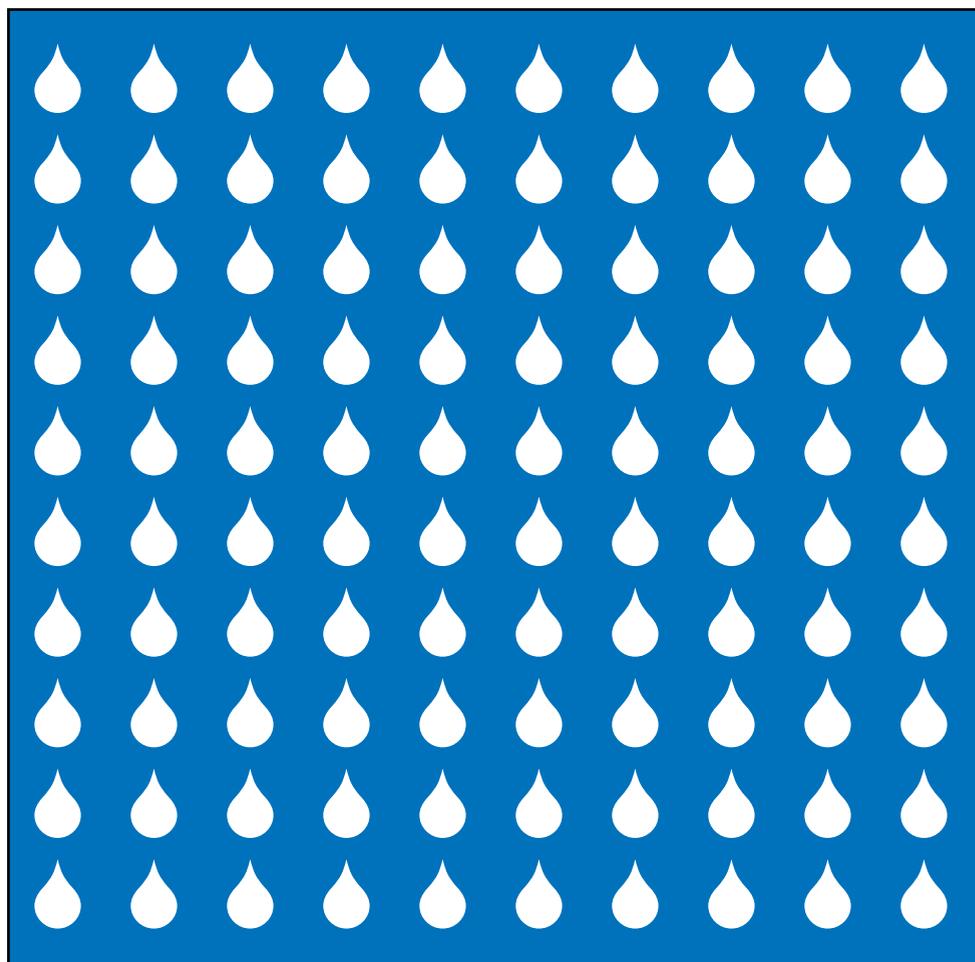
The water we drink and the water we use to wash our hands is cleaned at a treatment plant before we use it. The water used to irrigate farmland is not cleaned first. So the cleaner we can keep the water, the better it is for everyone!



Let's look at a hamburger. This hamburger is made of ground beef, bun, lettuce, tomato and onion.



Start coloring each color from the top left corner. *Most of the water drops will end up being more than one color.*



Color drops for the **ground beef** brown.
Color drops for the **hamburger bun** blue.
Color the drops for **lettuce** green.
Color drops for the **tomato** red.
Color drops for the **onion** yellow.

How many drops have no color? These drops show how much of the hamburger is NOT water!

How many drops have all five colors?

How many drops have only one color?

LET'S MAKE A COLLAGE

You will need:

Magazines, scissors, glue, and a large piece of paper cut in the shape of a water drop.



Cut pictures out of the magazines that show water or something that needed water when it was made.

You have learned water is used to make products, to cook, to grow food and for fun and play. Animals use water in many ways, too!

Glue all the pictures on the large water drop-shaped paper to create a collage.
Look at the collage.

Could you go through the day without water?

REVIEW ~ PERCENTAGES

Circle the words that make the statements true.

It is true that

50% is the same as or more than half?

60% is more than or less than half?

36% is more than or less than half?

95% is more than or less than half?

95% is more than or less than 50%?

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Look around your classroom or house.

Make a list of things that needed water to be made.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____

HINTS



A baseball glove is made of leather. Leather comes from animals. Animals drink water. What else do you see that uses leather?

Wood comes from trees. Trees need water to grow. What do you see that is made of wood?

Steel and other metals are made using water. What do you see that has metal or steel parts?

If you named 20 items write your name here

We can do many things to help water stay clean. We learned urban runoff can add to nonpoint source pollution. Urban storm runoff can include oil, pet waste, gas, antifreeze, fertilizers, pesticides, paints, litter, and more. Lawns, gardens, and landscaping are major sources of pollution.

Some things we do to help include:

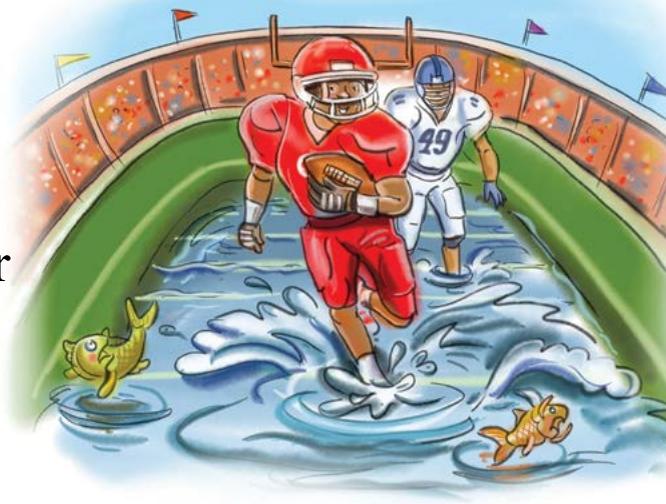
- ◆ Put litter and garbage in trash cans.
- ◆ Recycle aluminum cans, paper, glass, plastic, styrofoam and metal.
- ◆ Xeriscape with native plants.
- ◆ Recycle leaves and lawn clippings by making compost.
- ◆ Plant plants that encourage butterflies and birds that keep bug pests away.
- ◆ Clean up spilled motor oils.
- ◆ Pick up and throw away pet waste.
- ◆ Volunteer to help clean up your yard, your neighborhood, a park.
- ◆ Get a bunch of friends together to help clean up your school, neighborhood, park, canal, ditch, or wetland.
- ◆ Ride a bike, walk or take a bus instead of getting a ride in a car.



