

Understanding Water – Activity Book

*Compliments of the City of Cañon City Stormwater Program
in cooperation with the Colorado Foundation for Agriculture*

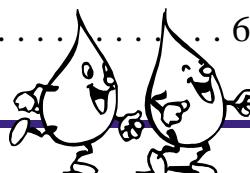
CONTENTS



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.

INTRODUCTION	1
SALT WATER	2
FRESH WATER	3
STATES OF MATTER	6
LIQUID	7
SOLID	8
GAS (WATER VAPOR)	9
DENSITY	11
WATER CYCLE	15
WATERSHEDS	20
WATER SUPPLY	23
AGRICULTURE	26
BUSINESSES	30
SCHOOLS	31
PEOPLE EVERYWHERE	32
WATER TREATMENT	34
POLLUTION	40
USES OF WATER	44
CLEAN WATER	45
LAND USE ACTIVITIES	46
BASIC INGREDIENT OF LIFE	49
CONSERVATION	54
WASTEWATER	58
GLOSSARY & WATER TERMS	62
RESOURCES	64
ANSWERS TO ACTIVITIES AND QUESTIONS	65



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, treatment, 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 allows you to check off the Colorado Content 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 on easy-to-remove perforated pages. An evaluation sheet is also included and perforated for easy removal and use. Please take the time to answer the questions, fold it with the postage paid mailer on the outside, 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:

Wildlife Activity Book (limited quantity)

Wool and Sheep Activity Book (limited quantity)

Resource Directory (revised 1998)

Century of Seasons CD ROM (out of stock)

Colorado history has never been more enjoyable!

Colorado Reader subscription

Classroom packets are delivered monthly during the school year. Each classroom set contains 32 eight-page student readers and a teacher's guide. Available as a subscription option with the *Colorado Reader* is the *Denver Post* Newspaper in Education CO-AG program. The CO-AG program includes weekly lesson plans faxed to you along with delivery of the Sunday and Tuesday newspaper. Both the *Colorado Reader* subscription and the CO-AG program are free to educators who request them.

ON-GOING PROGRAMS:

Agri-CULTURE in the Classroom Summer Institute. Earn 2 graduate-level 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.

Food, Land and People (FLP) Workshops introduce participants to an excellent activity resource. You will see how others interpret the activities and present them to students. You also have the opportunity to become a facilitator.

PROJECTS IN DEVELOPMENT:

A River's Journey CD ROM

This will be an interactive CD ROM about water. The format will be similar to *A Century of Seasons*. The structure of the multi-media presentation coupled with the teacher's guide lets you choose whether your students work individually or travel through the materials as a class.

Choices and Consequences (interactive web site)

Once this program has been pilot tested, you and your students will be invited to an interactive web site that outlines a real-life scenario of a dilemma facing an agriculture producer. Students will be able to suggest solutions and interact with experts in different fields. This is a problem-solving exercise that expands students' understanding of complex issues. They will learn how the problem was handled and benefit from learning the results of the chosen solution. If the dilemma posed shows a conflict with wildlife, experts from wildlife services as well as extension services, university educators and agriculture producers will respond to students' questions and solutions.



Colorado Foundation for Agriculture

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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

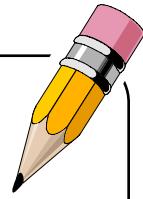
- everyone
- my neighbors and me
- farmers and ranchers
- schools
- animals
- businesses
- wildlife
- plants



Bold words, like **vapor**, are defined on pages 62 & 63.



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.

My family uses water

- to drink
- to cook
- to bathe
- to flush the toilet
- to wash faces and hands
- to water the lawn
- to wash dishes
- to wash clothes
- to wash the car
- to water house plants
- for fun, like playing in the sprinkler, swimming, filling water balloons
- to brush teeth
- to make ice cubes
- to fill a bird bath
- to fill a fish tank
- to grow vegetables
- 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 also too salty for plants.

Water is a **NATURAL RESOURCE**.



F R E S H

W A T E R

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 treatment. 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%.

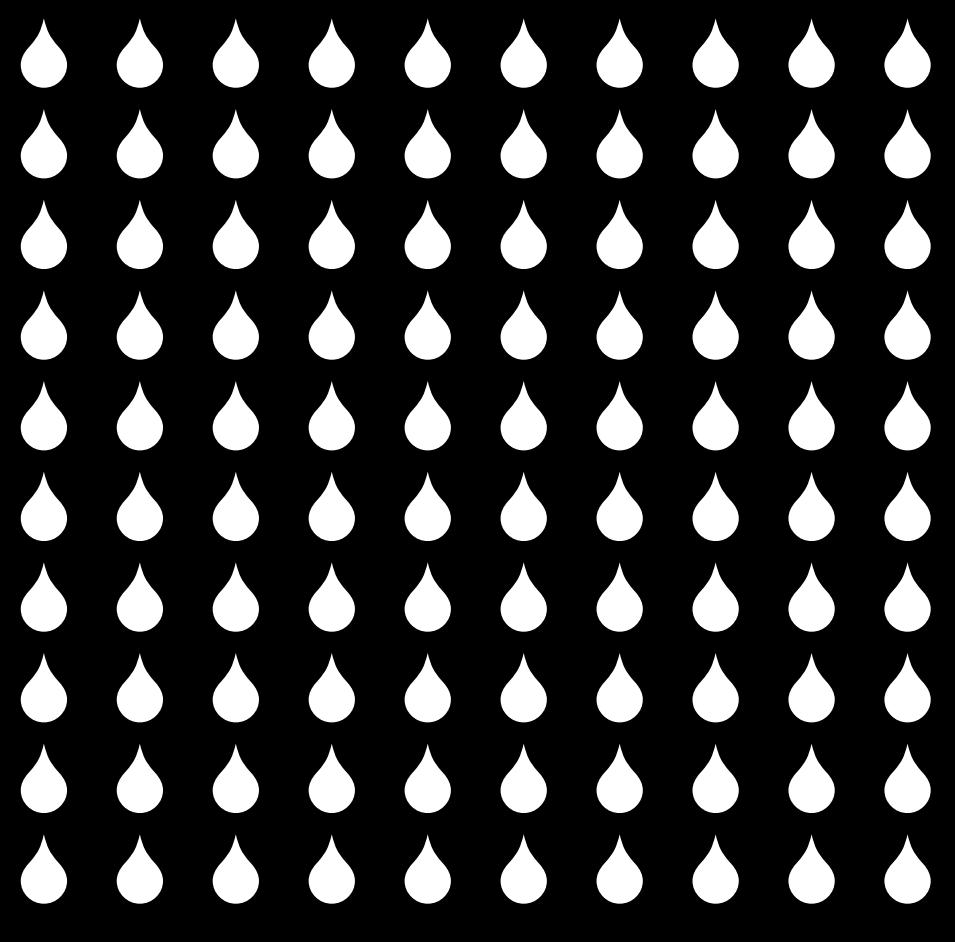
97% of the water on Earth is salt water.

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

Here are
10 rows
of 10
water
drops.

*How
many
water
drops are
there?*

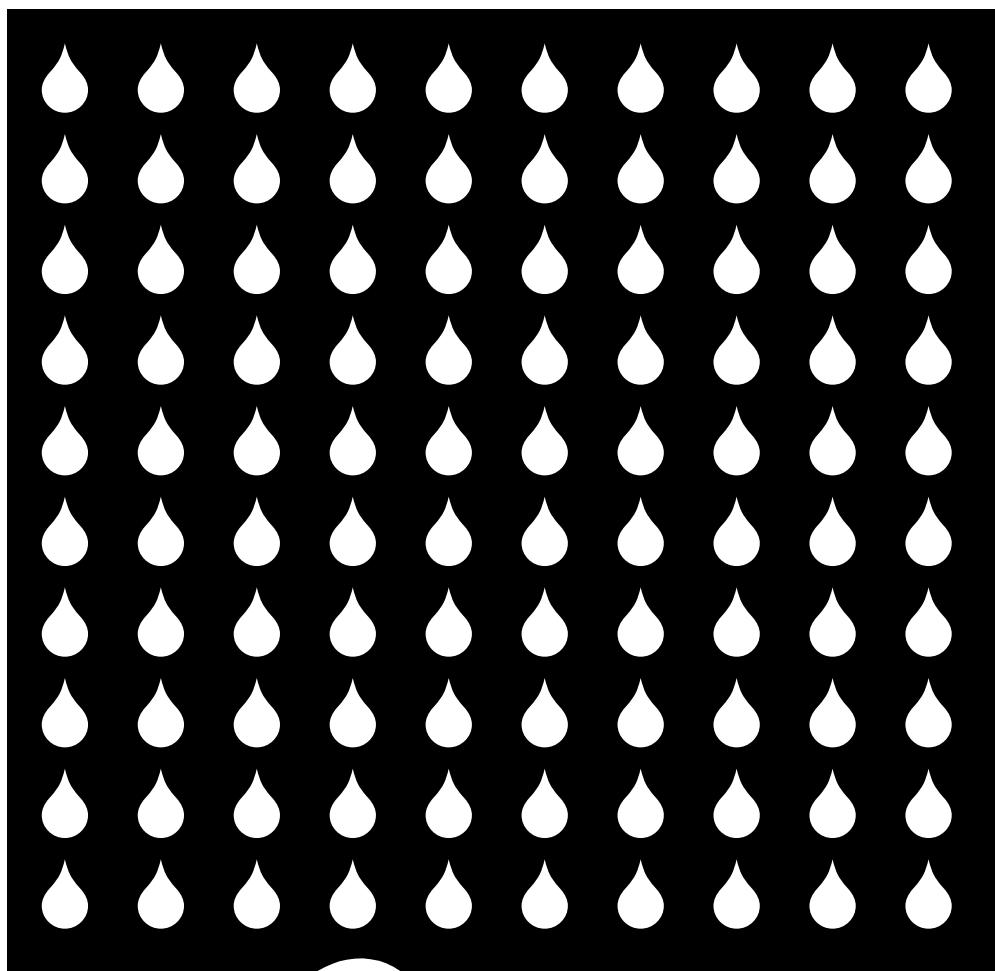
$$\begin{array}{r} 10 \\ \times 10 \\ \hline \end{array}$$



Color 97 of the drops green to show salt water.

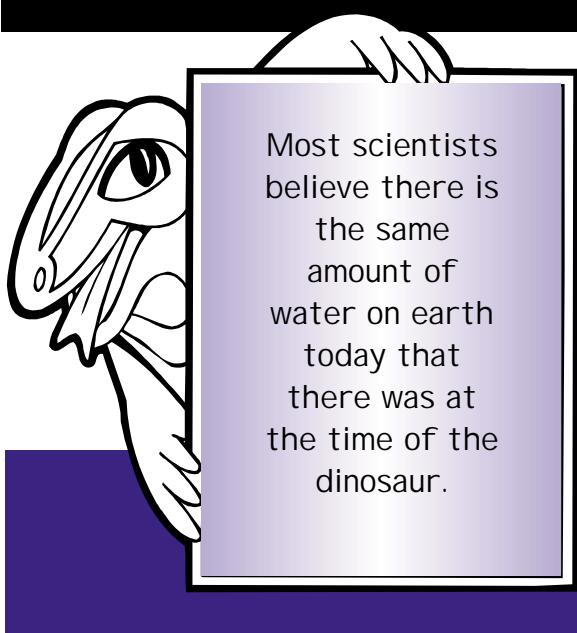
Color 3 of the drops blue to show fresh water.

Now the water drops represent all the fresh water on Earth. Eighty-five percent of Earth's fresh water is frozen in ice at the north and south poles.



*How much
water is
available for
people,
plants
and animals
to use?*

*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 is not frozen.

$$\begin{array}{r}
 100 \\
 - 85 \\
 \hline
 \end{array}$$

LESS THAN ONE PERCENT OF FRESH WATER IS AVAILABLE FOR PEOPLE, PLANTS AND ANIMALS TO USE!

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 _____.



Water that flows from a faucet is _____.



SCIENCE EXPERIMENT

Identify water as liquid, solid or vapor.

1
2
3

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.



L
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Q
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I
C
E

V
A
P
O
R

Science Experiment continued

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.



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?

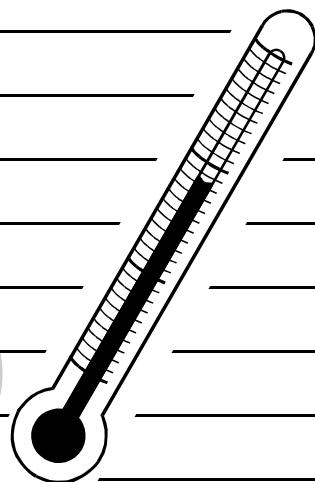
Water vapor.

Write three words that describe vapor.

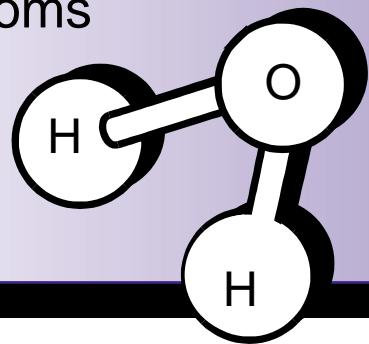
What caused the changes in the water?

HEAT

COLD



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.

