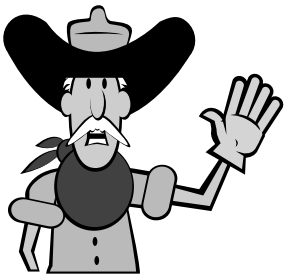
Name _____



PRETEST

MAJOR RIVERS
TEXAS WATER EDUCATION PROGRAM

PART A: The Water Cycle

Directions: Circle the letter of the word that best completes each sentence.

1. Water falls to earth as either rain or snow. This is called _____.
   a) surface runoff b) infiltration (c) precipitation

2. Some water on the ground flows into rivers, lakes, and oceans. This is called _____.
   a) condensation b) evaporation (c) surface runoff

3. Some water soaks into the ground. This is called _____.
   (a) infiltration b) precipitation c) condensation

4. The sun heats water on the ground and changes it into vapor. The vapor rises into the sky. This is called _____.
   (a) evaporation b) precipitation c) infiltration

5. Vapor cools, forms clouds, and changes back into water. This is called _____.
   a) infiltration (b) condensation c) precipitation

PART B: Texas Water Supply

Directions: Circle the letter of the word that best completes each sentence.

6. Most large cities in Texas are in the _____ half of the state where there is more water.
   (a) eastern b) northern c) western

7. The river that supplies Austin, our capital city, is the _____.
   a) Sabine (b) Colorado c) Trinity

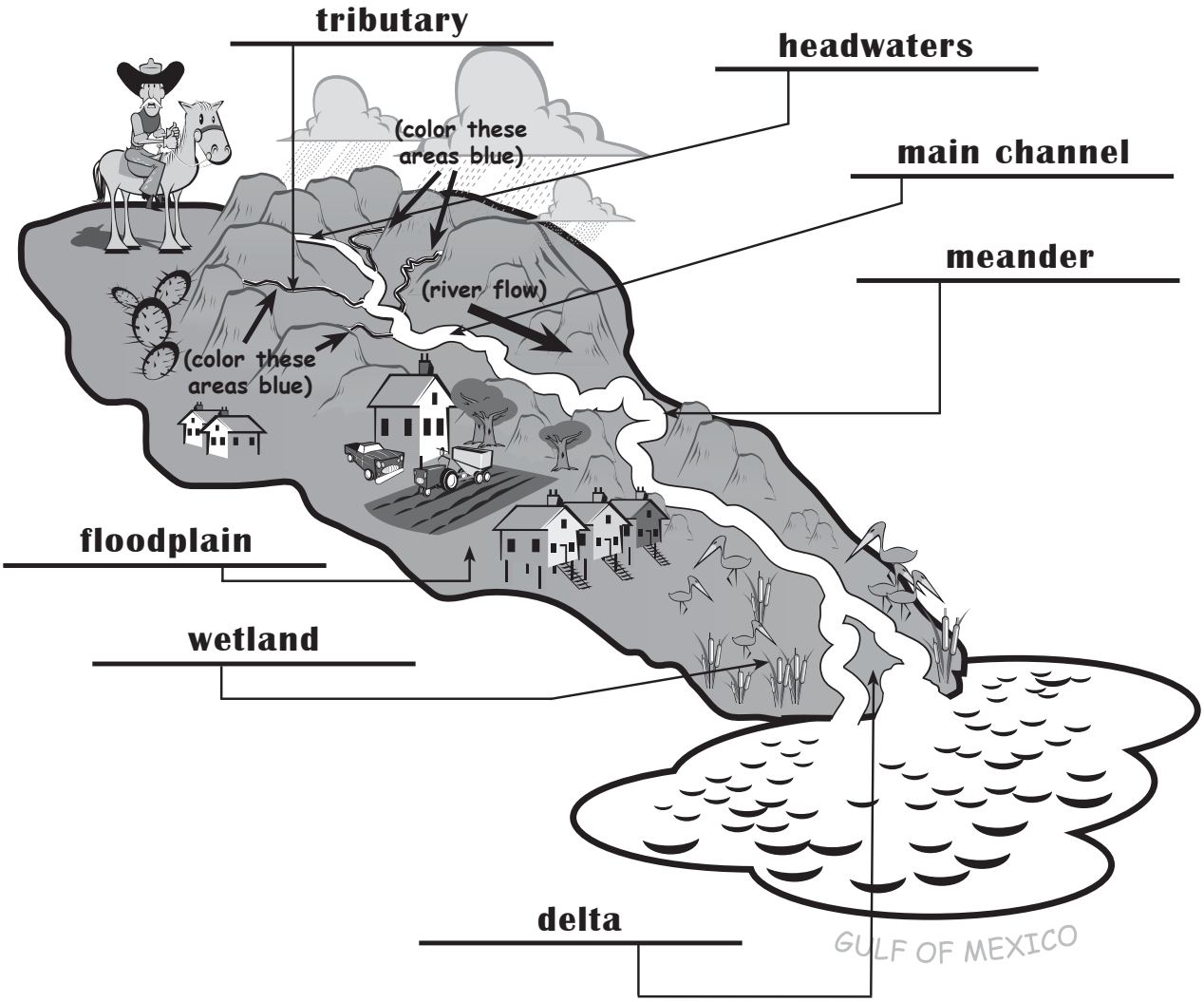
8. An underground layer of gravel, sand, or rocks that is filled with water is called _____.
   a) a reservoir (b) an aquifer c) a lake

9. The river between Texas and Mexico is the _____.
   a) Red b) Brazos (c) Rio Grande

10. More than half of the water used in Texas comes from _____.
    a) the ocean b) rivers (c) aquifers

PART C: What is a Watershed?

Directions: Put the following words in the correct blank to label the watershed: tributary, floodplain, meander, headwaters, wetland, delta, and main channel. Color the tributaries that flow into the main river blue. Place an arrow showing the direction of the river's flow.