An **acre** is a measure of land area.

An **acre foot** is a basic measurement of water volume.

An acre foot of water is enough water to cover one acre of land one foot deep; or enough water to put 10 inches of water on a football field.



One acre foot of water is 325,851 gallons.

If an urban family of five uses **one acre foot of water** for all its needs for **one year**...

How many **gallons per person** is this?

How many gallons of water does **your family** use in a year?

CONSERVATION of water means using less water because you *want to* use less, not because you *have to* use less (rationing).

If your family can do things that will result in using 10% less water, how many gallons of water would be saved? What would you do to save water?

If your family can do things that will result in using 20% less water, how many gallons of water would be saved? What would you do to save water?

As a family activity, fill out the water conservation inventory form. Use your answers to learn what you can do to be a water conservationist.

INDOORS

YES NO

Have you checked faucets, toilets and showerheads for leaks?

Have you fixed any leaks?

Do you use the toilet as a trash can?

Is your toilet a high-efficiency model?

Do you take baths?

Do you take showers?

Do you have a low-flow showerhead?

Do your faucets have low-flow nozzles?

Do you let water run while
you brush your teeth?

Do you run your dishwasher when it's not full?

Do you let water run while washing vegetables
or dishes?

Do you keep a pitcher of water in the refrigerator instead of
running the faucet until the water gets cold?

When you wash dishes by hand, do you use two basins -
one for washing and one for rinsing - instead of letting
the water run?



OUTDOORS

YES NO

Do you sweep the driveways, walks and patio instead of cleaning them with a hose and water?

Have you checked faucets for leaks and fixed any you found?

Do you use a sponge and bucket to wash the car, or go to a commercial car wash, instead of using a hose with running water?

Do you water the lawn in the early morning or evening to avoid evaporation?

Do you water only when your landscape needs it?

Do you use drip irrigation to water slowly, deeply, thoroughly and infrequently to encourage root growth?

Do you mow your lawn to two inches or more and leave the clippings?

Do you water trees and shrubs separately from the lawn?

Do you use mulch to reduce evaporation?

Have you planted native plants in your landscaping?

Do you collect rainwater to use in the garden?

Do you put litter and garbage in trash cans?

Do you recycle?

Do you compost leaves and other garden growth?

Have you learned the right way to throw away leftover paint containers, garden chemical containers and cleaning product containers?

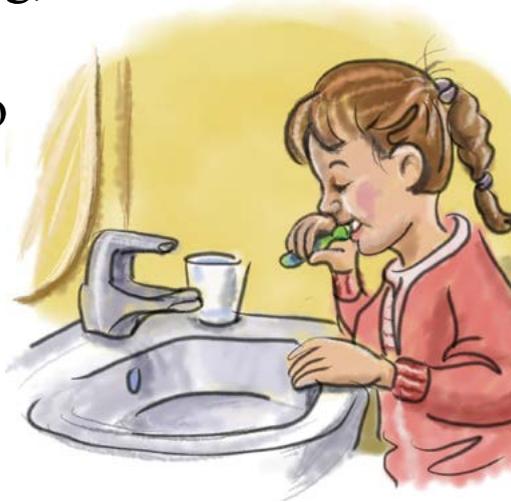
If you are a water conservationist your answers match the following:

INDOORS: yes, yes, no, yes, no, yes, yes, yes, no, no, no, yes, yes.

OUTDOORS: all yes.



Conserving water means we use less of it. It doesn't mean you quit washing the dishes and it doesn't mean you skip drinking a glass of water. Conserving water means not wasting water. Stopping a faucet from leaking, keeping cold water in the refrigerator to drink, turning off the water when you brush your teeth – all help conserve water.



Good things result from conserving water.

WE LIKE WATER TO BE CLEAN WHEN WE USE IT. AND WE CLEAN IT UP AFTER WE HAVE USED IT AND ARE READY TO RETURN IT TO THE WATER CYCLE.

WASTEWATER TREATMENT PLANTS CLEAN OUR USED WATER.