DENSITY

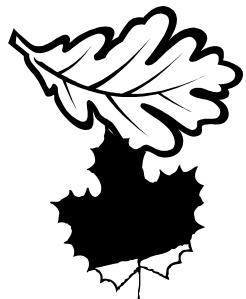
Some things **float** on water.

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 or kool-aid, will dissolve in water.

SCIENCE EXPERIMENT

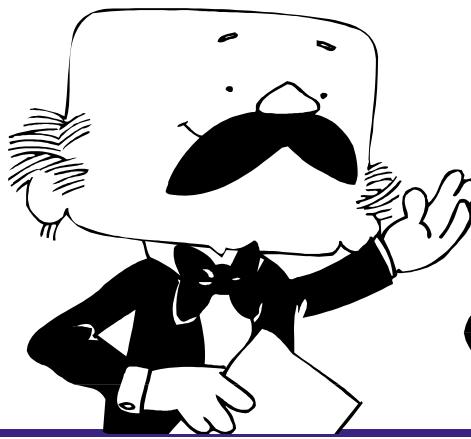
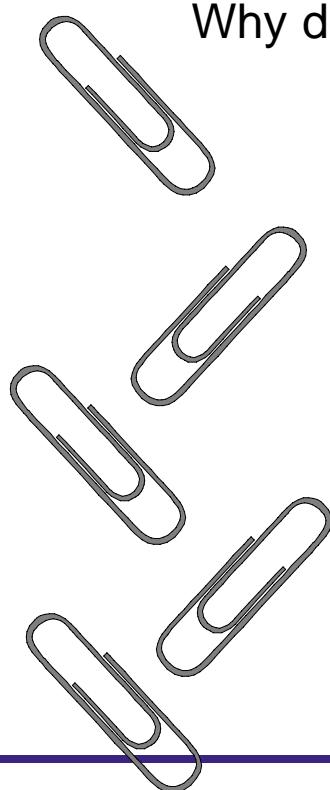
You will need: ✓ A large bowl of water ✓ Paper clips ✓ Aluminum foil

Put water in the large bowl of water. Drop a paper clip in the tub. 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 tub 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?

Solve the code to answer the professor's question.

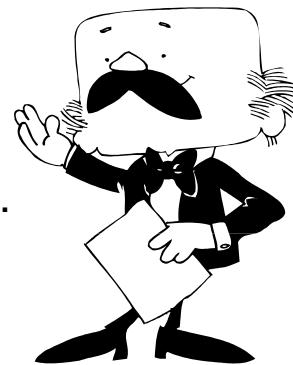
Complete the math problems. Find the letter that matches the number of the “code”. Write the letter on the line above the number to make the words and learn the answer to the question.

A = $12 + 12 =$ _____
 B = $2 + 3 =$ _____
 C = $12 - 6 =$ _____
 D = $4 \times 2 =$ _____
 E = $3 + 9 =$ _____
 F = $12 - 1 =$ _____
 G = $3 \times 5 =$ _____
 H = $3 \times 6 =$ _____
 I = $9 - 5 =$ _____
 J = $40 + 3 =$ _____
 K = $30 + 30 =$ _____
 L = $5 \times 2 =$ _____
 M = $7 + 7 =$ _____

+

N = $1 + 1 =$ _____
 O = $13 - 12 =$ _____
 P = $6 \times 6 =$ _____
 Q = $17 - 14 =$ _____
 R = $7 \times 1 =$ _____
 S = $3 + 6 =$ _____
 T = $7 + 6 =$ _____
 U = $8 + 8 =$ _____
 V = 82 _____
 W = $30 - 13 =$ _____
 X = $6 \times 5 =$ _____
 Y = $3 \times 7 =$ _____
 Z = $22 - 2 =$ _____

$\frac{13}{17}$ $\frac{18}{4}$ $\frac{12}{10}$ $\frac{14}{10}$ $\frac{24}{9}$ $\frac{7}{4}$ $\frac{5}{2}$ $\frac{10}{60}$; $\frac{12}{13}$ $\frac{18}{18}$ $\frac{12}{12}$
 $\frac{4}{6}$ $\frac{6}{12}$ $\frac{12}{10}$ $\frac{6}{16}$ $\frac{16}{5}$ $\frac{5}{12}$ $\frac{12}{17}$ $\frac{4}{4}$ $\frac{10}{10}$ $\frac{10}{10}$
 $\frac{11}{11}$ $\frac{10}{10}$ $\frac{1}{1}$ $\frac{24}{24}$ $\frac{13}{13}$. $\frac{4}{4}$ $\frac{6}{6}$ $\frac{12}{12}$ $\frac{4}{4}$ $\frac{9}{9}$
 $\frac{10}{10}$ $\frac{12}{12}$ $\frac{9}{9}$ $\frac{9}{9}$ $\frac{8}{8}$ $\frac{12}{12}$ $\frac{2}{2}$ $\frac{9}{9}$ $\frac{12}{12}$
 $\frac{13}{17}$ $\frac{18}{24}$ $\frac{24}{13}$ $\frac{2}{12}$ $\frac{10}{7}$; $\frac{4}{24}$
 $\frac{14}{14}$ $\frac{24}{24}$ $\frac{7}{7}$ $\frac{5}{5}$ $\frac{10}{10}$ $\frac{12}{12}$ $\frac{4}{4}$ $\frac{9}{9}$ $\frac{12}{12}$.



D
E
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T
Y

A S L T WATER
S A L T WATER

N A I R
R A I N

Unscramble the water words

S I L O D

C E I

V A P R O

V I R E R

I D E S Y N T

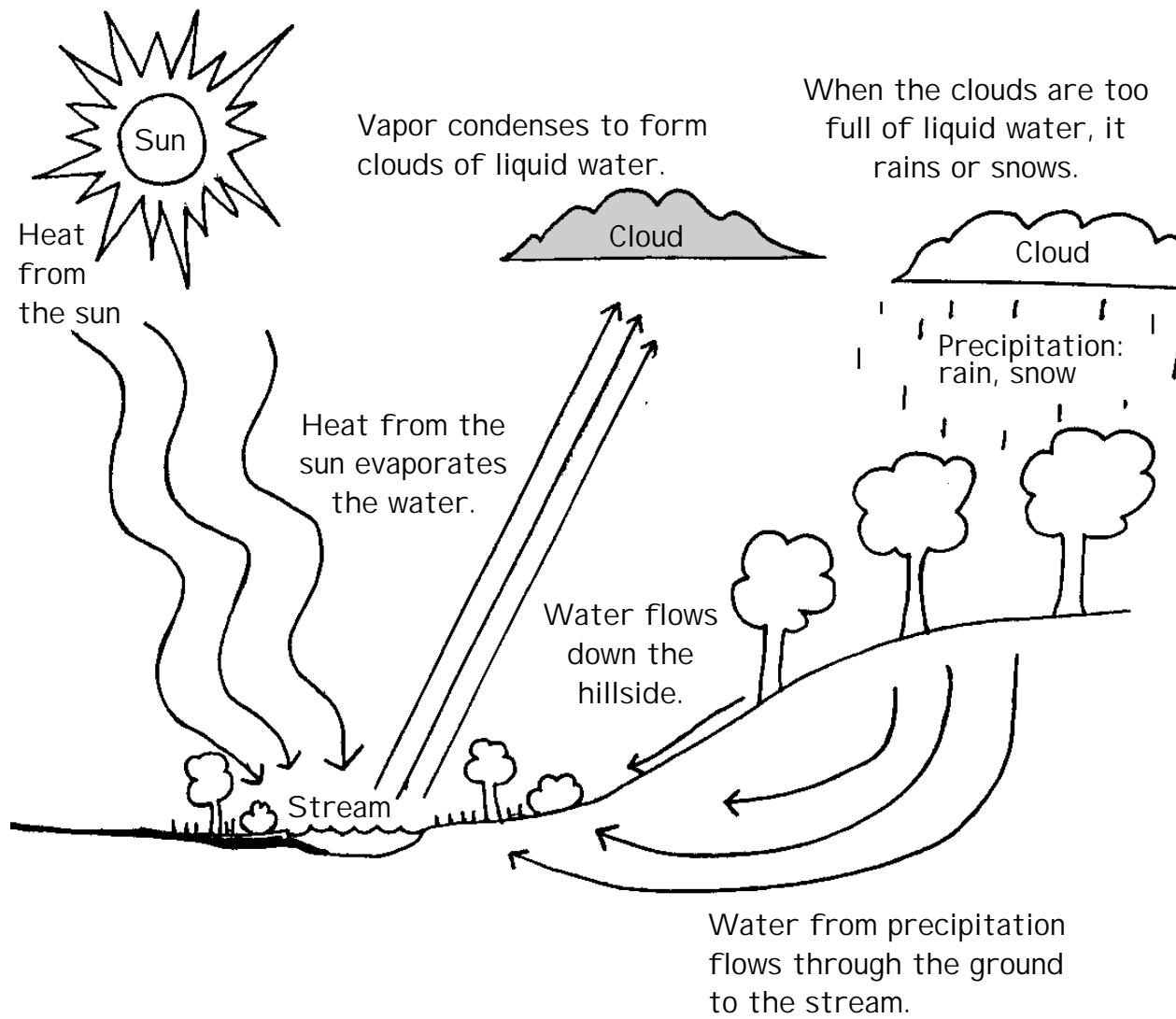
V I R E R

I L D U I Q

O E A N C



WATER CYCLE

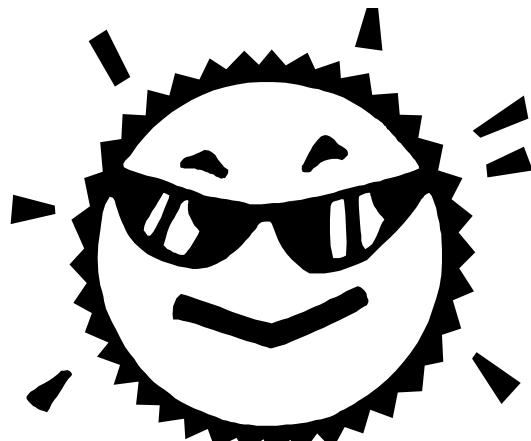


Water goes through three states of matter (liquid, solid, gas) in the water cycle. The water cycle is the movement of water from Earth to the **atmosphere** and back again.



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**.

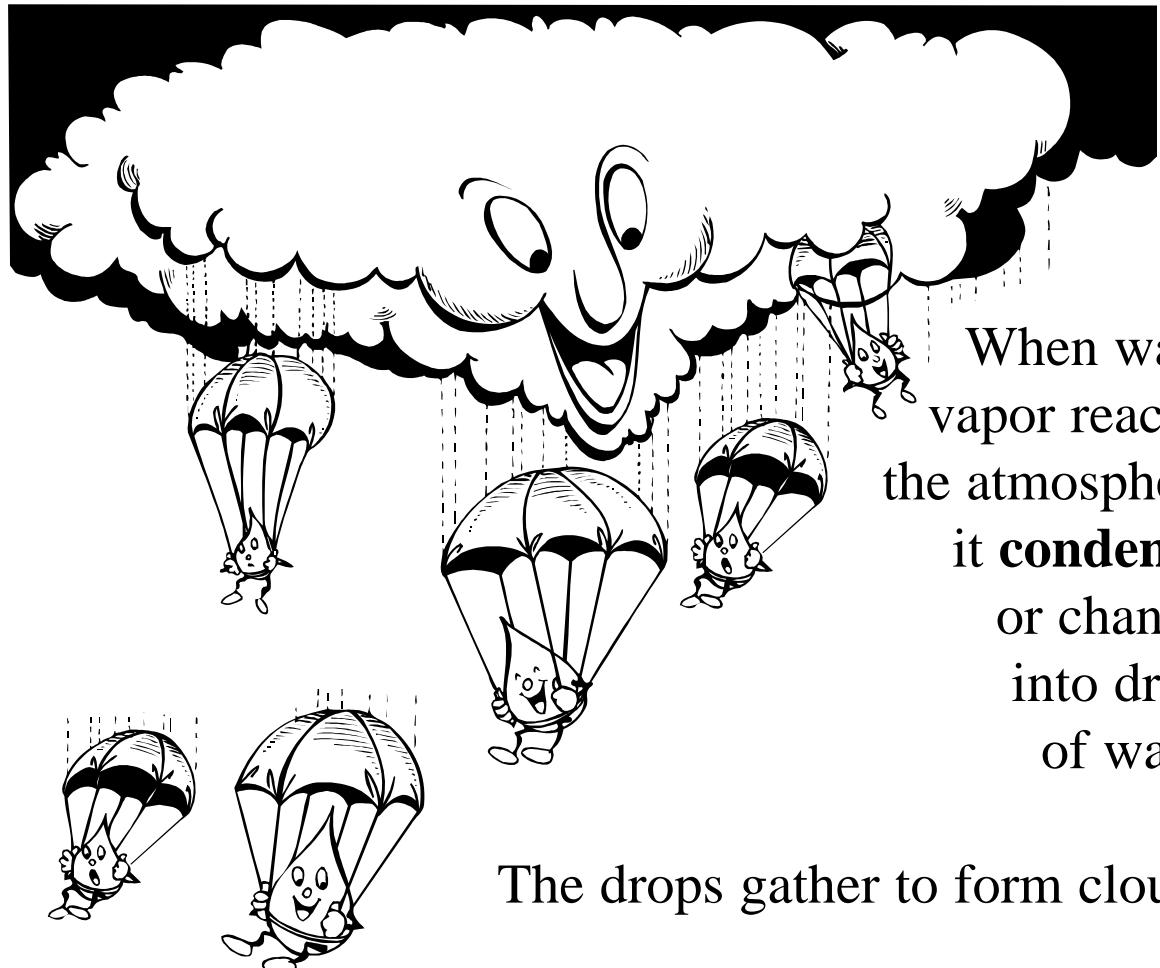


Plants and trees also “breathe” water into the atmosphere in a process called **transpiration**.