PART D: Water Treatment and Distribution

Directions: *Match the words on the left with their definitions on the right. Write the correct letter in the blank space.*

d water treatment plant	a) place where surface water is stored
b wastewater treatment plant	b) place where sewage is cleaned
e recycled water	c) carries water to homes and businesses
c pipeline	d) place where water is cleaned and made safe to drink
a reservoir	e) wastewater that is cleaned and reused

PART E: Using Water Efficiently

Directions: *Look at each group of activities that use water. Place an X next to the activity in each group that uses the most water in a year.*

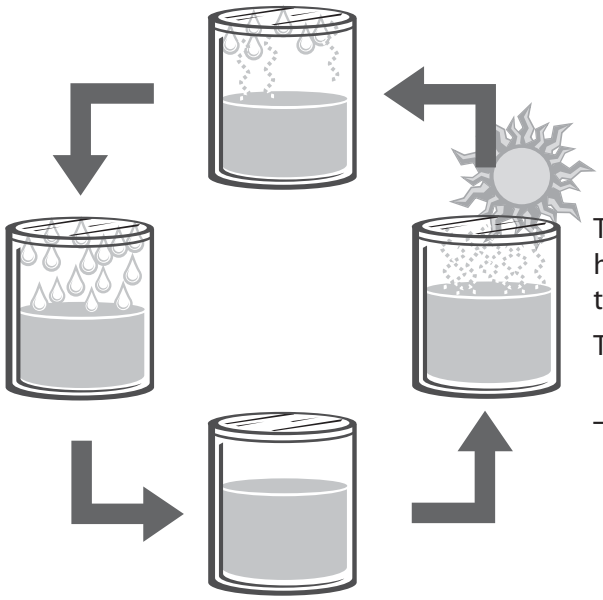
X flushing the toilet	____ using the faucet	____ washing clothes	____ using the faucet
____ washing dishes	**X** watering the lawn	**X** watering the lawn	**X** flushing the toilet
____ drinking water	____ taking a shower	____ drinking water	____ washing the car

EXERCISE 2 ANSWER KEY

Part A

Directions: The picture below is a way of showing the water cycle. Fill in each blank space with the part of the water cycle being described.

The vapor rises, hits the lid of the cup and cools. Liquid water drops form on the lid. This is an example of **condensation**.



The liquid water drops fall from the lid into the cup. This is an example of **precipitation**.

The liquid water is heated by the sun and turns into vapor. This is an example of **evaporation**.

Water Source

Part B

Directions: Circle the letter of the word that best completes each sentence. Next, write the word on the blank line.

1. Water falls to earth as either rain or snow. This is called **precipitation**.
   a.) surface runoff b.) infiltration (c.) c.) precipitation

2. Some water on the ground flows into rivers, lakes and oceans. This is called **surface runoff**.
   a.) condensation b.) evaporation (c.) c.) surface runoff

3. Some water soaks into the ground. This is called **infiltration**.
   (a.) a.) infiltration b.) precipitation c.) condensation

4. Water on the ground gets heated and changes into vapor. The vapor rises into the sky. This is called **evaporation**.
   (a.) a.) evaporation b.) precipitation c.) infiltration

5. Vapor cools, forms clouds, and changes back into water. This is called **condensation**.
   a.) infiltration (b.) b.) condensation c.) precipitation

Questions for Texas Water Supply Review (Part J – page 21):

Singles

1. Which part of Texas is the driest?
   (The west)
2. Where do most of the rivers in Texas empty into?
   (The Gulf of Mexico)
3. Which part of Texas is the wettest?
   (The east)
4. Where does Texas get its water?
   (From rivers and aquifers)
5. What is an aquifer?
   (An area of gravel, sand or rocks underground that contains water)
6. Name one aquifer.
   (Ogallala, Trinity, Carrizo-Wilcox, Edwards, Gulf Coast, Hueco-Mesilla Bolson, Pecos Alluvium, Seymour, or Edwards-Trinity)
7. What is water vapor?
   (Tiny, invisible droplets of water; water in its gas state)
8. What is rain, snow, hail and sleet called?
   (Precipitation)
9. What is water called that flows from the ground into rivers, lakes, and oceans?
   (Surface runoff)
10. What is it called when water soaks into the ground?
    (Infiltration)
11. What is it called when water changes into vapor?
    (Evaporation)
12. What is it called when water vapor changes back into a liquid?
    (Condensation)
13. What is recharge?
    (Water that infiltrates through the soil to be stored in an aquifer)

Doubles

1. What is precipitation?
   (Water that falls to earth as rain, snow, sleet or hail)
2. What is surface runoff?
   (Water on the ground that flows into rivers, lakes, and oceans)
3. What is infiltration?
   (Water soaking into the ground)
4. What is evaporation?
   (Water that gets heated, turns to vapor and rises into the air)
5. What is condensation?
   (Water vapor cools and changes back into liquid water)
6. How much of its water does Texas get from rivers?
   (Almost half)
7. How much of its water does Texas get from aquifers?
   (More than half)
8. Which river supplies water to both Texas and Mexico?
   (Rio Grande)
9. Which river supplies our capital city with water?
   (Colorado)
10. Which river forms a border between Texas and Louisiana?
    (Sabine)
11. Which river forms the Texas-Oklahoma border?
    (Red)
12. Name two aquifers.
    (Ogallala, Trinity, Carrizo-Wilcox, Edwards, Gulf Coast, Hueco-Mesilla Bolson, Pecos Alluvium, Seymour, or Edwards-Trinity)
13. Which river flows across the Panhandle into Oklahoma?
    (Canadian)
14. Which river supplies water to both Texarkana, Texas and Texarkana, Arkansas?
    (Sulphur)
15. Which river contributes water to Lake Houston and Lake Conroe?
    (San Jacinto)
16. What is it called when water infiltrates through soil to be stored in an aquifer?
    (Recharge)

Triples

1. How much rain falls in the east part of Texas?
   (From 30 to 60 inches)
2. How much rain falls in the west part of Texas?
   (From 8 to 30 inches)
3. Which river is the longest in Texas?
   (Rio Grande)
4. Which river means "reddish" in Spanish?
   (Colorado)
5. Which river starts near Santa Fe?
   (Pecos)
6. Which river supplies Corpus Christi?
   (Nueces)
7. Which river has the Blanco and San Marcos rivers as tributaries?
   (Guadalupe)
8. Which river supplies water to Dallas and Fort Worth?
   (Trinity)
9. Which aquifers are made of limestone?
   (Trinity and Edwards)
10. Which aquifer is under the High Plains in the Panhandle?
    (Ogallala)
11. Which aquifer is the farthest south in Texas?
    (Gulf Coast)
12. Which river empties into the Red River near Shreveport?
    (Cypress)
13. Which river supplies Sam Rayburn Reservoir — Texas' second largest lake?
    (Neches)
14. Which rivers empty into Matagorda Bay?
    (Lavaca and Colorado)
15. Which aquifers are made of a mixture of sand, grave, clay, and silt?
    (Ogallala, Hueco-Mesilla Bolson, Seymour and Pecos Alluvium)

To create a round:

- Pick a group of questions from above and write the question from one question and the answer from the previous question. The first card should have the answer to the last question. Do not number the cards. Follow the directions on page 21. Sample cards appear below.

Start Card

Answer: The west

Question: Where do most rivers in Texas empty into?

Answer: The Gulf of Mexico

Question: Which part of Texas is the wettest?

Answer: The east

Question: Which part of Texas is the driest?

EXERCISE 3 ANSWER KEY

Part A

Directions: Circle the letter of the word that best completes each sentence. Next, write the word on the blank line.