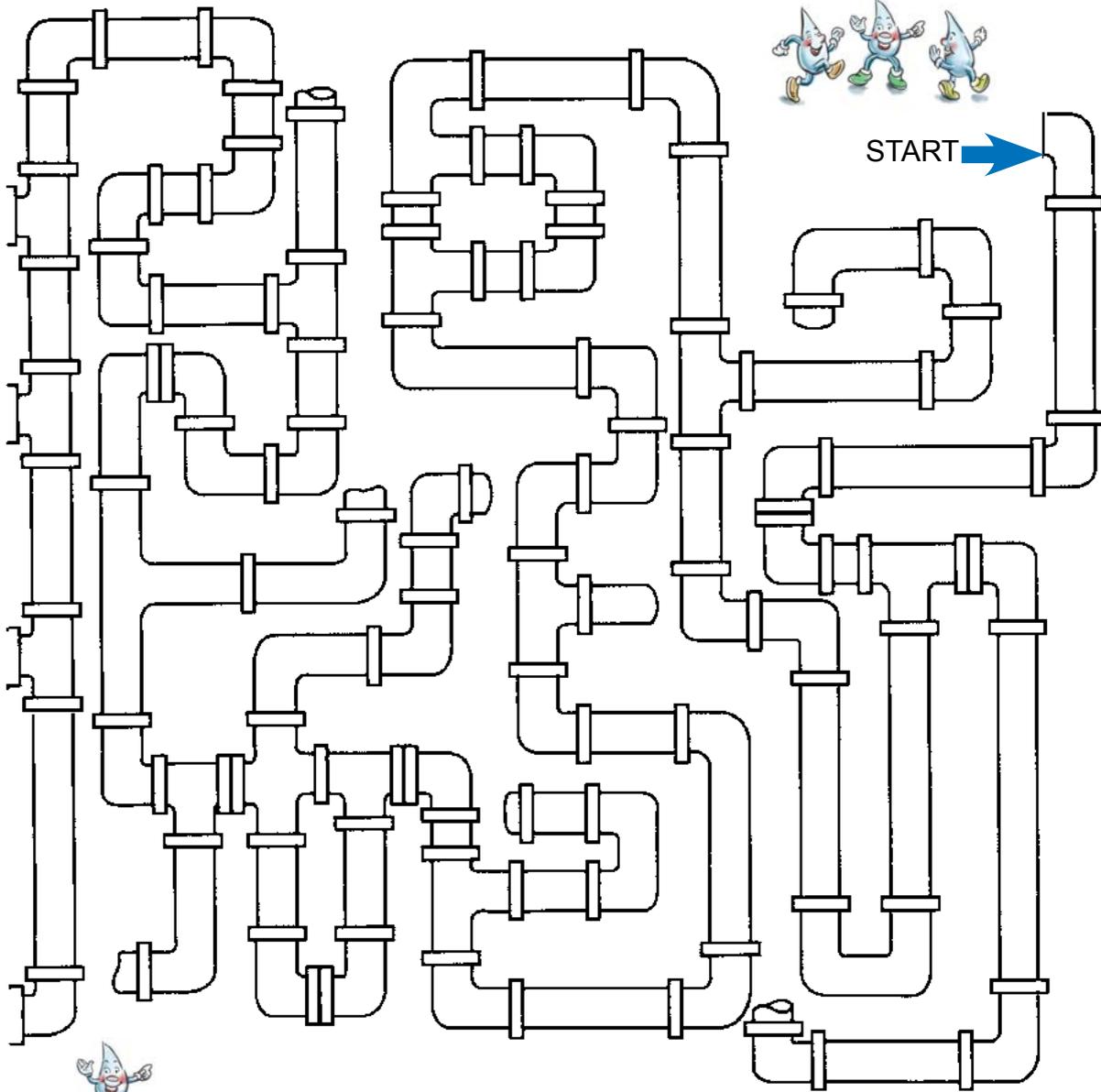


USE WATER WISELY!

SINKS HAVE DRAINS. THE BATHTUB HAS A DRAIN. THE TOILET HAS A DRAIN. WASHING MACHINES, DISH WASHERS AND SOME REFRIGERATORS HAVE DRAINS. ALL THE DRAIN PIPES IN YOUR HOUSE CARRY WATER INTO A LARGER PIPE THAT IS UNDERGROUND. IT CONNECTS TO ANOTHER LARGER PIPE THAT IS PART OF THE SEWER SYSTEM. THE SEWER SYSTEM IS A WHOLE LOT OF PIPES. THEY CARRY THE WASTE WATER TO A WASTEWATER TREATMENT PLANT.

Let's go down the drain...

Find which way the water flows through the pipes to reach the wastewater treatment plant.



Wastewater Treatment Plant



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R

Wastewater flows through the sewer pipes to reach the treatment plant.

There are **3** steps to cleaning wastewater:

1 primary treatment **2** secondary treatment and
3 advanced treatment.

1 The first step uses bar screens to filter out large objects like sticks and rocks. Water flows easily through the bar screens but big stuff gets stuck and can be removed. Everything that passes through the bar screens flows into a tank. In this tank, dirt and particles settle to the bottom. This is called **sedimentation**. Solids settle to the bottom of the tank. The solids that collect are pumped from the bottom of the sedimentation tank into another settling tank.

2 The second step uses **bacteria** to break down wastes. (Bacteria are funny little critters. They can be good or bad. They are doing good things here.) The wastewater flows through tanks where air is added and the waste is stirred to help the bacteria grow. The bacteria and solids settle to the bottom in the secondary sedimentation tank.

3 The last step is the advanced treatment process. Water flows through sand and gravel. This is called **filtering**. The filtered water is disinfected. The most common disinfectants used are chlorine, ultraviolet light or ozone.

What is left over after wastewater has run through the treatment plant?

There is clean water. It flows into the river and goes on downstream.

There is sediment. The sediment settled on the bottom of the tanks. The sediment is made into **biosolids**. Once processed, the biosolids can be used as a fertilizer. Biosolids can be put on cropland to help plants grow.

Solve the crypto-puzzle!

(CLUE W = T, Z = W, R = O and V = S)

J R R G W K L Q J V D E R X W

F R Q V H U Y L Q J Z D W H U:

F O H D Q Z D W H U,

E L R V R O L G V,

O H V V S R O O X W L R Q.