*Sunlight striking falling rain makes a colorful effect.
What is this called?*



WATER CYCLE



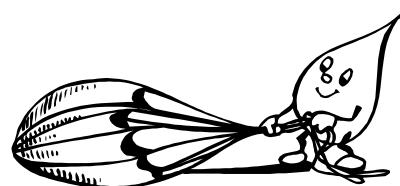
When water vapor reaches the atmosphere, it **condenses** or changes into drops of water.

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.

Then the cycle goes around again.



MATCH 'EM

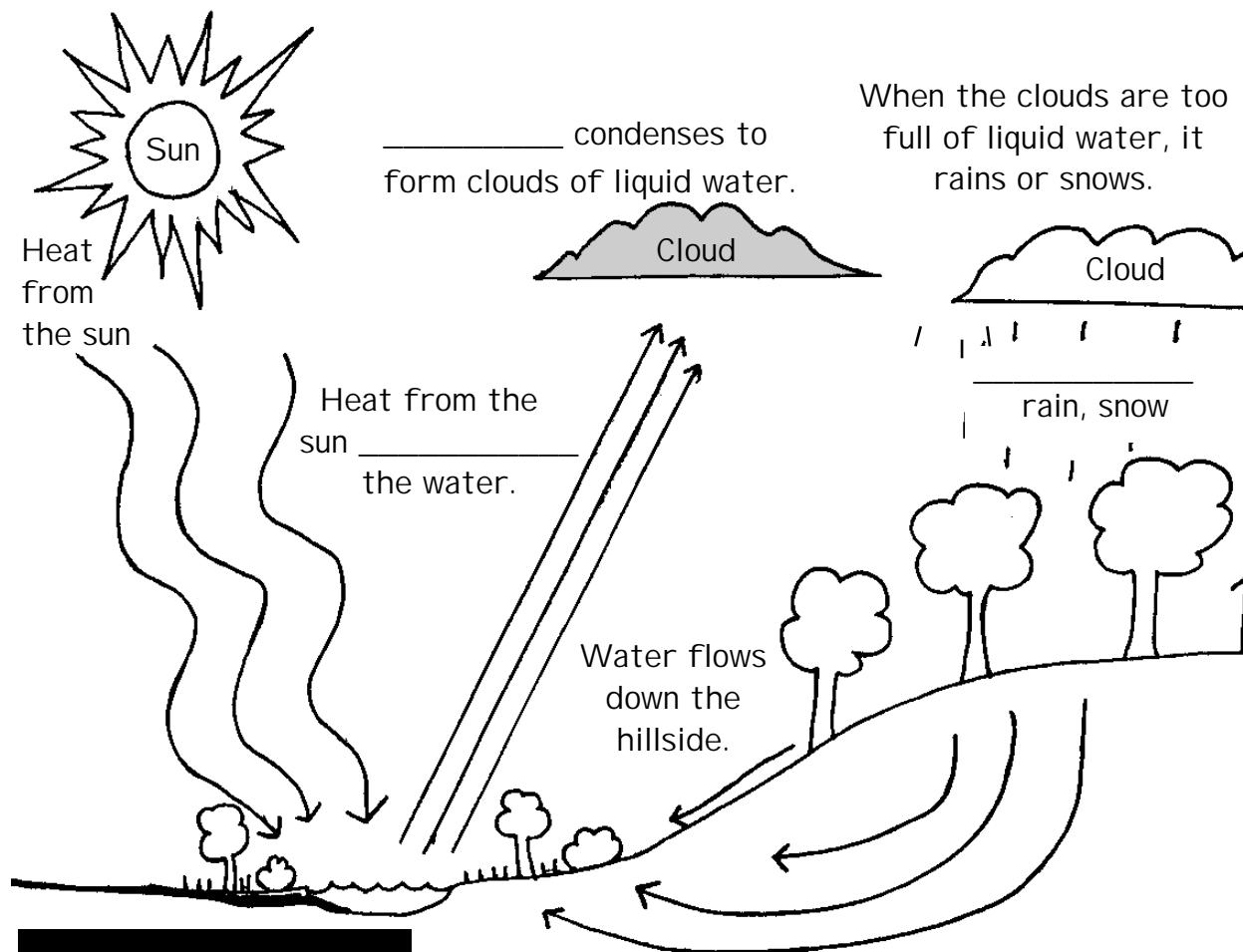
Match the words and the meanings

Write the
letter of the
definition on
the line

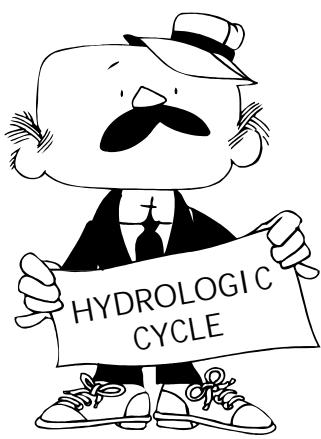
- _____ **EVAPORATION**
- _____ **CONDENSATION**
- _____ **LIQUID, ICE, VAPOR**
- _____ **PRECIPITATION**
- _____ **RUNOFF**
- _____ **TRANSPIRATION**

- 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.

Fill in the blanks in the water cycle.



Describe what happens in the water cycle:

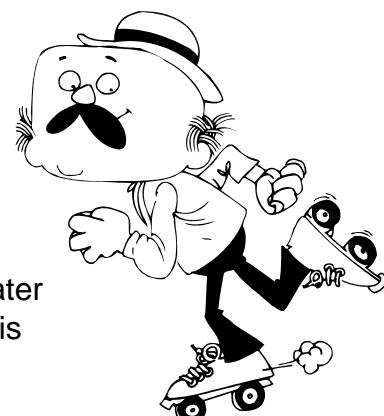
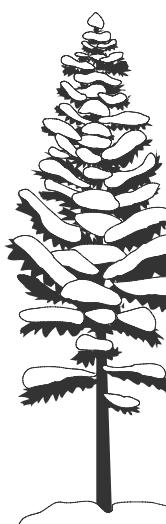


Another name for the water cycle is **Hydrologic Cycle**. Look for this word in a dictionary. Why do both terms have the same meaning?

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. This stored water can be used throughout the year.

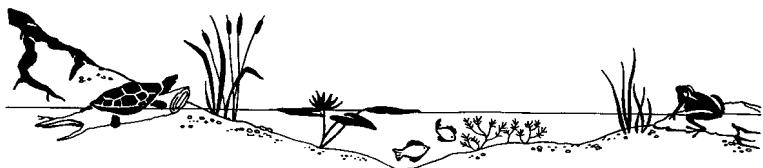
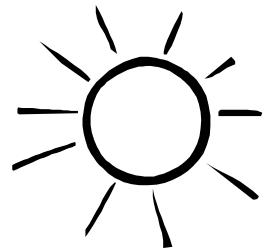
Water stored in reservoirs and lakes is released when it is needed. The places needing water may include cities, businesses, homes or farms. Water can also flow to another state. Water is moved by letting it flow down rivers, **canals** (ditches) or huge pipes that may sit above or below ground.



A **dam** is a structure built to stop the flow of water down a stream. A **reservoir** is the water that is caught behind a dam.

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...



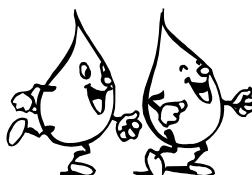
W
A
T
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H
E
D
S

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 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:

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?

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?

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.



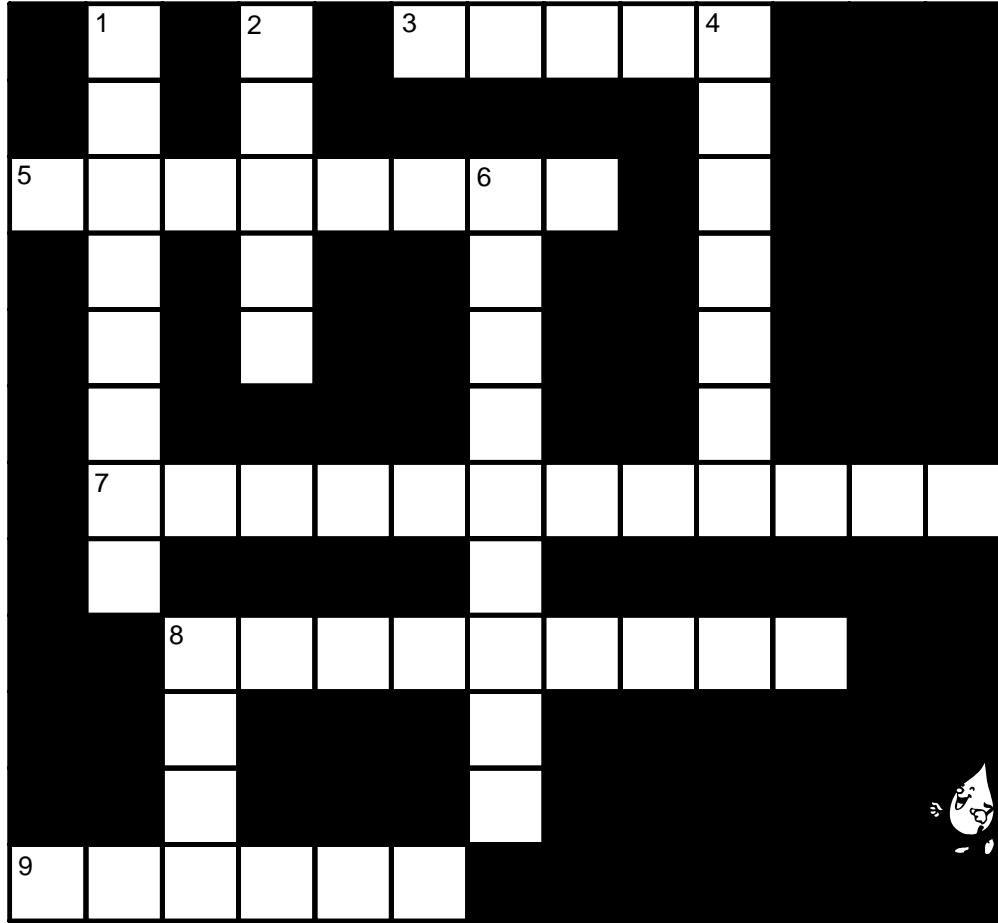
Everything gets dry when there is not enough rain. Not enough rain can cause a **drought**. When an area has a drought, plants and the ground dry out.

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, the 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.