1. An underground layer of gravel, sand or rocks that is filled with water is called **an aquifer**.
   a.) a reservoir (b.) an aquifer c.) a lake

2. The area of Texas that receives the most rain is the **east**.
   (a.) east b.) north c.) west

3. Almost **one-half** of the water we use in Texas comes from rivers.
   (a.) one-half b.) none c.) all

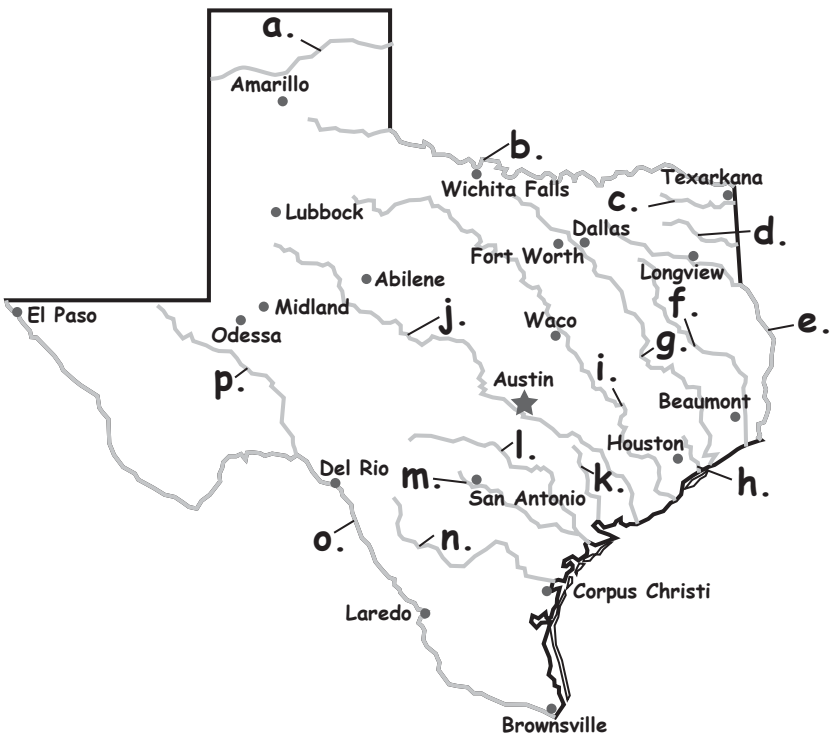
4. The river that supplies Austin, our capital city, is the **Colorado**.
   a.) Rio Grande (b.) Colorado c.) Trinity

5. The rivers in Texas all flow to the southeast and empty into the **Gulf of Mexico**.
   a.) Matagorda Bay (b.) Gulf of Mexico c.) Yucatan Peninsula

6. **Water planning** is the process that community leaders use to prepare for future water needs.
   a.) Building dams b.) Bottling water (c.) Water planning

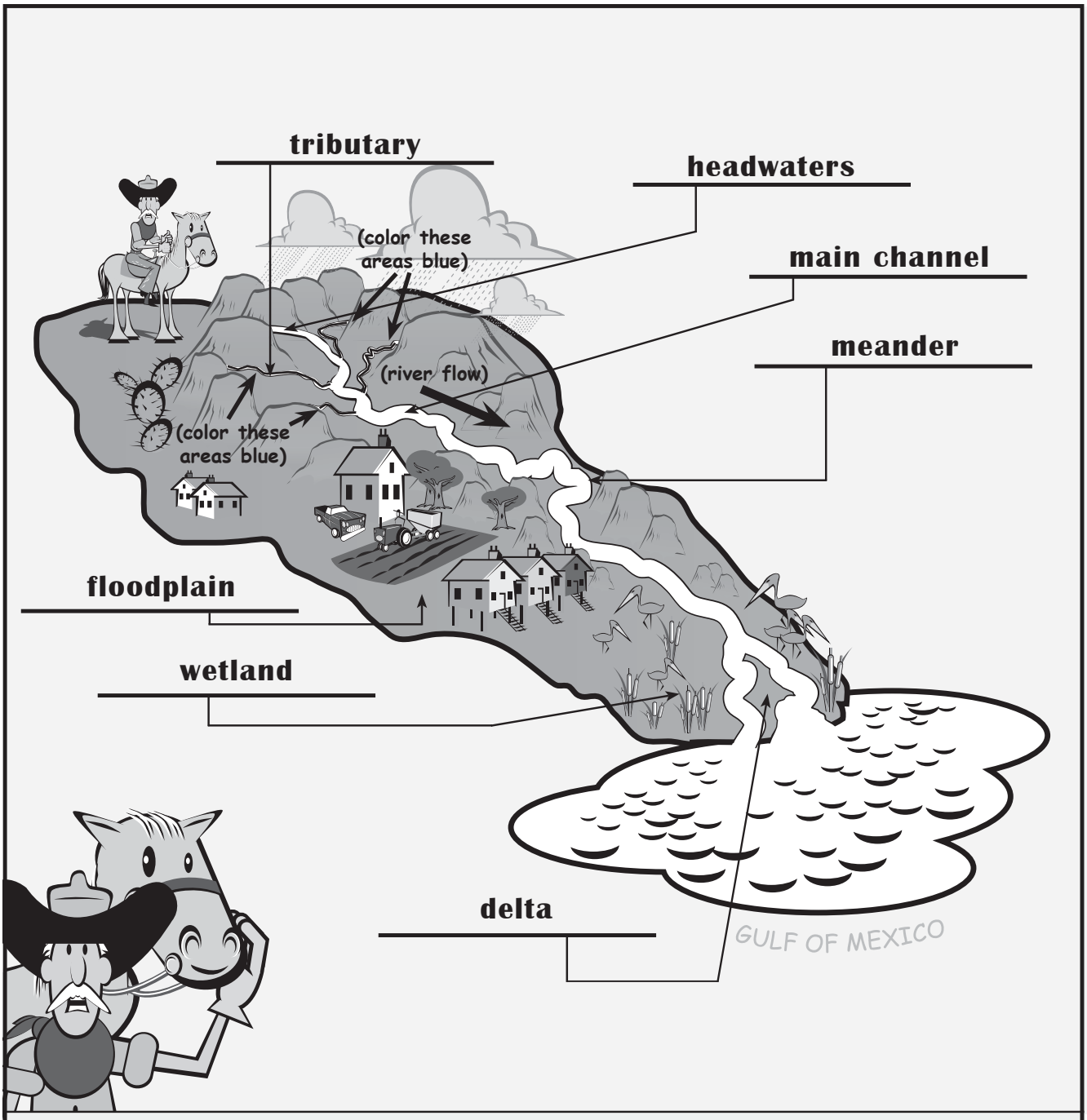
Part B

Directions: Next to the name of each river, write its letter shown on the map. Try not to look back at pages 6 and 7. The first one has been done for you.



i 1. Brazos River
a 2. Canadian River
j 3. Colorado River
d 4. Cypress River
l 5. Guadalupe River
k 6. Lavaca River
f 7. Neches River
n 8. Nueces River
p 9. Pecos River
b 10. Red River
o 11. Rio Grande
e 12. Sabine River
m 13. San Antonio River
h 14. San Jacinto River
c 15. Sulphur River
g 16. Trinity River

EXERCISE 4 ANSWER KEY



Directions:

1. Put the following words in the correct blank to label the watershed: tributary, floodplain, meander, headwaters, wetland, delta, and main channel.