W
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Glossary & Water Terms

- ACRE:** a unit of measurement of land. It is equal to the area of land inside a square that is about 209 feet on each side (43,560 square feet).
- ACRE FOOT:** the volume of water required to cover one acre of land to a depth of one foot (43,560 cubic feet or 325,851 gallons).
- AGRIBUSINESS:** producers of agricultural goods and services, such as farm equipment makers, food and fiber processors, wholesalers, transporters, and retail food and fiber outlets.
- AGRICULTURE:** the science, art and business of cultivating the soil, producing crops, raising livestock and making products available to meet the world's food, and much of its clothing, shelter and other needs.
- ALUM:** a chemical used in the water cleaning process that makes particles stick together (coagulate) so they become heavy enough to sink to the bottom of a container.
- AQUIFER:** consists primarily of sand, gravel and porous rock through which water may move but which is surrounded by mainly impervious materials. Aquifers may be thin or thick, may be very small or may stretch for hundreds of miles. The refilling or replacement of water in aquifers is called recharging.
- ATLAS:** book of maps.
- ATMOSPHERE:** the gaseous mass or envelope surrounding Earth.
- BACTERIA:** microscopic organisms that live in water and on land. They help break down organic materials into simpler nutrients through a process called decay.
- BASIN:** the area of land that drains to a particular river.
- BIOSOLIDS:** solid materials of organic origin resulting from wastewater treatment (at one time called sludge); biosolids meet federal and state standards for use as fertilizers.
- CANAL:** a man-made waterway.
- CLIMATE:** the average weather conditions of a place or region. Includes the average rainfall, temperature, humidity and wind conditions.
- COAGULATION:** process of combining small particles with other small particles to create larger solids.
- COAGULATE:** to cause small particles to combine with other small particles.
- COLLAGE:** an artistic composition of materials and objects pasted over a surface.
- COMMUNITIES:** a group of people living in the same locality; common possession or participation.
- COMPOSTING:** mixing decaying organic matter (grass clippings, leaves, etc.) to form a rich soil conditioner.
- COMPOUND:** a combination of two or more elements or parts; atoms of two or more different elements combined.
- CONDENSATION:** the process of changing a gas into a liquid; for example, when steam or water vapor turns into water.
- CONDENSE:** to undergo condensation.
- CONSERVATION (water):** the wise use of water with methods ranging from more efficient practices in farm, home and industry to capturing water for use through water storage or conservation projects.
- CONSERVATION (soil):** a combination of land use and practices to protect and improve soil and to prevent soil deterioration from erosion, exhaustion of plant nutrients, accumulation of toxic salts, excessive compaction or other adverse effects.
- CULTIVATION:** to prepare and improve land for raising crops.
- CYCLE:** a periodically repeated sequence of events.
- DAM:** structure built to stop the flow of water down a stream.
- DENSITY:** the mass per unit of volume of a substance.
- DIARY:** a daily record, especially a personal record of events, experiences and observations.
- DISINFECT:** to cleanse of disease-carrying microorganisms.
- DISINFECTANT:** an agent that disinfects (like chlorine).
- DISINFECTION:** the process of cleansing pathogenic microorganisms (in our case, from water).
- DISSOLVE:** to reduce to liquid form; to break up or disperse.
- DIVERSION:** removal of water from any body of water by canal, pipe or other conduit.
- DOWNSTREAM:** in the direction of a stream's current.
- DRAINAGE BASIN:** see Basin; see Watershed.
- DRIP IRRIGATION:** a method of irrigating that is done by drilling holes in a hose or pipe so water flows to individual plants.
- DROUGHT:** a long period with no rain.
- ELEMENT:** a substance composed of atoms.
- EROSION:** a natural process by which rock and soil are broken loose from the Earth's surface at one location and moved to another by wind, moving water, ice and landslides.
- ESSENTIAL:** necessary.
- EVAPORATE:** to change a liquid to vapor.
- EVAPORATION:** the process of changing a liquid to a gas (vapor); for example, when water turns into steam or water vapor.
- EVAPOTRANSPIRATION:** the total moisture loss from an area controlled by climactic conditions and plant processes (evaporation and transpiration; ET).
- FARMER:** a person who operates or works on a farm for the purpose of producing a crop or livestock.
- FERTILIZERS:** materials added to soil to make it better for growing crops. Manure, composts from decayed leaves and certain chemicals are common materials used as fertilizers.
- FILTRATE:** to put through a filter.
- FILTRATION:** the process of putting water through filters to clean the water.
- FLOAT:** to remain suspended on the surface of water without sinking.
- FLOC:** a mass formed as a result of flocculation.
- FLOCCULATION:** the process of causing particles to form lumps or masses.
- FLOOD:** an overflowing of water onto land.
- FLOOD IRRIGATION:** a method of irrigating that is done by causing water to overflow onto land to reach crops.
- FRESH WATER:** salt-free water.
- FURROW IRRIGATION:** a method of irrigation in which water flows down small ditches (furrows) between rows of crops.
- GAS:** a state of matter distinguished from the solid and liquid states by very low density.
- GERMINATE:** to begin to grow; sprout.
- GLACIER:** a huge mass of compacted snow.
- GLOBE:** a sphere showing a representation of Earth.
- GROUNDWATER:** groundwater, as opposed to surface water, is water that does not runoff, and is not taken up by plants, but soaks down into an aquifer.
- H₂O:** water (2 hydrogen atoms with one oxygen atom).
- HAZARDOUS:** dangerous.
- HYDROGEN:** a colorless gaseous element.
- HYDROLOGIC CYCLE:** the cycle of water movement from the atmosphere to Earth and back again through evaporation, transpiration, condensation, precipitation, percolation, runoff and storage. See Water Cycle.
- ICE:** frozen water.
- IRRIGATE:** to supply with water by means of ditches, pipes, etc.
- IRRIGATION:** the artificial distribution of water on the land surface to establish a crop or to increase crop yield where the precipitation is inadequate.

LAND: one of the major factors of production that is supplied by nature and includes all natural resources in their original state such as mineral deposits, wildlife, timber, fish, water and the fertility of the soil.

LANDSCAPING: to adorn or improve an area of ground by contouring the land and planting flowers, shrubs, trees, etc.

LIQUID: the state of matter in which a substance exhibits a characteristic readiness to flow.

LIVESTOCK: domestic animals raised for home use or profit.

MOISTURE: wetness.

MOUNTAINOUS: a region having many mountains.

NATURAL RESOURCES: products and features of Earth that permit it to support life and satisfy people's needs; these include land, water, air, birds, animals, sand, soil, coal, etc.

NONPOINT SOURCE POLLUTION (sometimes called RUNOFF POLLUTION): pollution coming from a wide, non-specific source (car exhaust, oils, street salt, etc.)

ORGANIC MATTER: plant and animal material in various states of decomposition that may be part of the soil.

OXYGEN: colorless, odorless, tasteless gaseous element; essential for plant and animal respiration (breathing).

PARTICLES: very small pieces or parts.

PERCENT: per hundred; quantity with relation to a whole.

POINT SOURCE POLLUTION: pollution coming from a single source such as a factory smokestack or sewer.

POLLUTANT: something that makes land, water and air dirty and unhealthy.

POLLUTE: doing anything that makes something else dirty or impure.

POLLUTION: wastes contaminating the soil, water or air.

PRECIPITATION: rain, snow and other forms of water that fall to Earth.

RAIN: a form of precipitation falling to Earth in the form of liquid water.