**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.
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.

**WATER WORDS:**

BASIN
CANALS
CONSERVATION
DROUGHT

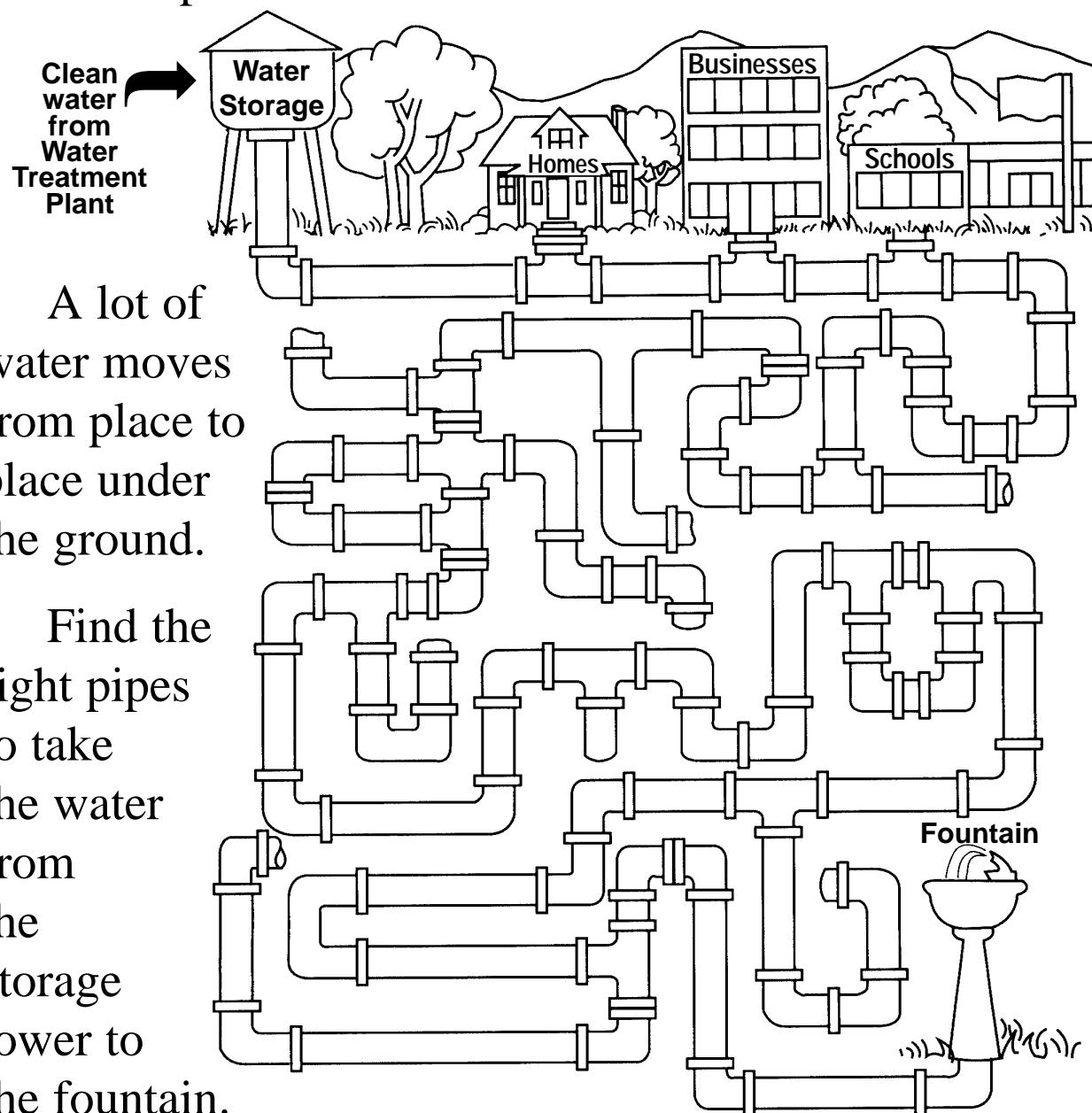
FLOOD
MOISTURE
RAIN
RATIONING

RESERVOIR
SNOWPACK

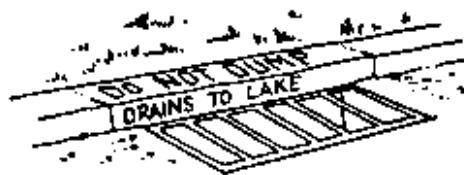
Water is used over and over – as many as five to seven times – before it flows out of Colorado.

Communities will use water in many ways. Water that is used inside our homes, schools and businesses will be cleaned 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, 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 cars or 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 pastureland 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.

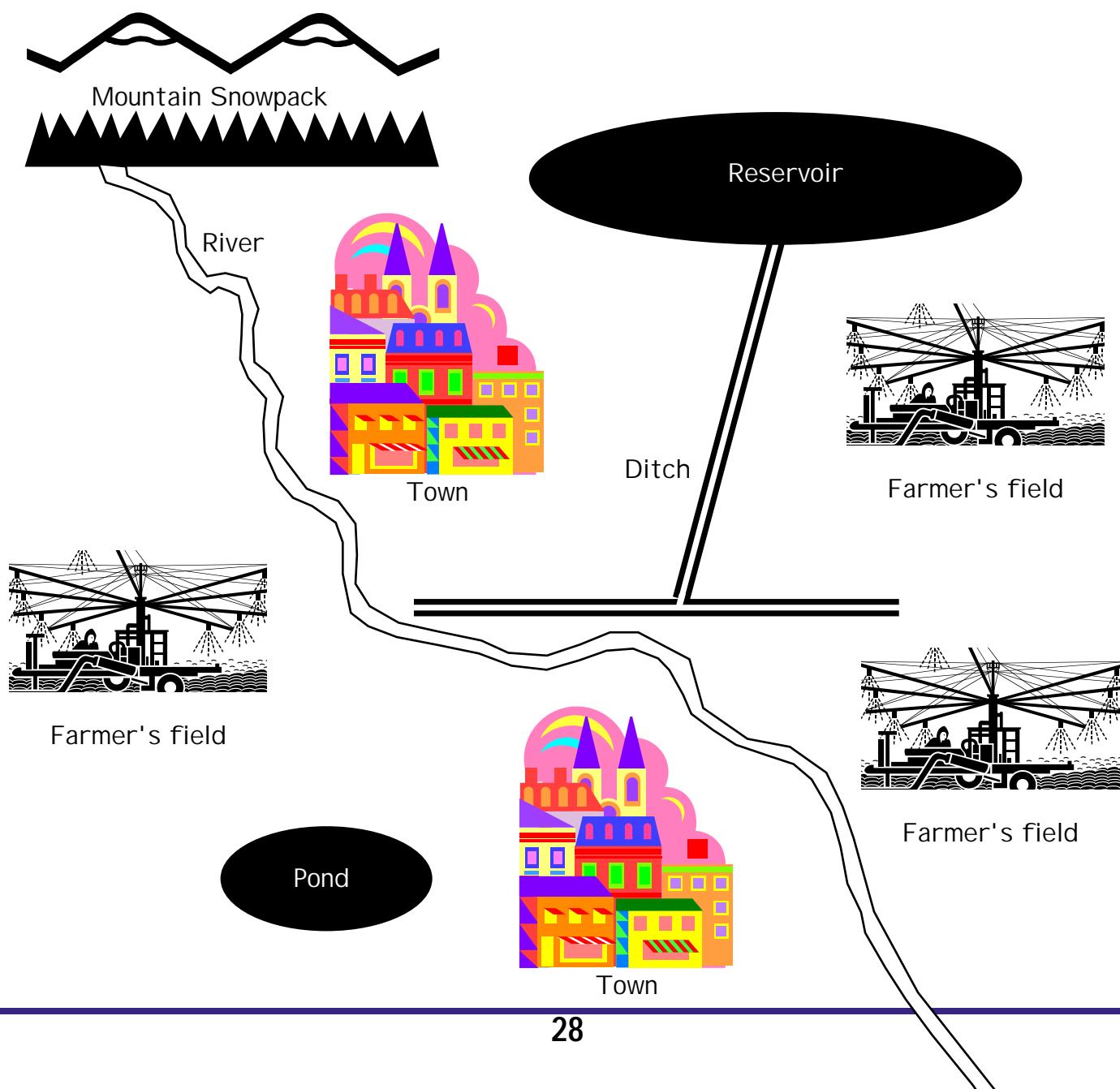


Yet another way to irrigate is **surge irrigation**. A computerized valve turns the water supply to furrows on and off. This system is designed to allow water to soak into the ground before more is applied.



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.

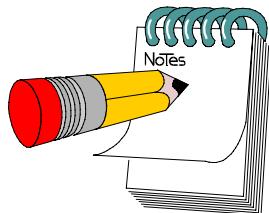
WATER WORDS:

WATERING LIVESTOCK
DRINKING BEVERAGES
CLEANING
PROVIDING WATER FOR WILDLIFE
HAVING FUN

W
A
T
E
R
U
S
E
S



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.**

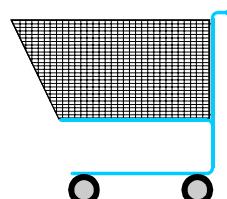
Restaurant



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



Supermarket



Car Dealer



Farmer



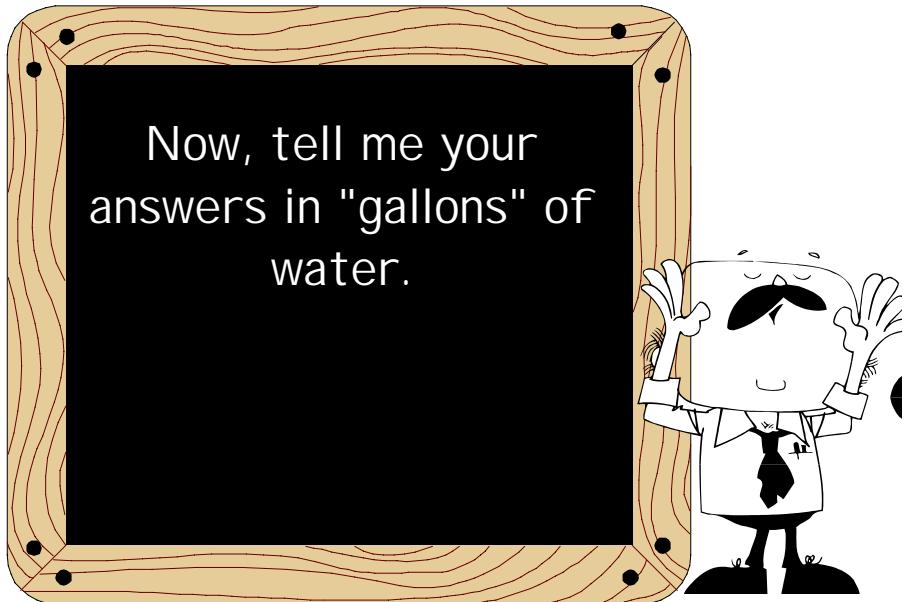
W A T E R U S E S

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, the schoolyard **landscaped** with plants and grass, restrooms and drinking fountains.

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 in a day?

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



People throughout the country have the same needs for water as Colorado residents. Businesses, schools, farms and communities need water. Since less than one percent of available water is fresh water, all of us must share the water. Remember the water cycle? Water is used over and over again. The water that falls as snow in the mountains can find its way to a community in Missouri.

Water used for irrigation flows to plants. About half of this irrigation water will return to the atmosphere. It will form clouds and fall to Earth as precipitation. Some of the irrigation water will soak into the ground, perhaps to be brought to the surface by a well for drinking water for people or animals. A drop of water in a puddle outside your house may find its way to Texas, New York or Canada. It may travel to Europe!

Imagine you are a drop of water.
Describe a trip you take starting
from a garden hose.



WATER USES

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 one of two states that water flows out of but not into. What is the other state?

The Mississippi River is the **L O N G E S T** river in the United States on which boats & ships can travel.

Do rivers flow into other rivers?

Does the water ever reach the oceans?



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

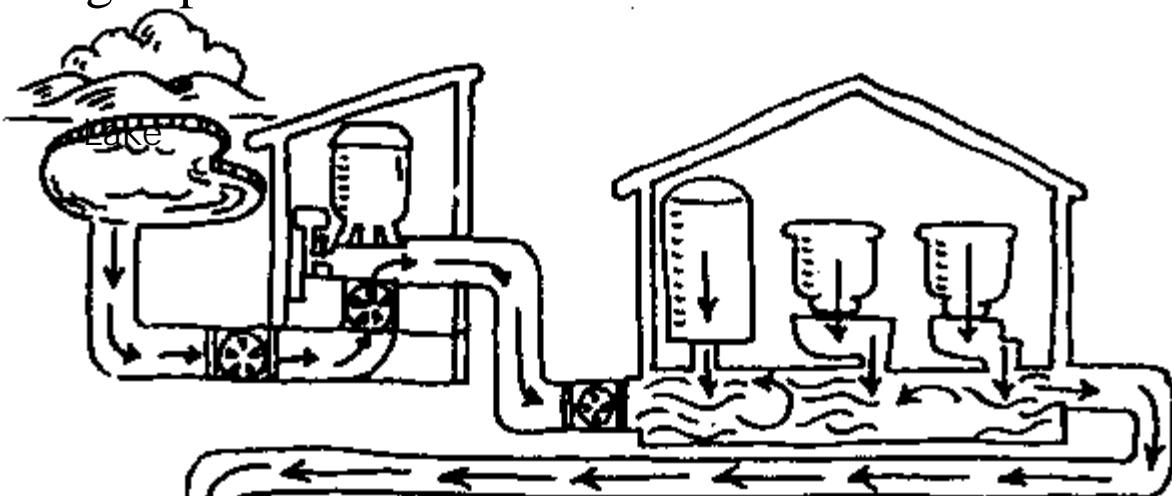
YOU CAN

USE A



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

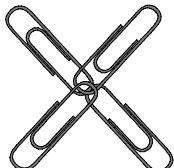
There are fine particles that don't settle to the bottom of the container. These particles need to become heavy enough to sink. **Coagulation** is the process of combining small particles with other small particles to create larger solids. **Alum**, a chemical which makes the particles stick together,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



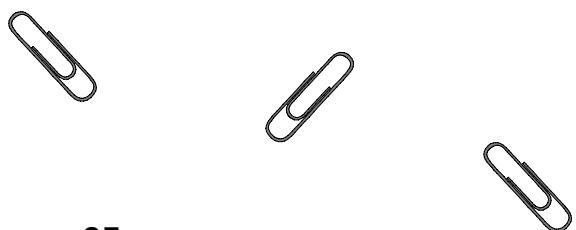
It is easier to remove big things from water than tiny things. If you can make the little things in water stick together or make them heavier than water so they sink, it will be easier to gather them together.