2. Color the tributaries that flow into the main river blue.

3. Place an arrow showing the direction of the river's flow.

Message:
Water is used for a variety of purposes: in homes, businesses, industry, agriculture, recreation and the generation of electricity. In fact, just about anything we do eventually involves some water use. Some of the ways we use water can have an adverse effect on our environment.

Objectives:
Students will identify various uses of water, including municipal, agricultural, industrial, recreational, and electrical generation.

Students will differentiate between point-source and nonpoint-source pollution.

Students will recognize that most water pollution is caused by human activity within the watershed.

Time Requirements:
Three class periods

Materials:
- Student Workbook
- Thermometers
- Optional:
  - Scheduled time in computer lab or classroom
  - Computer with Internet access and TV connection/LCD or computer projector

For Frankie the Fish Activity:
- Frankie the Fish Data and Observation Sheet (enough copies for each student)
- Aquarium (optional)
- Three-liter soda bottles with top cut off
- Black permanent marker
- Graduated cylinder and measuring spoons
- Pitchers with water
- String • Water • White poker chips
- Yellow sponges • Washers • Hot-glue gun
- Ruler • Soil • Brown sugar
- Molasses • Detergent • Shredded paper
- Scissors • Red & yellow food coloring

Procedures:

A. Introduce water uses.
- Introduce vocabulary: agricultural, electricity, industrial, municipal, nonpoint-source pollution, point-source pollution, recreational, and turbidity. Definitions are included with the resources at the end of this lesson.
- Ask students to think about the many ways we use water. Provide the following categories on the board, and divide the students into groups to brainstorm and list how these various activities use water.
  1. Municipal activities
  2. Agricultural activities
  3. Recreational activities
  4. Industrial activities
  5. Generation of electricity

B. Students read from workbook: How Our Water Use Affects Our World, page 11. (See page 46 of Teacher's Guide.)
- Have students turn to page 11 in their workbooks. Call on individual students to take turns reading text aloud. Use the following questions to generate a discussion.

Municipal

1. What is municipal water?
   (Water that cities and towns treat and provide to their citizens.)
2. What are some of the ways we use municipal water?
   (For drinking water, water for homes, and for businesses.)
3. Where does this school get its water?
   (Teacher will have to research; answers will vary.)
4. What is the source of students' water at home?
   (Answers will vary.)
5. What home water use activities do you think use the largest amounts of water?
   (Bathing, watering the lawn, flushing the toilet, etc. — this is a preview to Lesson 7.)

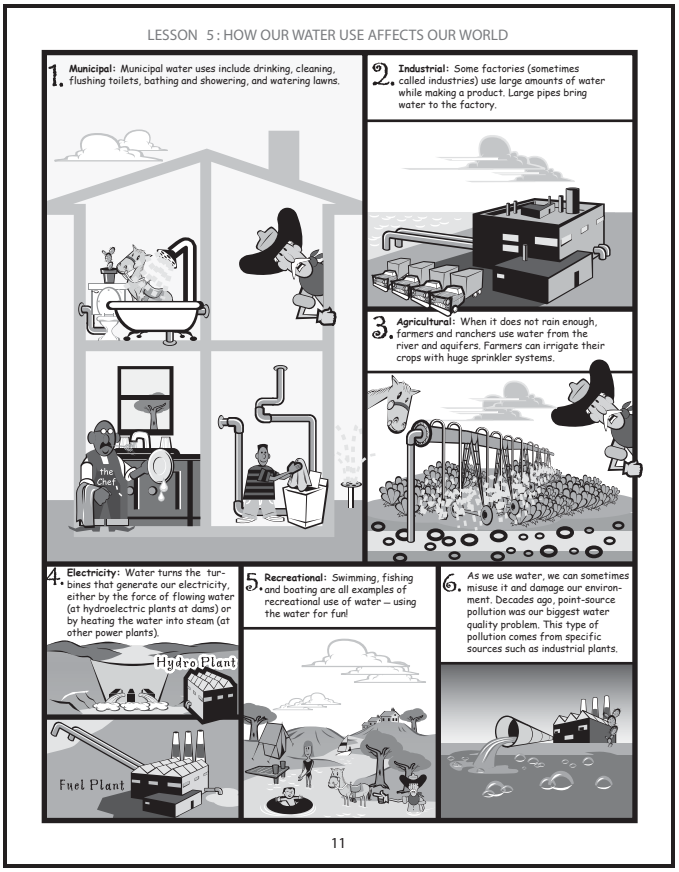
Industrial

1. How do industries use water?
   (For the production of goods, or for cooling equipment.)
2. Where is the most industrial use in Texas, east or west? Why do you think this is so?
   (Generally, in the east. Answers will vary as to why, but there are more industries where more water is available for them to use.)

3. What are some of the industries in your community?
   (Answers will vary.)
4. Are industries important to your community? Do you have family or friends who work for industries?
   (Answers will vary.)
5. Do industries have to pay more for water? Do you think they use water wisely?
   (Answers will vary.)

Agricultural

1. What are a few examples of agricultural uses of water?
   (Farming and raising livestock.)
2. Where are the most farms in Texas?
   (The east and the north.)
3. Where are the most ranches in Texas?
   (The west and the south.)
4. What is irrigation?
   (The application of water to grow crops or maintain landscapes.)
5. What crops are grown in Texas?
   (*Cotton, corn, wheat, vegetables, and many more.)*



6. In what part of Texas are most of the vegetables and fruits grown?
   (South and Central Texas)
7. Where in Texas do you think most rice is grown?
   (Along the Gulf coastal plains and marshlands — near the coast.)
8. Where in Texas do you think cotton is grown?
   (Mostly in the Panhandle, but also near the coast.)
9. Why do ranchers need water?
   (Cattle and other livestock need water to survive.)