RANCHER: a person who owns or operates a ranch. A ranch is any large farm on which a particular crop or kind of animal is raised.

RATIONING: allowing use of a fixed portion or amount.

RELATIVE HUMIDITY: the percentage of moisture saturation of the air.

RENEWABLE NATURAL RESOURCES: resources such as forests, rangeland, soil and water that can be restored and improved to produce the food, fiber and other things humans need on a sustained basis.

RESERVOIR: a natural or artificial place to store water; water storage created by building a dam.

RIVER: a large natural stream of water flowing into an ocean, lake, or other body of water.

RIVER BASIN: the land area surrounding one river from its headwaters to its mouth.

RUNOFF: includes rain and snow which is not absorbed into the ground; instead it flows across the land and eventually runs into streams and rivers. Runoff can pick up pollutants from the air and land, carrying them into the streams and rivers.

SALT WATER: water from oceans; water containing salt.

SEDIMENT: small pieces of matter that settle at the bottom of liquid; soil, sand and materials washed from land into waterways.

SEDIMENTATION: when soil particles (sediment) settle to the bottom of a waterway or water container.

SINK: to drop to the bottom of liquid.

SNOWPACK: accumulated snow in the mountains.

SOIL: the loose top layer of Earth's surface in which plants grow; a naturally occurring mixture of minerals, organic matter, water and air.

SOLID: of a definite shape and volume; not liquid or gaseous.

SPRINKLER IRRIGATION: a method of irrigation using sprinklers to distribute water to plants.

STEAM: the vapor phase of water.

STORAGE: keeping something (in our case, water) on hand and available for use as needed.

STORE: (noun) a stock or supply of something available for use; (verb) to collect and keep for future use.

STORM DRAIN: a drain used to direct runoff from streets to streams, ditches or lakes.

SURFACE TENSION: The force exerted along the surface of a fluid that causes it to "bead up" and form into drops.

SURFACE WATER: water that is on top of the ground (lakes, rivers, oceans, etc.).

SUFFIX: an addition to the end of word to make a word with a new meaning.

SURGE IRRIGATION: a method of irrigation using computerized valves to turn the water supply on and off to allow extra time for water to soak into the ground.

TILLAGE: turning the topsoil over by plowing, spading or rototilling to create a seedbed for plants.

-TION: a suffix added to a word to create a word meaning an action or process.

TRANSPIRATION: the process by which plants remove soil moisture by losing water vapor through their leaves.

URBAN: city.

VAPOR: any barely visible or cloudy diffused matter, such as mist, fumes or smoke.

VOLUME: size.

WATER: a clear, colorless liquid; H₂O; essential for most plant and animal life; most widely used of all solvents.

WATER CONSERVATION: the wise use of water with methods ranging from more efficient practices in farm, home and industry to capturing water for use through water storage or conservation projects.

WATER CYCLE: water is always in one stage or another, in one place or another, of the endless water cycle - the cycle involves evaporation, precipitation and runoff. The water cycle has no fixed speed or distribution - the only constant is the total amount of water on Earth.

WATER RIGHT: a right to use, in accordance with its priority, a certain amount of water.

WATERSHED: the region draining into a river, river system or body of water; the total land area, regardless of size, above a given point on a waterway that contributes runoff water to the flow at that point; all the land that serves as a drainage for a specific stream or river.

WATER STORAGE: the locations in which water is stored. Water storage can be above ground in lakes, reservoirs and other "containers" or below ground as groundwater.

XERISCAPE: the use of plant materials and practices that minimizes landscaping water use; usually native plants.

Resources & References

The following publications and materials provided reference information for *Understanding Water Activity Book*.

Utah Agriculture and Me - Ag in the Classroom
Elementary Curriculum: Utah Farm Bureau Federation, Salt Lake City, UT

Water Education Calendar: International Office for Water Education, Utah Water Research Office, Utah State University, Logan, UT

Minnesota Agriculture Magazine and Ag-tivities for Fun and Learning: Minnesota Ag in the Classroom, St. Paul, MN

Colorado Model for Conservation Education Resources: by George Ek, David Loth and Helen Loth, Colorado Dept. of Education, Colorado Dept. of Natural Resources, Colorado Division of Wildlife

Conserving Soil: National Assn. of Conservation Districts

Water Conservation and Nonpoint Source Pollution: Utah State University Cooperative Extension

WET, Water Education for Teachers: The Western Watercourse, Montana State University, Bozeman, MT

Farm Facts (Agriculture - An American Success Story): American Farm Bureau Federation, Park Ridge, IL

4-H Ecology Project Leader's Guide: Cooperative Extension Service, Kansas State University, Manhattan, KS

Colorado Water: League of Women Voters of Colorado, Denver, CO

Conservation in Colorado: State of Colorado Dept. of Natural Resources Soil Conservation Board

Water Water Water Water Water and Bank Balance: Managing Colorado's Riparian Areas (Bulletin 553A): Colorado State University Cooperative Extension, Fort Collins, CO

Colorado Water Citizens Water Handbook (Information Series No. 67: Colorado State University Cooperative Extension, Fort Collins, CO

The following entries, in addition to being reference sources, have materials available for educators. Confirm availability and cost (if any) of the materials.

American Water Works Association (AWWA)
6666 W. Quincy Ave.
Denver, CO 80235
303-794-7711; www.awwa.org
Educational materials, *The Story of Drinking Water, Our Water Cycle*

Central Colorado Water Conservancy District
3209 West 28th Street
Greeley, CO 80634
970-330-4540; Fax: 970-330-4546;
www.ccwcd.org
Glossary of water terms

City of Aurora Utilities Department
1470 S. Havana, #400
Aurora, CO 80012
303-695-7387
The Story of Drinking Water booklet, other educational materials, water conservation information, displays, exhibits

City of Fort Collins Natural Areas
www.fcgov.com/naturalareas
naturalareas@fcgov.com
970-416-2815; Fax 970-416-2211
Educational materials, nature tours

City of Fort Collins Water Utilities
P.O. Box 580
Fort Collins, CO 80522
970-221-6681
www.fcgov.com/utilities/community-education/youth
Educational materials, videos, speakers, tours