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

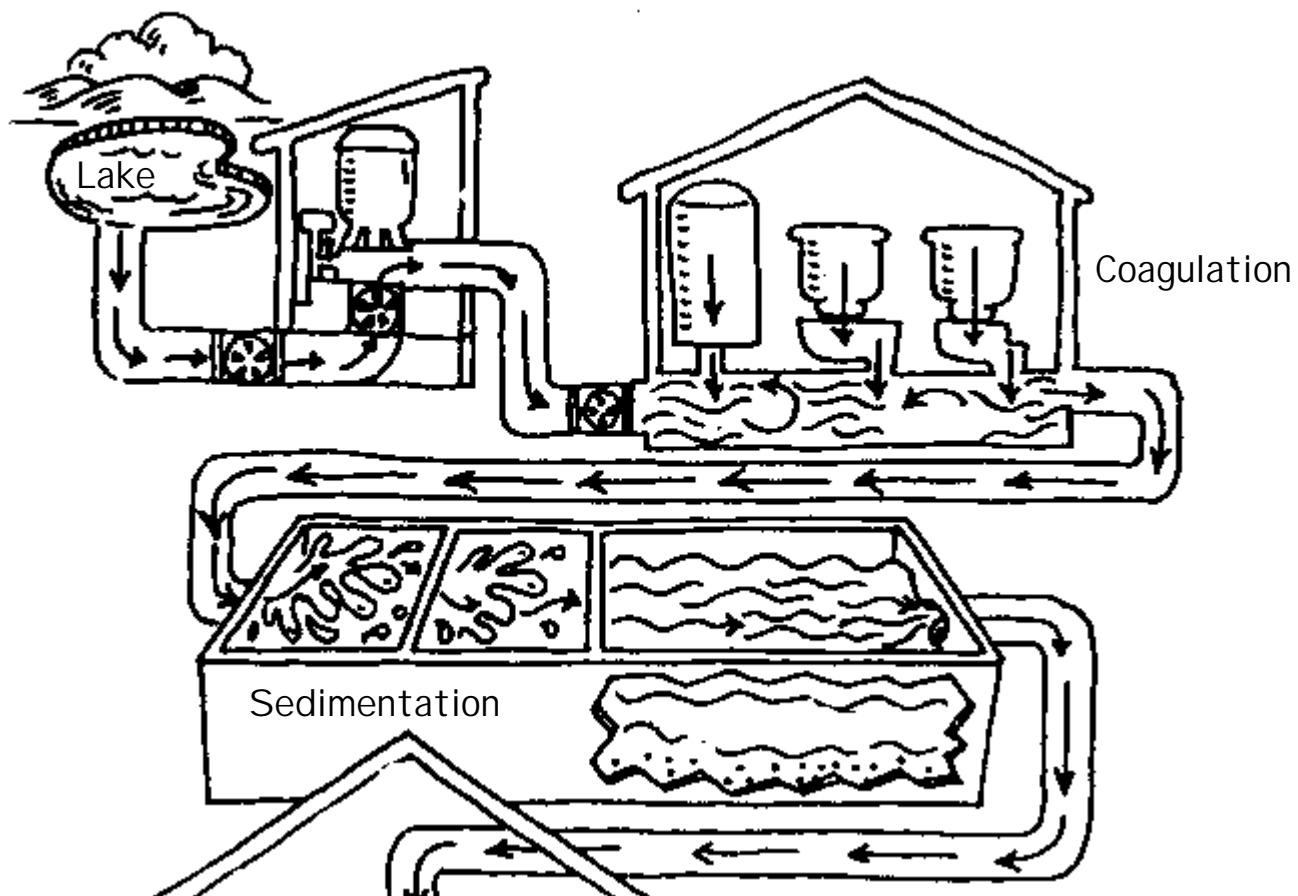
1



2



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



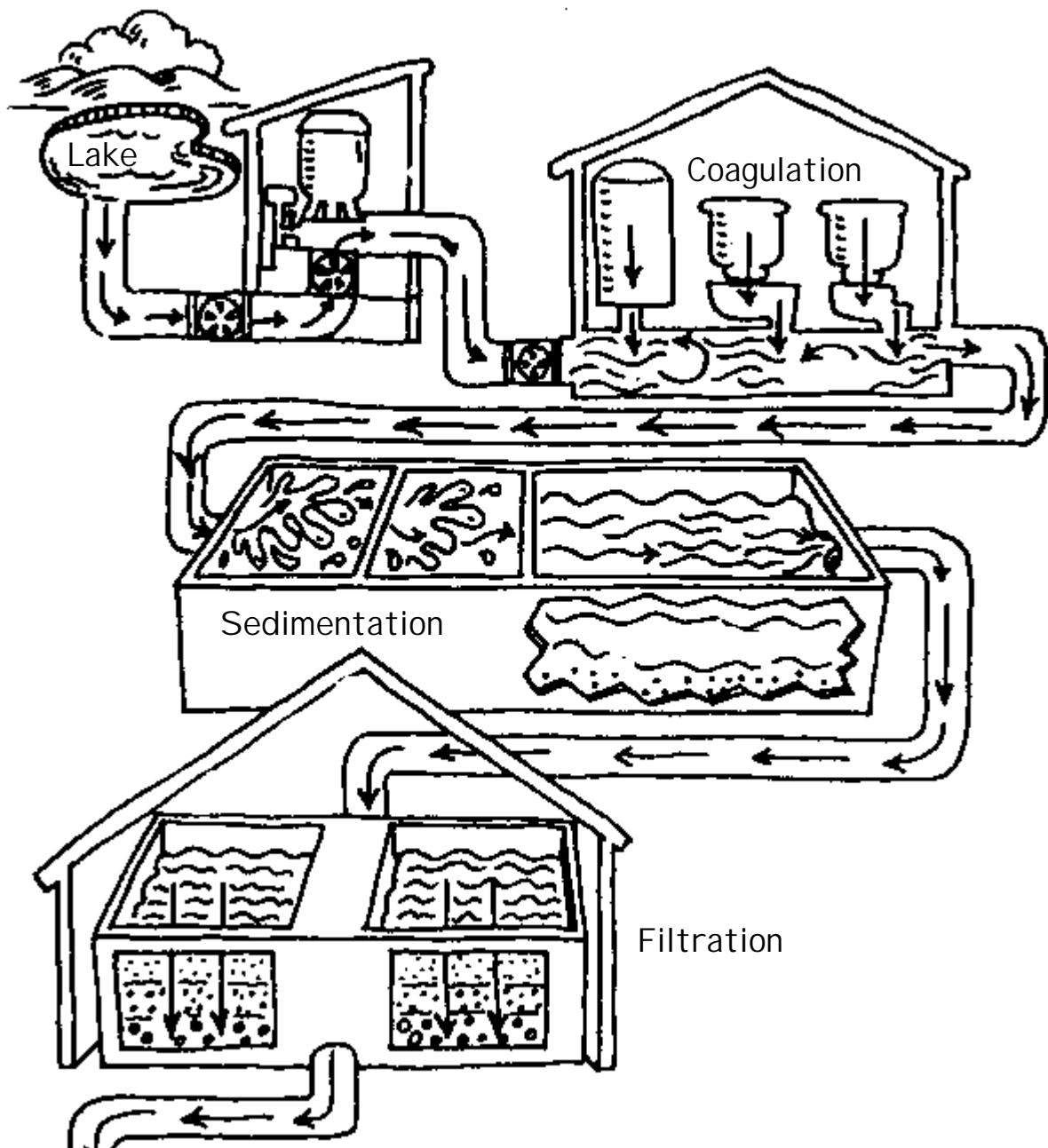
Another name you might hear for this process is "**flocculation**."

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



Why is this done?
Look back one page!

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**.

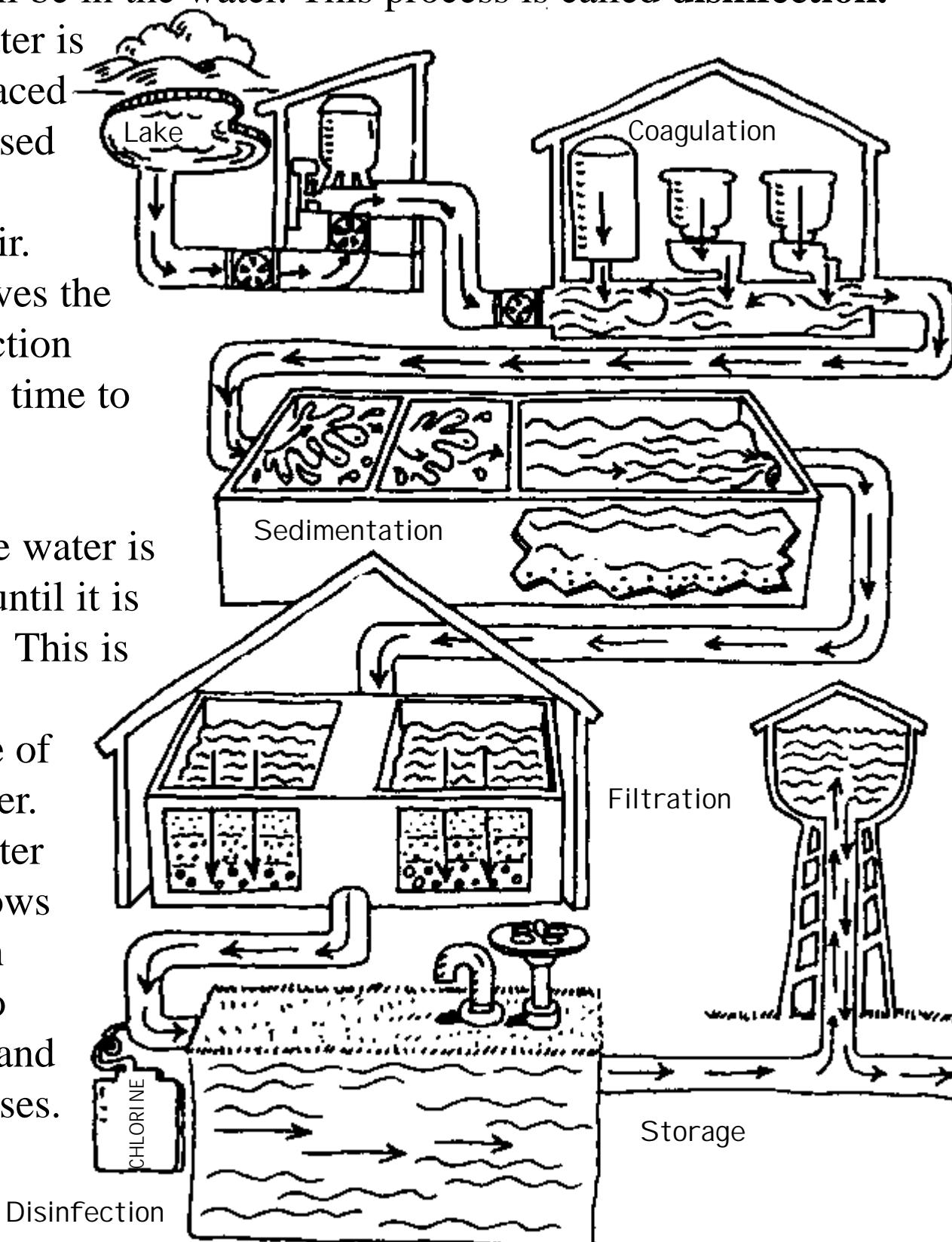


A small amount of chlorine (or another **disinfectant**) is added to the water to kill any bacteria or microorganisms that may still be in the water. This process is called **disinfection**.

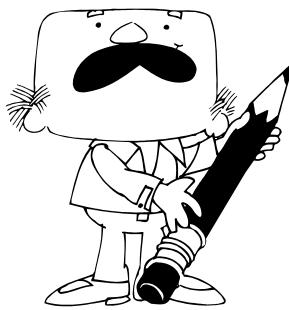
Water is then placed in a closed tank or reservoir.

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.

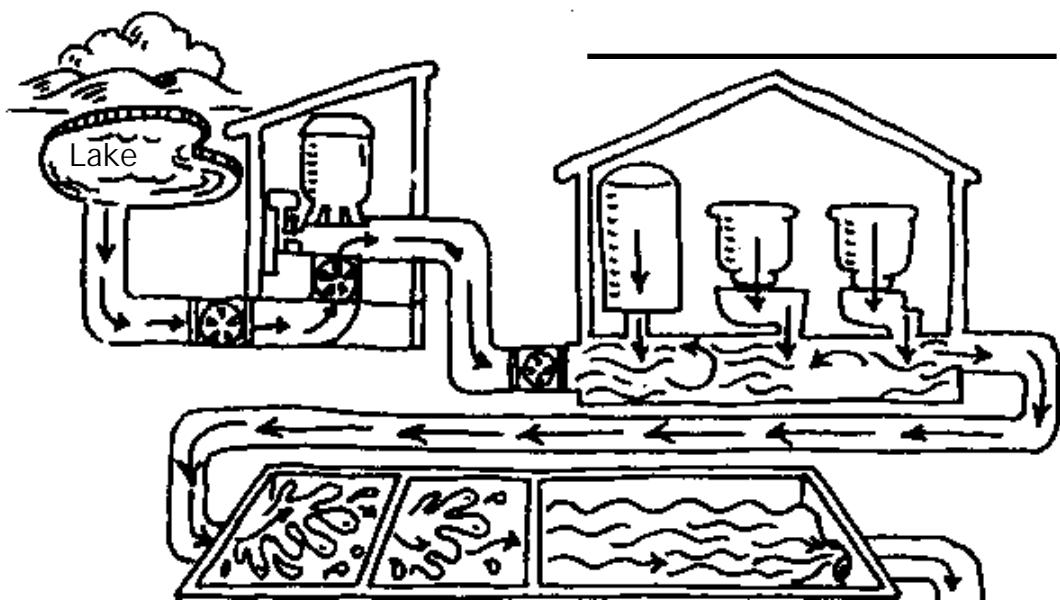


T R E A T M E N T



Use your new words to show how water is cleaned so we can drink it.
Stop at each treatment point and unscramble the words