Electricity

1. How is water used to generate electricity?
   (The force of the water that is held behind the dams is used to turn giant turbines that generate electricity.)
2. Do you think this uses much water?
   (Electricity is generated through the motion of water. It does not actually consume water.)
3. Where are most hydroelectric plants in Texas, east or west?
   (The east)
4. Where does the school's electricity come from?
   (Most of our electricity comes from power plants that use coal or natural gas as fuel, although a small percentage comes from plants that use renewable energy such as water or wind.)
5. What is the difference between hydroelectricity and electricity generated by burning coal and natural gas?
   (Hydroelectricity is the production of electricity using water that is already moving downstream — in other words, it is a clean use of a resource that already exists in a particular location. When an electric power company burns coal or natural gas to generate electricity, it must transport the fuel from somewhere else.)
6. What does water have to do with the use of electricity?
   (When water is used, electricity is used. When we practice water conservation, we are also helping the environment through energy conservation — for example, your water heater.)

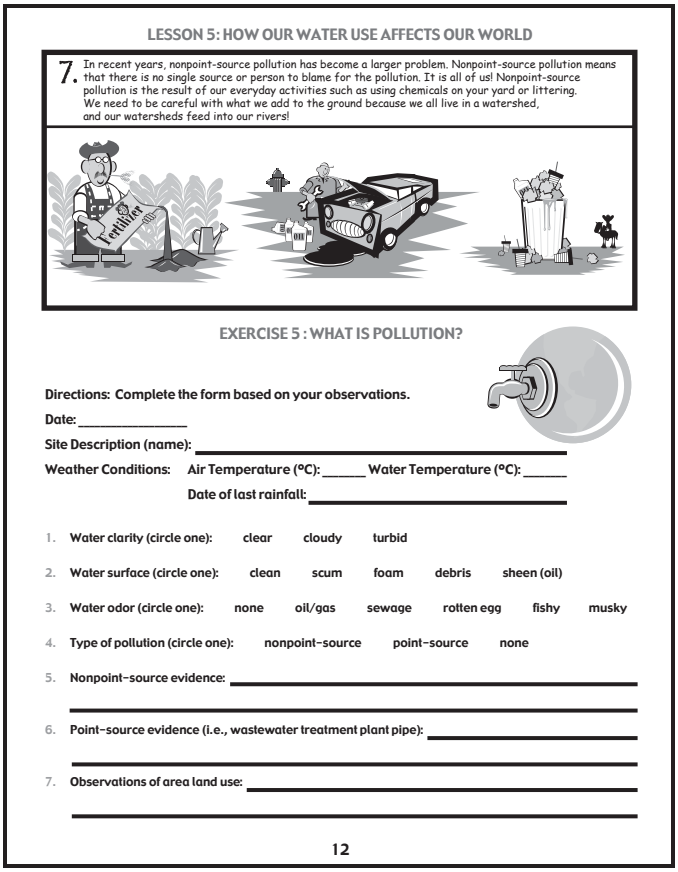
Recreational

1. What do we call it when we are using water for fun?
   (Recreation)
2. How does your family use water for fun?
   (Answers will vary — swimming, fishing, boating, etc.)
3. Where are most water recreation areas in Texas, east or west?
   (The east)
4. Is recreation an important use of water?
   (Answers will vary, an opinion question.)

- Following the discussion, instruct the groups to go back to their lists and see if there is anything they may have left off. Save these lists for students to use later in the lesson.

C. Read in Student Workbook: How Our Water Use Affects Our World, pages 11-12.

- Define and discuss point-source pollution and nonpoint-source pollution.



LESSON 5: HOW OUR WATER USE AFFECTS OUR WORLD

7. In recent years, nonpoint-source pollution has become a larger problem. Nonpoint-source pollution means that there is no single source or person to blame for the pollution. It is all of us! Nonpoint-source pollution is the result of our everyday activities such as using chemicals on your yard or littering. We need to be careful with what we add to the ground because we all live in a watershed, and our watersheds feed into our rivers!

EXERCISE 5 : WHAT IS POLLUTION?

Directions: Complete the form based on your observations.

Date: _____

Site Description (name): _____

Weather Conditions: Air Temperature (°C): _____ Water Temperature (°C): _____

Date of last rainfall: _____

1. Water clarity (circle one): clear cloudy turbid
2. Water surface (circle one): clean scum foam debris sheen (oil)
3. Water odor (circle one): none oil/gas sewage rotten egg fishy musky
4. Type of pollution (circle one): nonpoint-source point-source none
5. Nonpoint-source evidence: _____
6. Point-source evidence (i.e., wastewater treatment plant pipe): _____
7. Observations of area land use: _____

12

- Point-source pollution can be traced to a single point, such as a pipe. Example: an industrial plant pumping waste into a river, or an inefficient wastewater treatment plant discharging its waste into the river. Point-source pollution is less common these days, because there are restrictions and severe fines for these incidents.
- Nonpoint-source pollution cannot be traced to a single point, because it comes from many places or a widespread area. Examples include agricultural runoff and urban runoff from streets, yards, parking lots, etc. Nonpoint-source pollution is the direct result of our everyday land use activities.
- Discuss how our land use activities can result in nonpoint-source pollution.

1. How can our activities in our yards contribute to nonpoint-source pollution?
   (People put fertilizer on their lawns to help them grow faster and greener, and they put pesticides on their lawns to kill insects.)
2. How do our streets, driveways and parking lots contribute to nonpoint-source pollution?
   (Oil and gas can drip from cars and accumulate on the ground surface; it will be caught up in the runoff and make its way into the watershed after a rain.)
3. What are some other ways that people contribute to nonpoint-source pollution?
   (By improperly disposing of household hazardous wastes, dumping oil and gas on the ground.)
4. Can new development add to our nonpoint-source pollution?
   (It could — sediment from the construction site could erode into the river.)
5. Do agricultural activities sometimes contribute to nonpoint-source pollution?
   (Perhaps — sediment after plowing, fertilizers, pesticides, and insecticides can get washed into our waterways as well as nutrients from animal waste.)

D. Student investigation: Differentiate between point-source and nonpoint-source pollution

- Give small groups of students copies of Frankie the Fish story and observation sheet (see page 50). Students will read aloud the story about Frankie the Fish and complete each step of the activity by following the instructions in the brackets beneath

Message:
Many organizations exist to provide water efficiently and safely to residents. Local communities and neighborhoods have their own utilities that provide water to homes and schools. Water must be treated before and after we use it to remove pollution. Water should be safe for us to use and not harm the environment once it leaves our homes.

Objective:
Students will identify the steps and processes of the water distribution system in Texas — wells and reservoirs, pipelines, water and wastewater treatment plants, septic systems, and recycled water.