CoCoRaHS
Colorado State University
1371 Campus Delivery
Fort Collins, CO 80523-1371
970-491-1196; www.cocorahs.org
Rain, hail, and snow collection data

Colorado Blue Thumb Club
nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=20005590.txt
Drinking water Activities for Students, Teachers, and Parents

Colorado CattleWomen Education Project
Colorado Beef Council
789 Sherman St., Suite 105
Englewood, CO 80203
303-830-7892; Fax 303-830-7896
Educational materials

Colorado Climate Center
Department of Atmospheric Science
Colorado State University
1371 General Delivery
Fort Collins, CO 80523-1371
ccc.atmos.colostate.edu
Educational materials

Colorado Farm Bureau
9177 E. Mineral Circle
Centennial, CO 80112
303-749-7500; Fax 303-749-7703;
www.colofb.co
Email: info@colofb.com
Educational materials, speakers, displays

Colorado Foundation for Agriculture
P.O. Box 10
Livermore, CO 80536
970-881-2902; www.growingyourfuture.com
Email: bbllinde@growingyourfuture.com
Educational materials: Colorado Readers, Activity Books, e-lessons

Colorado Office of Water Conservation
1313 Sherman Street, Room 721
Denver, CO 80203
303-866-3441; www.cwcb.state.co.us/
Water Fact sheets, brochures, educational materials

Colorado River Water Conservation District
P.O. Box 1120
Glenwood Springs, CO 81602
970-945-8522; Fax 970-945-8799;
www.crwcd.org
Educational materials, quizzes, videos

CSU Cooperative Extension materials are available by contacting:
Resource Room
Colorado State University
Fort Collins, CO 80523
970-491-6198; www.extcolostate.edu/
Educational materials

Colorado WaterWise
PO Box 40202
Denver, CO 80204-0202
www.coloradowaterwise.org
Educational materials

National Assn. of Conservation Districts
509 Capitol Court, NE
Washington, D.C. 20002-4937
(202) 547-6223 (NACD); Fax (202) 547-6450
www.nacdnet.org
Educational materials, merchandise (catalog)

National Cattlemen's Association & Beef Board
9110 E. Nichols Avenue, #300
Centennial, CO 80112
303-694-0305; www.beef.org
Educational materials, brochures

Northern Colorado Water Conservancy District
220 Water Ave.
Berthoud, CO 80513
800-369-7246 (RAIN); Fax 877-851-0018
www.ncwcd.org
Tours, speakers, educational materials
On-line info: Colorado Water Knowledge

Soil and Water Conservation Society (SWCS)
945 SW Ankeny Road
Ankeny, Iowa 50023-9723
515-289-2331; Fax 515-289-1227
www.swcs.org
Water in Your Hands; Wetlands Activity Guide

U.S. Geological Survey
(Water Resource Education)
2150 Centre Avenue
Fort Collins, CO 80526
970-226-9100
water.usgs.gov/education.html
Topics: coastal hazard, watersheds, hazardous waste, wetlands, water use, wastewater, navigation, ground water, water quality

Water Information Program
Southwestern Water Conservation District
841 E. Second Ave.
Durango, CO 81301
970-247-1302
Fax 970-259-8423
<http://www.waterinfo.org>
Email: water@frontier.net
Geographic area: La Plata, Montezuma, Archuleta, San Juan, San Miguel, Dolores and parts of Montrose, Hinsdale and Mineral counties.
Speakers, educational materials, water festival assistance, displays

Answers

Page 3

All the statements are true. All the boxes will be marked.

Page 4

All the statements are true. All the boxes will be marked.

Page 5

$10 \times 10 = 100$

Page 6

Frozen water (polar) = 66 drops; Fresh = 33 drops

Page 7

The incomplete sentences are:

- Salt in ocean water.
- Animals and plants water.
- Water wet.

Answers will vary; they can be:

- Salt **is** in ocean water.
- Animals and plants **need (drink)** water.
- Water **is** wet.

Page 8

Water **vapor** condenses to form clouds.

Liquid water freezes into snowflakes. It is then a **solid**.

Water that flows from a faucet is **liquid**.

Page 9

Answers will vary. Adjectives describing liquid may include wet, cold, warm, moist, etc.

Answers will vary for how they attempted to change ice to liquid.

Page 10

Answers will vary. Adjectives describing solid may include cold, hard, slippery, etc.

Page 11

The pinwheel will turn. Answers will vary. Vapor may be described as light, airy, invisible, etc.

A change in temperature (either hotter or colder) causes water to change form.

Page 13

leaves will **float**

salt will **dissolve**

an anchor will **sink**

Object answers will vary.

Page 14

The paper clip, by itself, will sink because it is heavier than water. The aluminum boats float because they are lighter than water. The boat will hold several paper clips because the area of the boat in contact with the water disperses the weight of the objects it contains.

The marble will sink while the ice cube will float – even if they weigh the same. The ice cube contains air within its shape that makes it lighter (less dense) than the marble and water.

Page 15

A=24; B=5; C=6; D=8; E=12; F=11; G=15; H=18; I=4; J=43; K=60; L=10; M=14; N=2; O=1; P=36; Q=3; R=7; S=9; T=13; U=16; V=82; W=17; X=30; Y=21; Z=20
THE MARBLE WILL SINK; THE ICE CUBE WILL FLOAT.
ICE IS LESS DENSE THAN LIQUID WATER; A MARBLE IS MORE DENSE.

Page 16

solid
vapor
ice
density
liquid
river
ocean

Page 18

A rainbow.

Page 20

Evaporation: B. The sun heats water. The water becomes vapor that rises into the atmosphere.

Condensation: D. Water vapor forms clouds. When the clouds cool, the vapor becomes liquid.

Liquid, Ice, Vapor: F. The three states of water.

Precipitation: C. Liquid is heavier than vapor. Gravity pulls the liquid down to Earth as rain or snow.

Runoff: A. When the rain reaches Earth it flows across the land into lakes, steams and oceans.

Transpiration: E. Plants take in water, then “breathe” the water out as vapor.