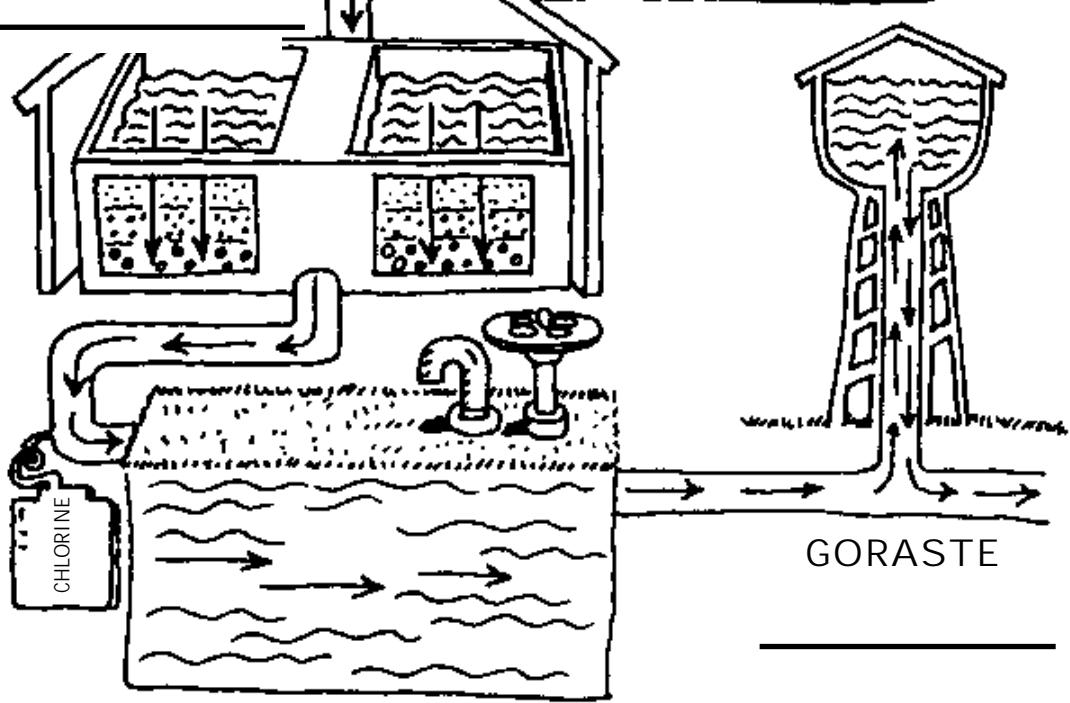
GOCAALUTION



EDSTAI MNETION



FTRI LATION



GORASTE

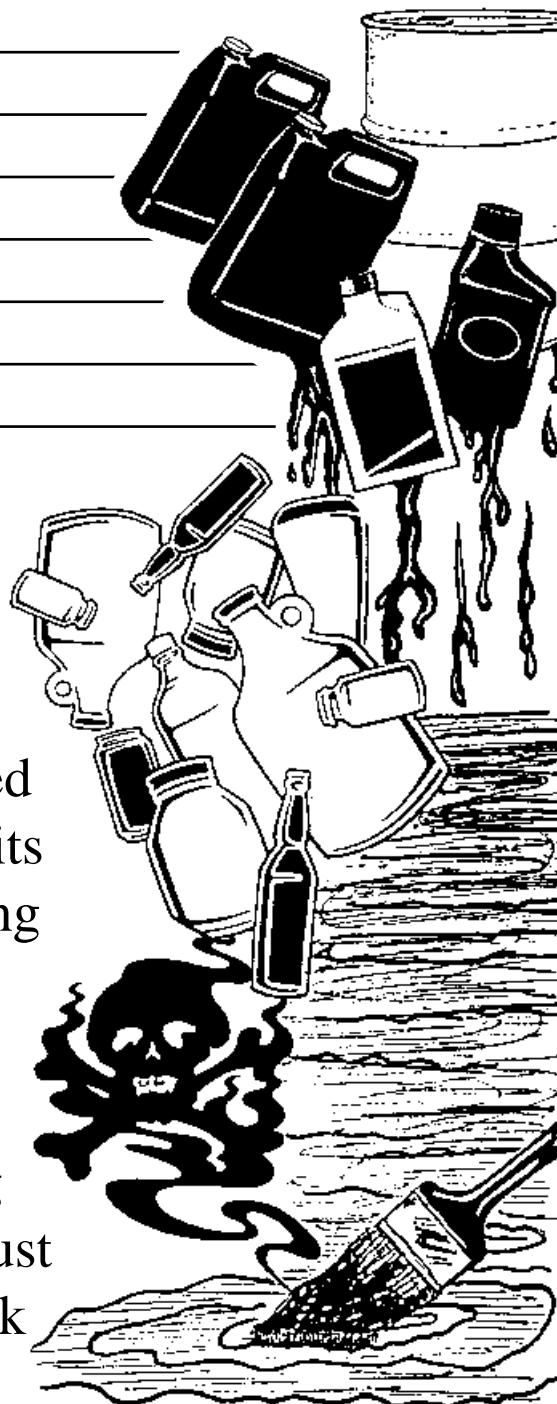
DISNICEFTION

CHLORINE

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 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 the street 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 on the lines below to make a complete sentence.



POLUTION

What do
you see
in the
picture?



How can we help the fish?



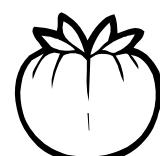
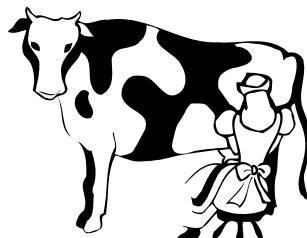
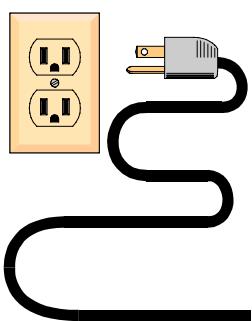
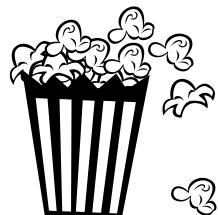
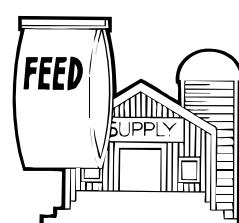
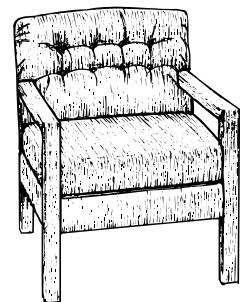
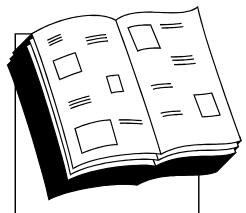
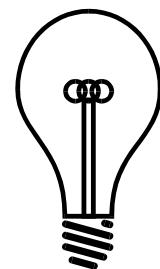
The Environmental Protection Agency (EPA) says that nonpoint sources are the main cause of our water pollution.



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.

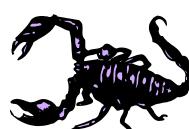


NATURE

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



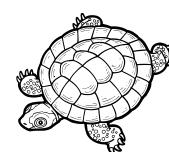
Generally, where there is a lot of water, there is a lot of life. Different types of animals live in different places. Deserts are home to plants and animals that use water differently than other plants and animals. Oceans and seas are home to plants and animals that need the environment provided by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



Write in your diary about wildlife, birds and plants you have seen.
Describe where you saw them.



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.



Agriculture



Forestry



Septic Systems



Construction



Mining



Urban Storm Runoff

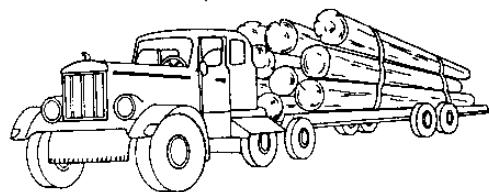
(Ah, good news! You may not have seen pollution being created because the people doing these activities used good management practices to prevent pollution!)

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.



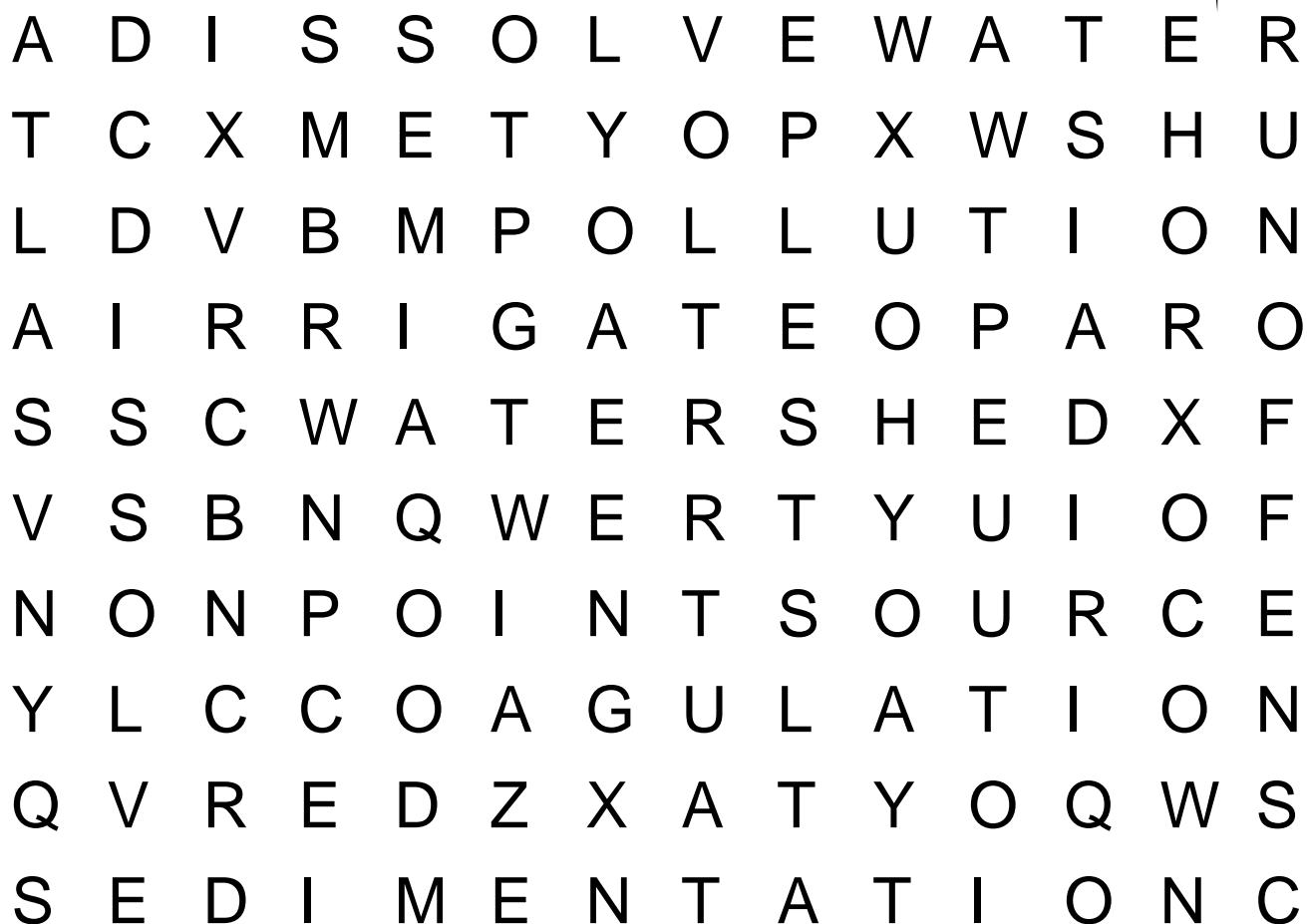
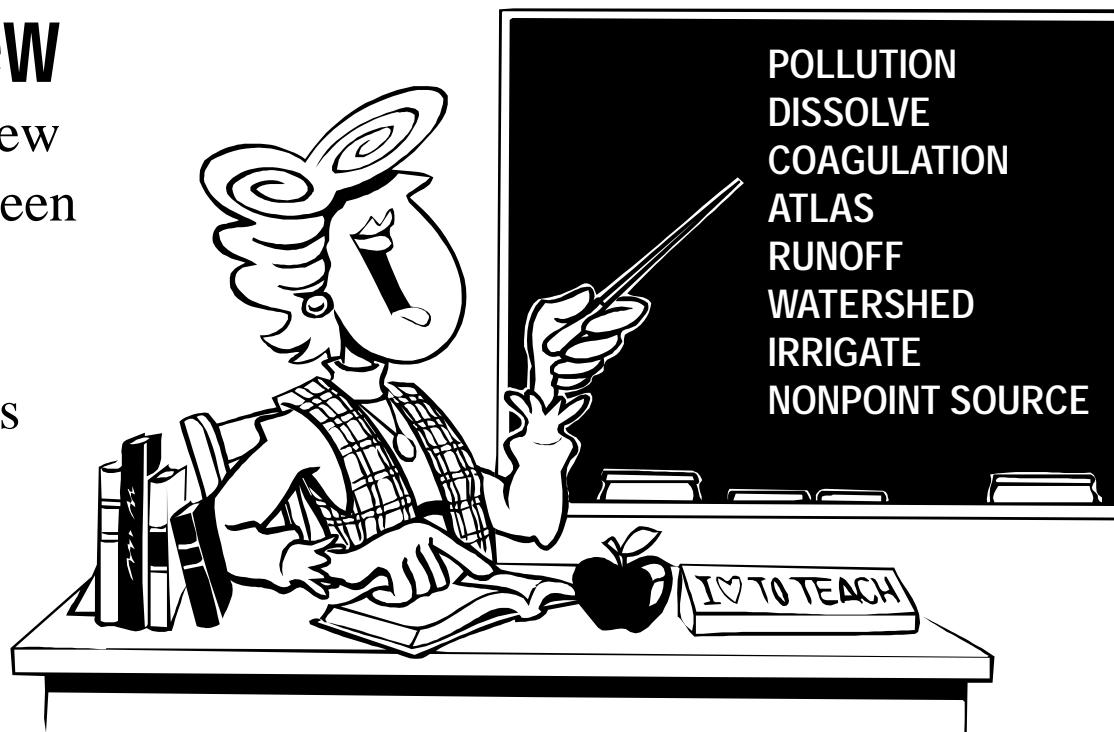
Urban storm runoff can include oil, animal waste, gas, antifreeze, fertilizers, pesticides, paints, etc. Lawns, gardens and landscaping are major sources of pollution. Rubber from our tires is left on roads every time we drive. Spilled household cleaners, paints, car fluids, etc., or their containers,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