Time Requirements:
Three class periods

Materials:
- Student Workbook
- Water Treatment and Distribution handout
- Optional:
  - Scheduled time in computer lab or classroom
  - Computer with Internet access and TV connection/LCD or computer projector

For Water Treatment Lab:
- Water Treatment Laboratory Worksheet (enough copies for each student)

Below is enough for four groups. ***[Note: you will need at least 16 of the 20-ounce soda bottles and at least 12 small plastic cups.]***

Plan ahead a couple of weeks and ask students to bring these materials in from home:

- 4 small (four-ounce) plastic cups (such as an applesauce cup) containing 15 mL (one tablespoon) alum (Buy it at any grocery store.)
- 4 two-liter soda bottles containing 750 mL (24 ounces or three cups) water mixed with 230 mL (eight ounces or one cup) of garden dirt (Label these: "Source Water" or "Surface Water.") ***[Note: Mix water to soil in a 3:1 ratio.]***
- 4 clean two-liter soda bottles, cut in half without tops, labeled "Aeration"
- 4 clean two-liter clear soda bottles, cut in half without tops, labeled "Coagulation"
- 4 clean two-liter soda bottles, cut in half with tops labeled "Filtration" (see diagram on page 58)
- 4 rubber bands
- 4 stirring sticks
- 4 small pieces of old stockings or cheesecloth
- 4 eight-ounce plastic cups filled with gravel
- 4 eight-ounce plastic cups filled with sand
- 4 metric rulers
- 4 graduated cylinders or measuring spoons
- 4 stop watches or watches with a second hand

Procedures:

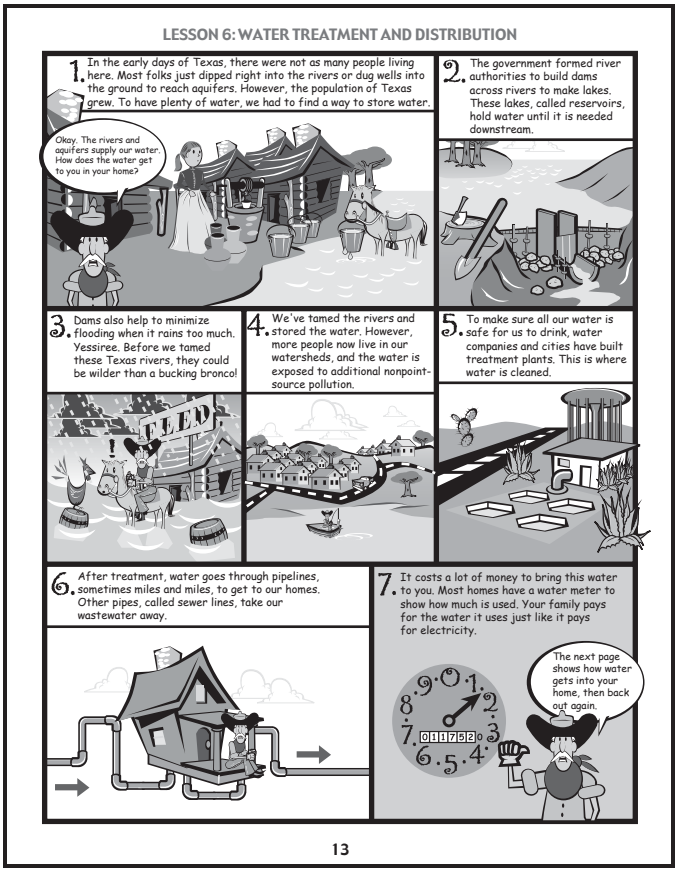
A. Introduce vocabulary and review words from previous lessons that will aid in the student's understanding of water treatment and distribution.
- New words: aeration, coagulation, disinfection, filtration, irrigate, pipelines, recycled water, sedimentation, septic system, sewage, water treatment plant, wastewater, and water meter.
- Review words: groundwater, reservoir, surface water, and water well.

Definitions are included with the resources at the end of this lesson.

B. Students read about and discuss Water Treatment and Distribution. (See page 56 of Teacher's Guide.)
- Instruct students to open their workbooks to page 13, Water Treatment and Distribution. Call on individual students to take turns reading the text.
- Use the following questions to discuss the reading:

1. How did people get water in early days? *(They used buckets to get water out of the rivers or they dug wells into the ground.)*
2. How did the method of getting water then make life different than it is now? *(There were no pipelines or indoor plumbing to carry water to homes or move water within those homes. Water was also not treated or cleaned in any way before it was used, therefore diseases could be spread quickly by contaminated [dirty] water.)*
3. River authorities and water districts were created to help get water to the people. What did they do? *(They built dams to store water in reservoirs, and they built pipelines and canals to carry water to the people.)*