Page 21

Vapor condenses to form clouds of liquid water. Heat from the sun **evaporates** the water. **Precipitation:** rain, snow

Answers will contain these elements:

The sun heats the water on Earth. The water evaporates. It turns to vapor and rises. In the atmosphere it cools and condenses to form clouds. When the drops of water get too heavy to stay in the air, they fall as precipitation (rain, snow, sleet). They fall to the ground. The water either soaks into the ground or runs off into streams and rivers.

Hydro in hydrologic cycle come from the Greek word “hydro” meaning water. Hydrologic cycle = water cycle.

Page 23

Answers will vary depending on location.

Page 26

Across
3. flood
5. moisture
7. conservation
8. rationing
9. canals

Down
1. snowpack
2. basin
4. drought
6. reservoir
8. rain

Page 30

Answers will vary.

ANSWERS

Page 31

Top to bottom: having fun; watering livestock; cleaning; drinking beverages; providing water for wildlife.

Farmers and ranchers do many of the same things as urban residents.

Page 32

Answers will vary but may contain the following:

Restaurant: washing dishes; preparing food; drinking water; making beverages; washing hands; restrooms.

Recreation Center: showers; swimming pool; to make the ice for the rink; drinking fountains; restrooms.

Supermarket: in the produce section to keep the fruits and vegetables fresh; in the bakery to cook; in the deli to cook; for employees to wash hands; restrooms; sell bottled water.

Car Dealer: washes cars; restrooms; to make the coffee in the service waiting room.

Farmer: irrigation; for animals; and every way that a non-farmer might use water: to wash dishes; prepare food; shower; laundry; drink; etc.

Page 33

Answers will vary.

16 ounces times number of students = number of ounces of water (per day.) This answer times 5 days = number of ounces the class will drink in one school week.

There are 128 ounces in a gallon of water. Both the above answers divided by 128 will give the gallons.

Page 34

Stories will vary.

Page 35

Bodies of water: Atlantic Ocean; Gulf of Mexico; Pacific Ocean; Lake Michigan.

Rivers: Mississippi River; Platte River; Colorado River; Missouri River.

Rivers flow into other rivers or into the oceans. Yes.

Page 36

Coagulation = coagulate

Sedimentation = **sediment**

Filtration = filtrate

Disinfection = **disinfect**

Storage = store

Page 37

Group 1 will be easier to remove from water (coagulated paper clips!).

Page 38

It is easier to remove larger pieces than small ones.

Page 41

Coagulation; Sedimentation; Filtration; Disinfection; Storage.

Page 42

Answers will vary.

Page 43

All items will be circled.

Page 44

We need clean water to drink.

Page 45

The pond is polluted. There is litter in the water. There are bottles and cans floating in the water. The plants are sick. The frog is leaving the pond. Answers will vary on how we can help but will include cleaning up the litter.

Page 46

All items will be circled.

Page 47

Answers will vary.

Page 50

The words are there. You get to have fun solving this one, too! Some water words in the puzzle that are not on the chalkboard include: water and sedimentation.

Page 51

Five drops will have no color.

36 drops will have all five colors (the hamburger bun has the least amount of water of all the foods - 36%).

One drop has one color (the difference between lettuce 95% and tomato 94% is one).

Page 53

60% is more than half.

36% is less than half.

95% is more than half.

95% is more than 50%.

Answers to water use will vary.

Page 54

Answers will vary.

Page 55

Answers will vary.

Page 56

325,851 divided by 5 = 65,170.2 gallons per person.

65,170.2 times the number of family members = answer.

Answer times 10% (.10) = number of gallons conserved.

Answer times 20% (.20) = number of gallons conserved.

Page 57 and 58

Answers will vary. See page 56 for answers most likely given by an active water conservationist.

Page 63

Answer: Good things about conserving water: clean water, biosolids, less pollution.

Colorado Academic Standards

Understanding Water Activity Book includes a variety of activities that integrate learning about water and academic subject areas.

Following is a summary of prepared graduate competencies addressed in the development of and by materials included in this activity book.

MATHEMATICS

2nd grade

- Count within 1000. (CCSS: 2.NBT.2)
- Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. (CCSS: 2.NBT.3)
- Apply addition and subtraction concepts to financial decision-making (PFL)
- Fluently add and subtract within 20 using mental strategies. (CCSS: 2.OA.2)
- Know from memory all sums of two one-digit numbers. (CCSS: 2.OA.2)

3rd grade

- Multiply one-digit whole numbers by multiples of 10 in the range 10–90 using strategies based on place value and properties of operations. (CCSS: 3.NBT.3)
- Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. (CCSS: 3.NF.3c)
- Interpret products of whole numbers. (CCSS: 3.OA.1)
- Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities. (CCSS: 3.OA.3)
- Recall from memory all products of two one-digit numbers. (CCSS: 3.OA.7)
- Use models to add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units. (CCSS: 3.MD.2)

4th grade

- Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. (CCSS: 4.MD.1)
- Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. (CCSS: 4.MD.2)

SCIENCE

2nd grade

- Use evidence to develop a scientific explanation about how organisms depend on their habitat. (DOK 2-3)
- Analyze and interpret data about nonliving components of a habitat (DOK 1-2)
- Use evidence to develop a scientific explanation for how the weather and changing seasons impacts the organisms

such as humans, plants, and other animals – and the environment (DOK 1-3)

3rd grade

- Analyze and interpret observations about matter as it freezes and melts, and boils and condenses (DOK 1-2)
- Use evidence to develop a scientific explanation around how heating and cooling affects states of matter (DOK 1-3)
- Identify the state of any sample of matter (DOK 1)

4th grade

- Use evidence to develop a scientific explanation of what plants and animals need to survive (DOK 1-3)
- Create and evaluate models of the flow of nonliving components or resources through an ecosystem (DOK 2-3)
- Make a plan to positively impact a local ecosystem (DOK 2-4)