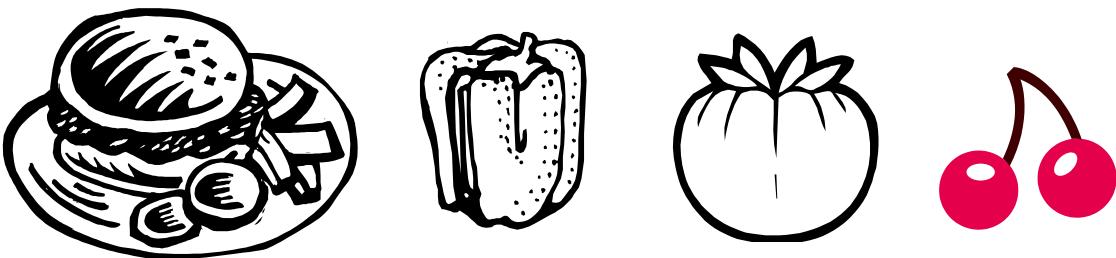
Let's **review**
a few of the new
words we've seen
so far.

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



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



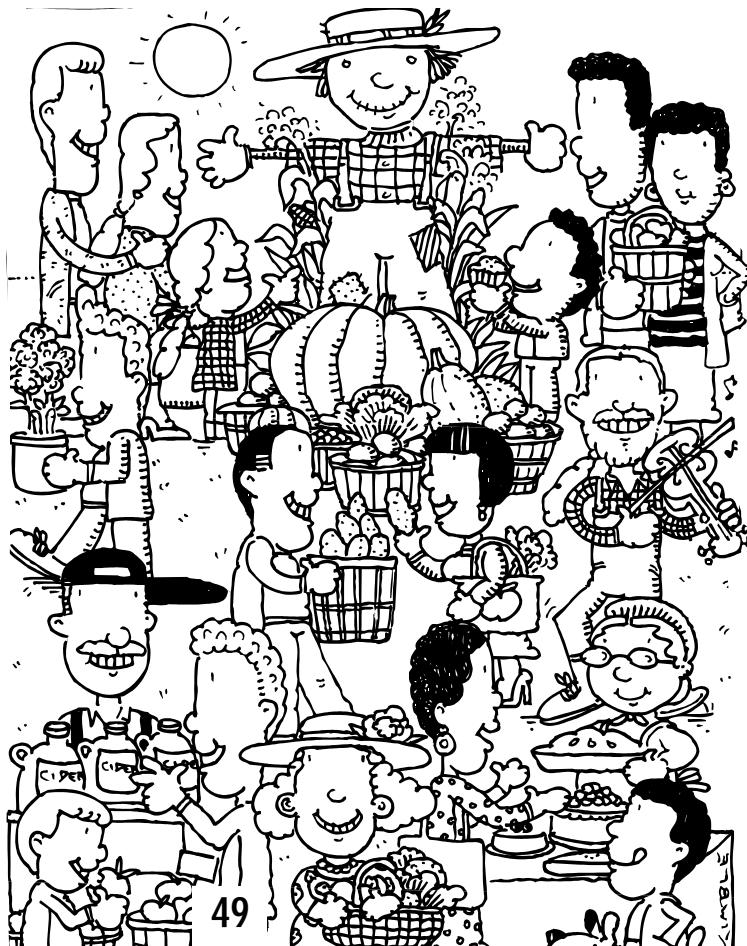


Besides the air we breathe (oxygen), water is the most important element in the human body. An average person can survive over a month without eating; but less than a week without water. The human body is 65 to 70 percent water.

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.

Cooked lean ground beef is 60% water.

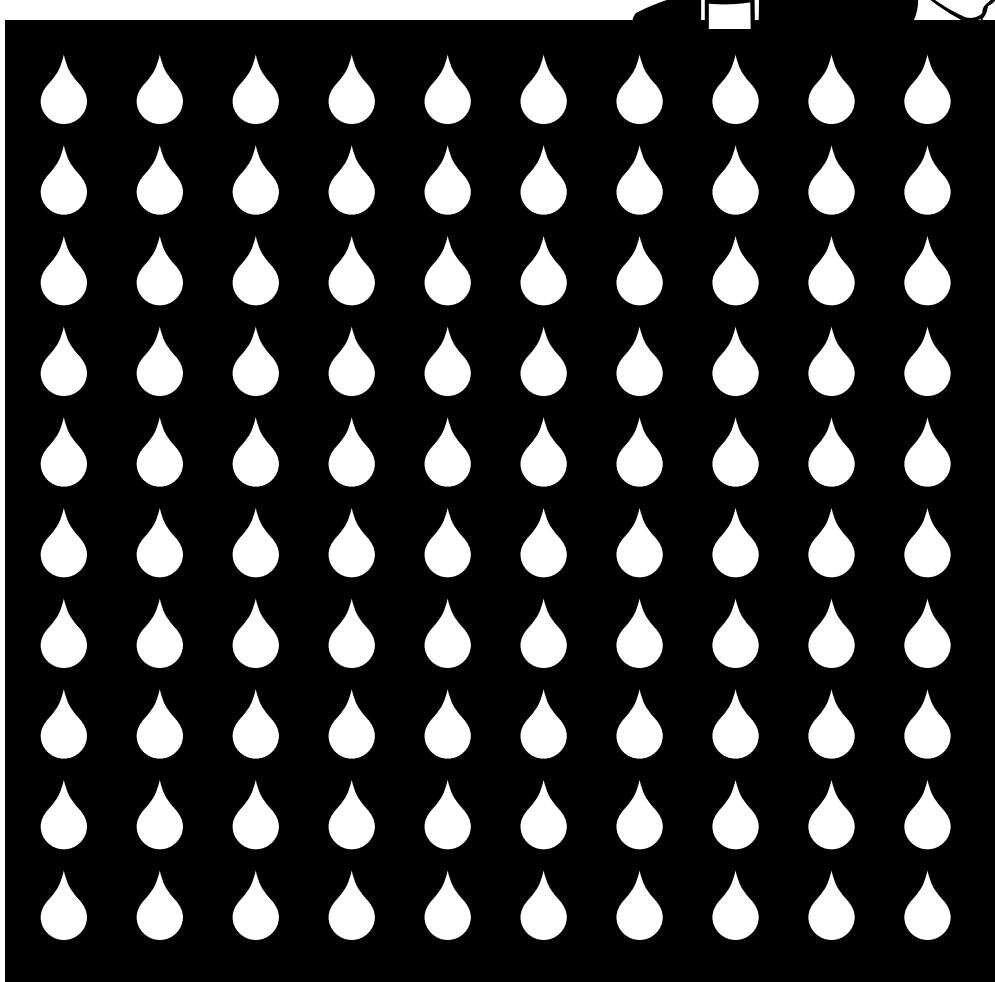
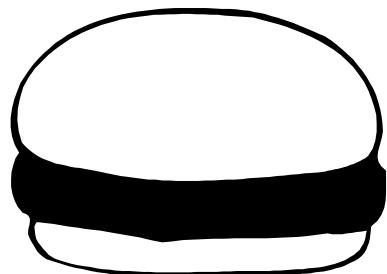
The hamburger bun is 36% water.

Lettuce is 95% water.

A tomato is 94% water.

An onion is 89% water.

To review how percentages work, turn back to page 3.



Start coloring each color from the top left corner. Most of the water drops will have more than one color in them.

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 color? These drops show how much of the hamburger is NOT water.

How many drops have five colors?

How many drops have only one color?

LET'S MAKE A COLLAGE

You will need:

Magazines, scissors, glue, and a piece of large 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.

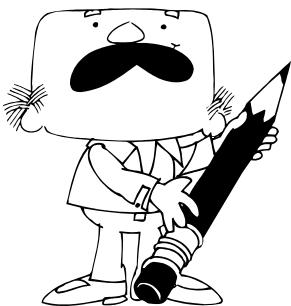
**It is TRUE that
50% is the same as or more than half.**

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% ?



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.

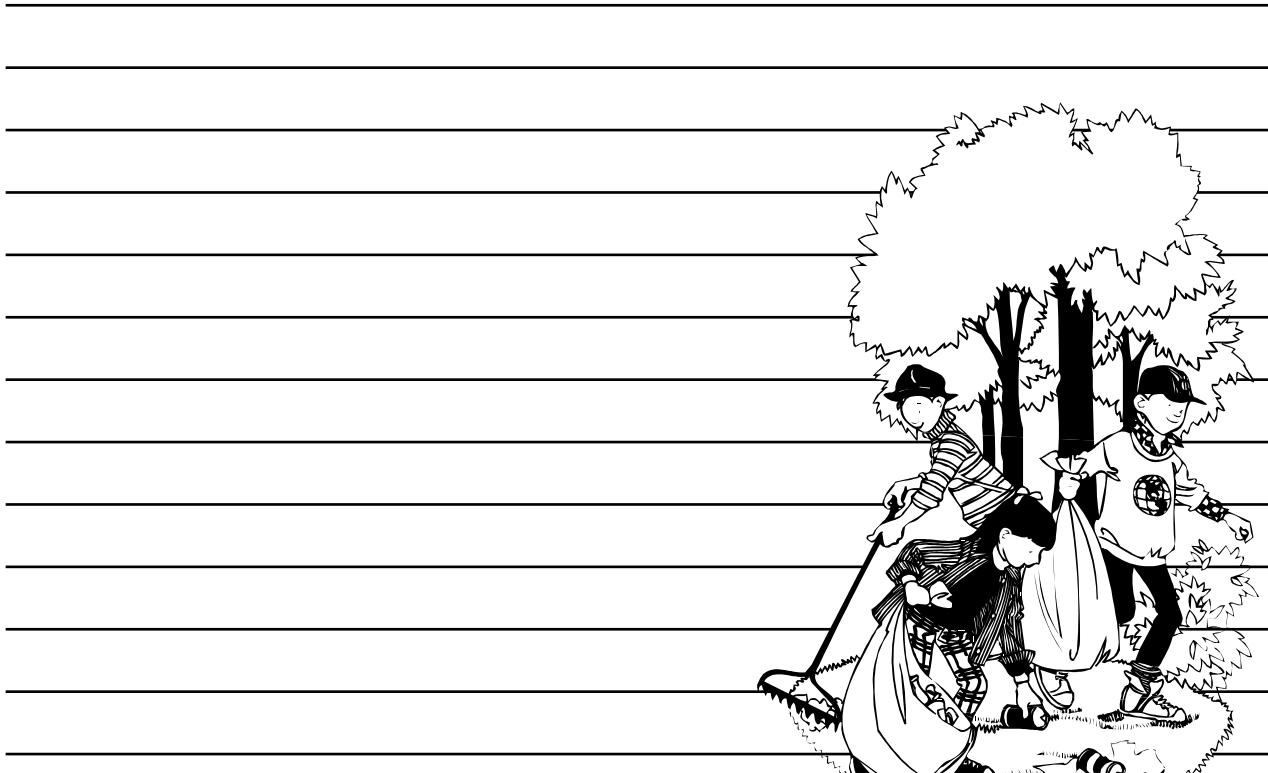
What do you see that has metal or steel parts?

If you named 20 items write your name here

We use water every day. We also use products that need water to grow or be made. The food we eat needs water to grow.

A farmer who lives downstream from you grows tomatoes, onions and lettuce. Pretend you had a salad using tomato, onion and lettuce for lunch. Where did the tomato, onion and lettuce come from? They came from the farmer who lives downstream from you. The farmer uses water you have already used to grow the vegetables. It is important to keep our water clean so the farmer has clean water to use.

Write what you can do to help the farmer get clean water to irrigate the vegetables you will eat for lunch.



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 and more. Lawns, gardens and landscaping are major sources of pollution.