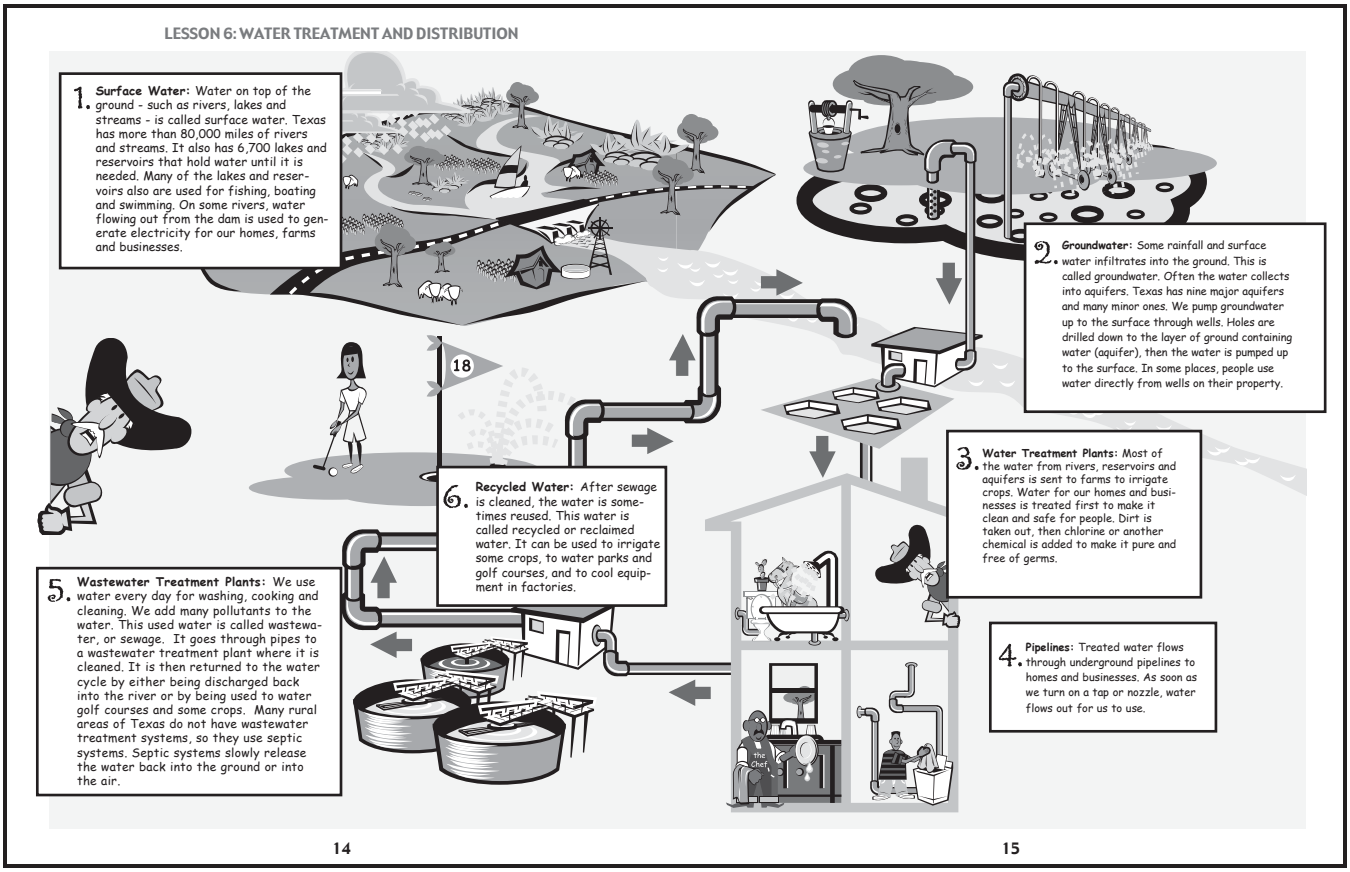
4. Dams also hold water back to help keep rivers from flooding. Why is it important to prevent rivers from flooding?
   (Floods can cause a lot of damage to homes and crops. They can kill people and animals.)
5. Why is water treated before it goes into our homes?
   (Water is treated to remove any pollutants — dirt, toxins and bacteria — that might have gotten into the water.)
6. How does water get from its source to your home?
   (Water travels through pipelines from either a water treatment plant or a well.)
7. Is the water that comes out of our faucets "free"?
   (No. It costs money to clean the water and get the water to us, so we must pay for the water we use.)
8. How do we know what to pay for our water?
   (Most homes have a water meter to keep track of how much is used. Someone reads the meter, then the water agency or company sends a bill for the water used.)



C. Use diagram to discuss the process of water treatment and distribution.

- Instruct students to turn to pages 14 and 15 in their workbooks.
- Have students take turns reading aloud about each step in the distribution of water.
- Use the following questions to discuss the treatment and distribution of water.

1. Where do we store water until we need it? *(Water is stored in reservoirs or large water tanks.)*
2. What else are reservoirs used for? *(Reservoirs are used for fishing, boating and swimming.)*
3. How do we get water out of an aquifer? *(Water from an aquifer is pumped from wells, which are like straws drilled into the ground.)*
4. Most of the water we get from water utilities goes to a water treatment plant. Why? *(To remove dirt and pollutants from the water and make it safe for people to use.)*
5. What happens to water at a water treatment plant? *(Dirt and pollution are taken out and chlorine or another chemical is added to make it pure and free of germs.)*
6. Does all water go to a water treatment plant? *(No. Some water goes directly from the rivers and aquifers to farms to irrigate crops. Also, in some places, people get water directly from wells on their property.)*
7. How does water get to our homes from a water treatment plant? *(Water flows through underground pipelines into our homes and businesses.)*
8. What happens to water after we're finished with it and it goes down the drain? *(The wastewater either goes into a septic system on our property, where it is slowly released back into the ground or air; or it goes to a wastewater treatment plant. At a wastewater treatment plant, the water is cleaned and then pumped into the ground or into rivers and lakes.)*
9. What is another name for wastewater? *(Sewage)*



10. What is recycled water?
    (Recycled water is wastewater that has been cleaned enough to be used again. It is used to water parks and golf courses, to cool equipment in factories, and to water some crops and landscapes. In some cases, recycled water is not suitable for human consumption.)

D. Water Treatment and Distribution handout.

- Use this handout to show students how water is supplied and distributed in Texas.
- Point out and discuss each step water must take as it makes its way through the path to get to our homes.
- Review vocabulary if needed.
- Review the rivers and aquifers on the map of Texas.
- Allow students to put their city on the map if it is not already labeled.

How to build a filter from a two-liter bottle

For use in creating materials for Activity E.

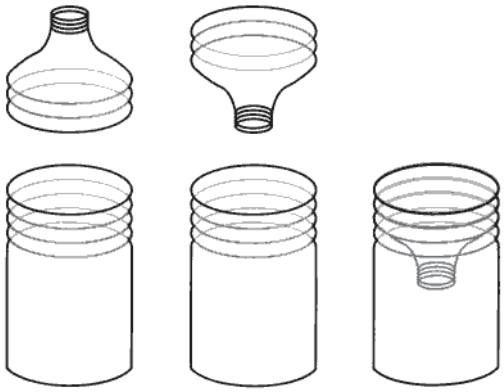


diagram courtesy of the City of Austin

E. Student laboratory activity: Water Treatment

- In groups, students will investigate the water treatment process, using dirt mixed in with water as their source (surface) water. Have the listed materials ready for each group of students. You also may want to write the following steps on the board for groups to copy and use to record their observations:

  1. Describe the "source water" or "surface water" your group has been provided for the lab.
  2. **Aeration**: Describe any changes you observe after you have aerated the water.
  3. **Coagulation**: Describe any changes after you added the alum.
  4. **Sedimentation**: Record the centimeters depth of sedimentation and describe observations of the water at intervals of zero, three, six, nine, and 12 minutes.
  5. **Filtration**: After you have completed the treatment process by filtering the water, compare the treated water to the untreated water ("source water" or "surface water" — the water you started with). Record your observations.

EXERCISE 6 ANSWER KEY

Part A

Directions: Read each item. Fill in the blank spaces with the words listed below.

- surface water
- water treatment plants
- pipelines
- reservoirs
- wastewater treatment plants
- groundwater
- recycled water

1. Dirt and germs are removed from water at **water treatment plants**.
2. Water is delivered to homes through **pipelines**.
3. Large amounts of surface water are stored in **reservoirs**.
4. Sewage is cleaned at **wastewater treatment plants**.
5. Cleaned wastewater that is used to water grass and some crops is called **recycled water**.
6. Water we pump out of aquifers is called **groundwater**.
7. Water from rivers, reservoirs and lakes is called **surface water**.