READING, WRITING, AND COMMUNICATING

2nd grade

- Produce complete sentences when appropriate to task and situation in order to provide requested detail or clarification. (CCSS: SL.2.6)
- Read high-frequency words with accuracy and speed
- Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (CCSS: RI.2.3)
- Read text to perform a specific task (such as follow a recipe, play a game)
- Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text. (CCSS: RI.2.7)
- By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 2–3 text complexity band proficiently, with scaffolding as needed at the high end of the range. (CCSS: RI.2.10)
- Use glossaries and beginning dictionaries, both print and digital, to determine or clarify the meaning of words and phrases. (CCSS: L.2.4e)
- Know and apply grade-level phonics and word analysis skills in decoding words. (CCSS: RF.2.3)
- Read with sufficient accuracy and fluency to support comprehension. (CCSS: RF.2.4)
- Organize ideas using a variety of pictures, graphic organizers or bulleted lists
- Use relevant details when responding in writing to questions about texts

3rd grade

- Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (CCSS: RL.3.1)
- Read grade level text accurately and fluently, attending to phrasing, intonation, and punctuation
- Determine the main idea of a text; recount the key details and explain how they support the main idea. (CCSS: RI.3.2)
- Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (CCSS: RI.3.3)
- Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area. (CCSS: RI.3.4)
- Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (CCSS: RI.3.7)
- By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 2–3 text complexity band independently and proficiently. (CCSS: RI.3.10)
- Know and apply grade-level phonics and word analysis skills in decoding words. (CCSS: RF.3.3)
- Read with sufficient accuracy and fluency to support comprehension. (CCSS: RF.3.4)
- Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences. (CCSS: W.3.3)
- Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (CCSS: W.3.2)
- Conduct short research projects that build knowledge about a topic. (CCSS: W.3.7)

4th grade

- Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (CCSS: RI.4.1)
- Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (CCSS: RI.4.3)
- Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text. (CCSS: RI.4.5)
- Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (CCSS: RI.4.7)
- By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range. (CCSS: RI.4.10)
- Know and apply grade-level phonics and word analysis skills in decoding words. (CCSS: RF.4.3)
- Read with sufficient accuracy and fluency to support comprehension. (CCSS: RF.4.4)

- Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g., wildlife, conservation, and endangered when discussing animal preservation). (CCSS: L.4.6)
- Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences. (CCSS: W.4.3)
- Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (CCSS: W.4.2)
- Conduct short research projects that build knowledge through investigation of different aspects of a topic. (CCSS: W.4.7)

SOCIAL STUDIES

2nd grade

- Identify and locate various physical features on a map (DOK 1)
- Identify how communities manage and use nonrenewable and renewable resources (DOK 1-2)
- Give examples of choices people make when resources are scarce (DOK 1-2)
- Identify possible solutions when there are limited resources and unlimited demands (DOK 1-2)
- Describe ways in which you can take an active part in improving your school or community (DOK 1-2)

3rd grade

- Find oceans and continents, major countries, bodies of water, mountains, and urban areas, the state of Colorado, and neighboring states on maps (DOK 1)
- Identify geography-based problems and examine the ways that people have tried to solve them (DOK 1-2)
- Describe the difference between producers and consumers and explain how they need each other (DOK 1-2)

National Agriculture Literacy Outcomes

Agriculture and the Environment Outcomes

Early Elementary

- Describe the importance of soil and water in raising crops and livestock
- Identify natural resources
- Provide examples of how weather patterns affect plant and animal growth for food

Upper Elementary

- Explain how the interaction of the sun, soil, water, and weather in plant and animal growth impacts agricultural production
- Identify land and water conservation methods used in farming systems (wind barriers, conservation tillage, laser leveling, GPS planting, etc.)
- Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel (e.g., soil, water, air, plants, animals, and minerals)

Plants and Animals for Food, Fiber & Energy Outcomes

Early Elementary

- Identify the importance of natural resources (e.g., sun, soil, water, minerals) in farming

EVALUATION FORM

UNDERSTANDING WATER

ACTIVITY BOOK

USER INFORMATION

Name _____

School or educational affiliation _____

Address _____

City, State, Zip code _____

County _____ Email _____

Grade Level _____ Subject Area _____ Number of Students _____

Describe how you used *Understanding Water Activity Book* with your students _____

	Great	Good	Poor	
Content Standards	5	4	3	2 1
COMMENTS:	_____			

Introduction (p. 3)	5	4	3	2	1
COMMENTS:	_____				

Salt Water (p. 4)	5	4	3	2	1
COMMENTS:	_____				

Fresh Water (p. 5-p. 7)	5	4	3	2	1
COMMENTS:	_____				

States of Matter (p. 8-p. 12)	5	4	3	2	1
COMMENTS:	_____				

Density (p. 13-p. 16)	5	4	3	2	1
COMMENTS:	_____				

Water Cycle (p. 17-p. 21)	5	4	3	2	1
COMMENTS:	_____				

Watersheds (p. 22-p. 24)	5	4	3	2	1
COMMENTS:	_____				

Water Supply (p. 25-p. 35)	5	4	3	2	1
COMMENTS:	_____				

Water Treatment (p. 36-p. 41)	5	4	3	2	1
COMMENTS:	_____				

Pollution (p. 42-p. 45)	5	4	3	2	1
COMMENTS:	_____				

	Great	Good	Poor	
Uses of Water (p. 46)	5	4	3	2 1
COMMENTS:	_____			

Clean Water (p. 47-p. 55)	5	4	3	2	1
COMMENTS:	_____				

Conservation (p. 56-59)	5	4	3	2	1
COMMENTS:	_____				

Wastewater (p. 60-p. 63)	5	4	3	2	1
COMMENTS:	_____				

Glossary & Water Terms (p. 64-p. 65)	5	4	3	2	1
COMMENTS:	_____				

Resources (p. 66)	5	4	3	2	1
COMMENTS:	_____				

Answers (p. 67-p. 68)	5	4	3	2	1
COMMENTS:	_____				

Student response to activity book	5	4	3	2	1
COMMENTS:	_____				

Academic integration	5	4	3	2	1
COMMENTS:	_____				

Do your students understand the importance of water?

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*Water's roles are endless.
Water quenches our thirst,
and is the liquid that accounts for seventy
percent of our body mass.
It also provides habitat for fish, animals
and plants, gives life to crops and
offers recreation. Water lends incredible
beauty to our landscapes and helps
generate electric power.
It's used to manufacture
the goods and products we all use.*

From
Water: Colorado's Precious Resource
Colorado Water Conservation Alliance



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