Some things we do to help include:

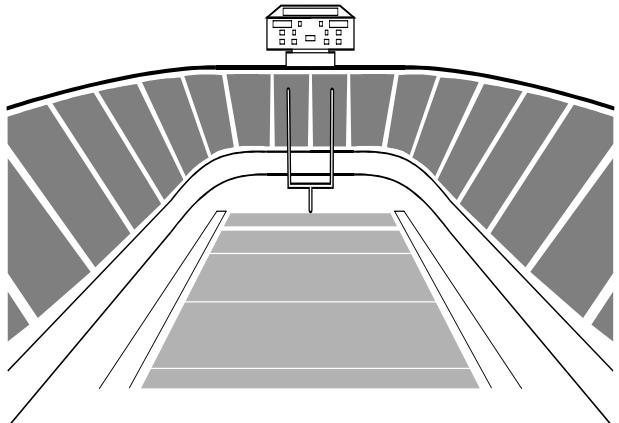
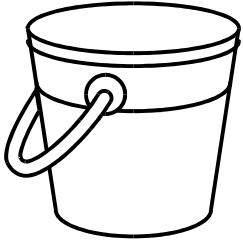
- Put litter and garbage in trash cans.
- Recycle aluminum cans, paper, glass, plastic, styrofoam and metal.
- Landscape with native plants.
- Recycle leaves and lawn clippings by making compost.
- Plant plants that encourage butterflies and birds that keep bug pests away.
- Clean up spilled motor oils.
- 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 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.

I INDOORS

YES NO

Have you checked faucets, toilets and showerheads for leaks?

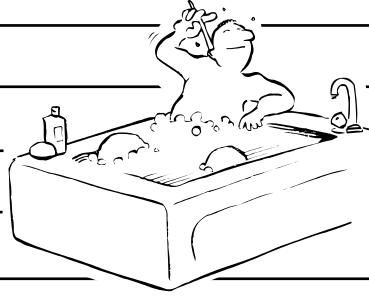
Have you fixed any leaks?

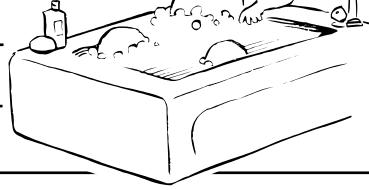
Do you use the toilet as a trash can?

Is your toilet tank 1.6 gallons in size?

If your toilet tank is larger than 1.6 gallons, have you placed a plastic, one-quart bottle with water in the tank to reduce the amount of water used with each flush?

If your toilet tank is larger than 1.6 gallons, have you installed a flush flow control stopper?

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?

Do you put the stopper in the sink and let the water fill up when you're washing your hands?

CONSERVATION

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 (and dog) instead of 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 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, yes, yes, no, yes, yes, yes, yes, no, no, no, yes, yes, yes.
 OUTDOORS: all yes.

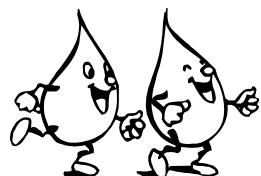
Conserving water means we use less of it. It doesn't mean you quit washing the dishes and it doesn't mean you skip drinking a glass of water. Conserving water means *not wasting* water. Stopping a faucet from leaking, keeping cold water in the refrigerator to drink, turning off the water when you brush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

THINKING
+
CHANGING HABITS
=
CONSERVATION

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.

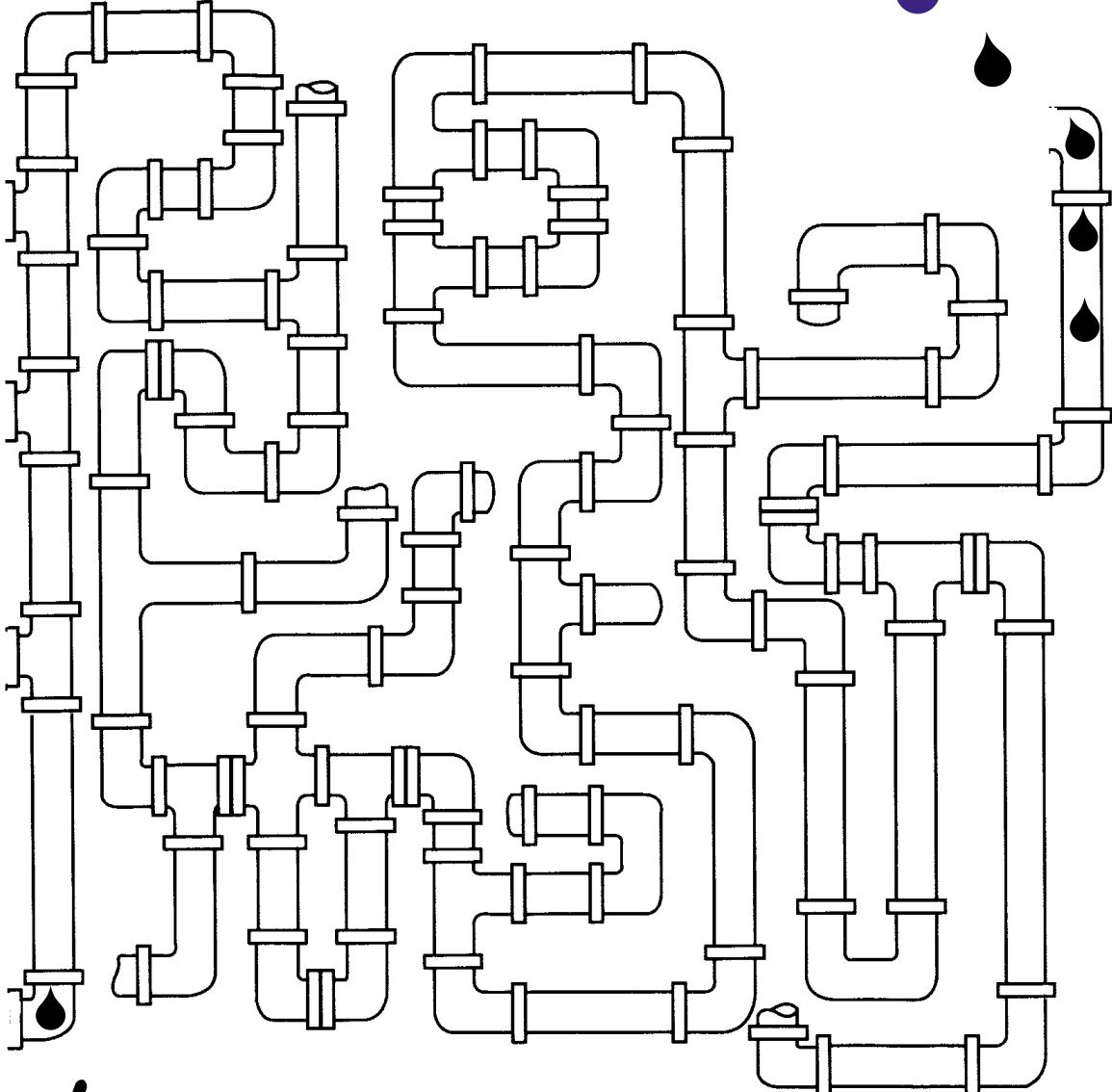
WASTEWATER TREATMENT
PLANTS CLEAN OUR USED WATER.



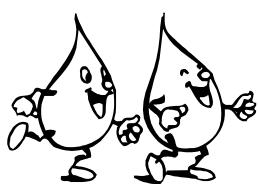
SINKS HAVE DRAINS. THE BATHTUB HAS A DRAIN. THE TOILET HAS A DRAIN. WASHING MACHINES, DISH WASHERS AND SOME REFRIGERATORS HAVE DRAINS. ALL THE DRAIN PIPES IN YOUR HOUSE CARRY WATER INTO A LARGER PIPE THAT IS UNDERGROUND. IT CONNECTS TO YET A LARGER PIPE THAT IS PART OF THE SEWER SYSTEM. THE SEWER SYSTEM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

W A S T E W A T E R

Let's go down the drain... find which way the water flows through the pipes to reach the wastewater treatment plant.



Wastewater Treatment Plant



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 F 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
A
S
T
E
W
A
T
E
R



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 on 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.

DOWNTSTREAM: 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.

GLOSSARY

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: pollution coming from a wide, non-specific source such as car exhaust, street salt, car oils, 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 the 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 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.

Credits

Cover photos: Michael Lewis, Denver, Colorado
 "Water Pipes" page 25: American Water Works Assn.
 Water Treatment page 36: Blue Thumb Club, American Water Works Assn.

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-activities 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 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.

Blue Thumb Club
 American Water Works Association (AWWA)
 6666 W. Quincy Ave.
 Denver, CO 80235
 800-926-7337
 Central Colorado Water Conservancy District
 3209 West 28th Street
 Greeley, CO 80631
 970-330-4540; Fax: 970-330-4546
 Water Wise curriculum

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 Water Utilities
 P.O. Box 580
 Fort Collins, CO 80522
 970-221-6681
 Fax 970-881-6593
Educational materials, videos, speakers, tours of treatment plants

Colorado CattleWomen Education Project
 Colorado Beef Council
 789 Sherman St., Suite 105
 Englewood, CO 80203
 303-830-7892; Fax 303-830-7896
Would You Share Your Water?

Colorado Farm Bureau
 2211 W. 27th Ave.
 Denver, CO 80217
 303-455-4553; Fax 303-964-2430
Educational materials, speakers, displays

Colorado Foundation for Agriculture
 P.O. Box 10
 Livermore, CO 80536
 970-881-2902; Fax: 970-881-2587
 Email: BJB333@aol.com
Colorado Readers including Colorado It's Agricultural, Water and Irrigation, Clean Water and more topics; Activity Books; "A Century of Seasons" CD ROM

Colorado Office of Water Conservation
 1313 Sherman Street, Room 721
 Denver, CO 80203
 303-866-3441
Water Fact sheets, brochures, Colorado Project Wet educational materials

Colorado River Water Conservation District
 P.O. Box 1120
 Glenwood Springs, CO 81602
 303-945-8522; Fax 303-945-8799
Water Terms; Water Cycle

CSU Cooperative Extension materials are available by contacting:
 Bulletin Room
 Colorado State University
 Fort Collins, CO 80523
 970-491-6198

National Assn. of Conservation Districts
 P.O. Box 855
 League City, TX 77574
 713-332-3402; Fax 713-332-5259
 800-825-5547
Educational materials, merchandise (catalog)

National Cattlemen's Association & Beef Board
 P.O. Box 3469
 Englewood, CO 80155
 303-694-0305; Fax 303-694-2851
Educational materials, brochures

Northern Colorado Water Conservancy District
 1250 N. Wilson
 Loveland, CO 80537
 970-667-2437
The Runoff newspaper, tours, speakers and educational material
 On-line info: Colorado Water Knowledge
<http://www.ncwcd.org>

Soil and Water Conservation Society (SWCS)
 7515 N.E. Arkeny Rd.
 Arkeny, Iowa 50021
 800-THESOIL
Water in Your Hands; Ready, Set, Get Wet; Your Hometown Clean Water Tour; The Water Cycle - Nature's Recycling System and other educational materials; catalog available

Terrene Institute
 1717 K Street NW, Suite 801
 Washington, D.C. 20006
 202-833-8317; 202-296-4071
Poster: Healthy Lakes Need Wise Lake and Watershed Management

U.S. Geological Survey
 (Water Resource Education)
 Box 25425
 Denver Federal Center
 Denver, CO 80225
 303-236-7477
Posters, including titles: Water: The Resource That Gets Used & Used & Used for Everything; How Do We Treat Our Wastewater?; Wetlands: Water, Wildlife, Plants & People; Groundwater: The Hidden Resource; Water Quality: Potential Sources of Pollution; Navigation: Traveling the Water Highways; Hazardous Waste: Cleanup and Prevention

Water Information Program
 Southwestern Water Conservation District
 P.O. Box 475
 Durango, CO 81302
 970-247-1302
 Fax 970-259-8423
 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
<http://www.waterinfo.org>



ANSWERS

Page 1

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

Page 2

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

Page 3

$$10 \times 10 = 100$$

Page 4

$$100 - 85 = 15$$

Page 5

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 6

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 7

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 8

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

Page 9

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 11

leaves will **float**

salt will **dissolve**

an anchor will **sink**

Object answers will vary.

Page 12

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 13

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 14

solid

vapor

ice

density

liquid

river

ocean

Page 16

A rainbow.

Page 18

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 19

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 22

Answers will vary depending on location.

Page 24

Down

1. snowpack

2. basin

4. drought

6. reservoir

8. rain

Answers

Page 28

Answers will vary.

Page 29

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 30

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 31

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 32

Stories will vary.

Page 33

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

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

The other state that water flows out of but not into is Colorado.

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

Page 34

Coagulation = coagulate

Sedimentation = **sediment**

Filtration = filtrate

Disinfection = **disinfect**

Storage = store

Page 35

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

Page 36

It is easier to remove larger pieces than small ones.

Page 39

Coagulation; Sedimentation; Filtration; Disinfection; Storage.

Page 40

Answers will vary.

Page 41

All items will be circled.

Page 42

We need clean water to drink.

Page 43

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 44

All items will be circled.

Page 46

Answers will vary.

Page 48

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 50

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 51

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 52

Answers will vary.

Page 53

Answers will vary.

Page 55

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 56 and 57

Answers will vary. See page 57 for answers most likely given by an active water conservationist.

Page 61

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