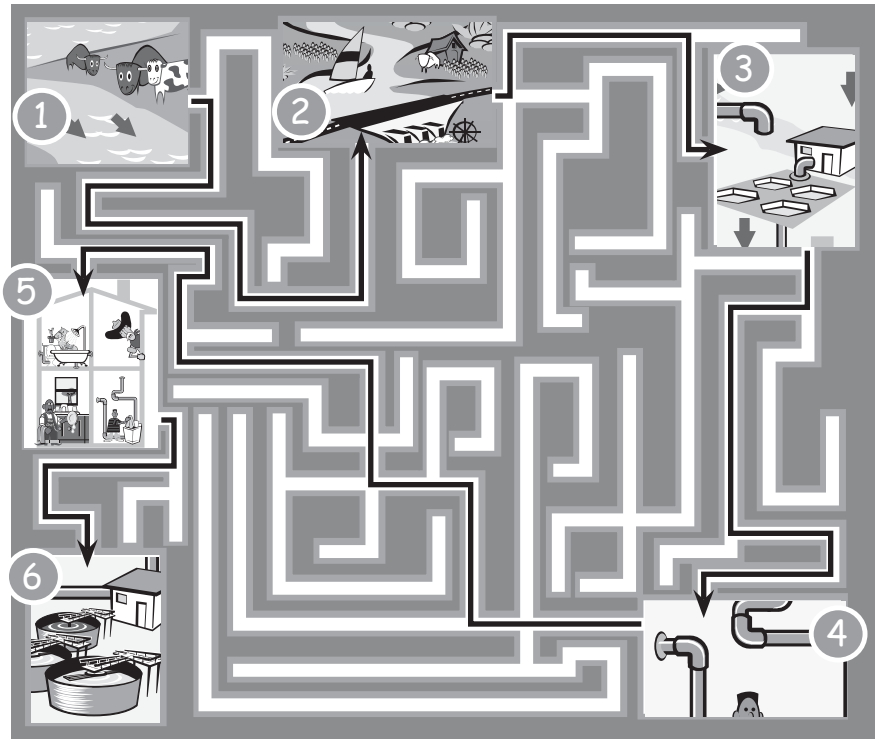
Part B

Directions: Trace Major Rivers and Aquifer through the maze. Stop at each water distribution point and unscramble the words to show where Major Rivers is.

ecafrus wraet
1. **surface water**

rrreesiov
2. **reservoir**

tawre ttrnaetme tnalp
3. **water treatment plant**



mohe
5. **home**

etsawretaw rtntaetme pntla
6. **wastewater treatment plant**

epipsenil
4. **pipelines**

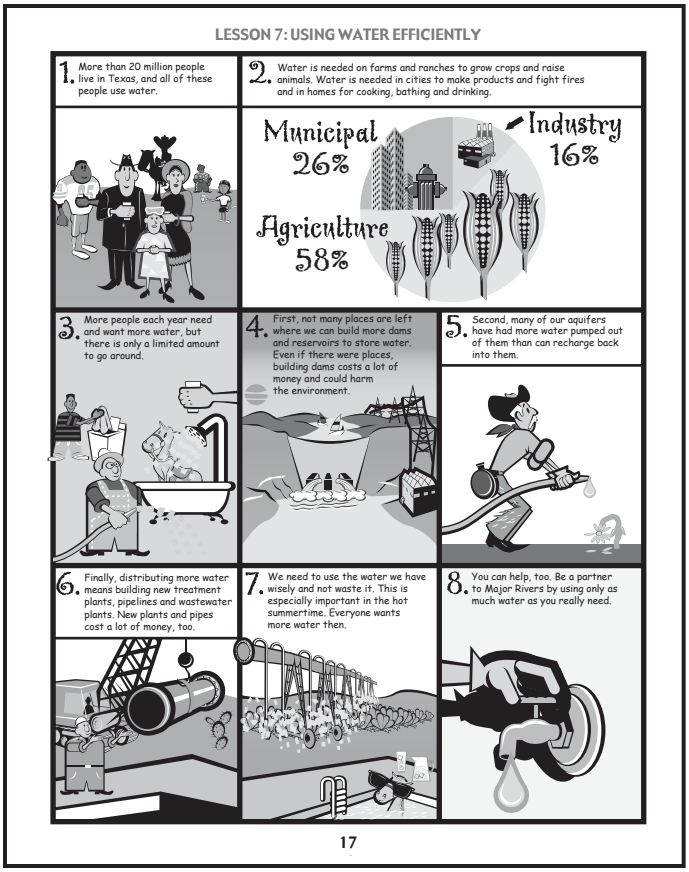
Message:
A growing population has produced a growing demand for water, yet we have a limited amount of water. Therefore, we need to use it as wisely and efficiently as possible.

Objective:
Students will review which home water activities use the most water, identify water conservation practices, and assess their individual water conservation practices.

Time Requirements:
Three class periods

Materials:
- Student Workbook
- Three-inch by three-inch pieces of blue, yellow and red paper for each student
- Major Rivers Home Information Leaflet

For Lawn Watering Laboratory:
- Stopwatches (enough for every group of three students to have one)
- Lawn sprinkler and hose



[Note: Use a spray-type sprinkler with a high precipitation rate (volume per minute) that covers at least a 10-foot by 10-foot square area. Rotating and oscillating sprinklers tend to have lower precipitation rates.]
- Large graduated cylinders
- Small, medium and large-sized flat-bottomed straight-sided containers (small 4 x 4-inch plastic container, 8 x 8-inch foil baking pan, and 9 x 13-inch baking pan)
- Ruler to measure inches and centimeters
- Student worksheets
- Blank sheet of paper
- Pencils, pens
- Masking tape
- Clipboard (one per group)

For Don't Be Clueless Investigation:
- Student worksheet for Don't Be Clueless investigation (page 75 & 76 of this Teacher's Guide)
- Compasses
- Metric rulers/measuring tapes
- Red markers

Procedures:

A. Introduce vocabulary that will aid in the student's understanding of using water efficiently: conserve, conservation, efficient, native plant, naturalized, or adapted plant. Definitions are included with the resources at the end of this lesson.

B. Students will read and discuss Using Water Efficiently.
- Have students turn to page 17 in Student Workbook. Call on individual students to take turns reading the text aloud.
- Use the following questions to generate a discussion of water use. Possible student answers are shown in parentheses.

1. The pie graph shows that water is used in agriculture, municipalities and industry. What are some examples of how water is used in each of these areas?
*(**Agriculture** — Water is used to irrigate crops and for animals to drink. **Municipal** — Water is used for drinking, washing clothes, cooking, bathing, watering lawns, washing*

cars, washing dishes, and brushing teeth. Water is used at schools, in restaurants, in hospitals, for street cleaning, in swimming pools and golf courses, and in car washes. ***Industry*** *— Water is used in industries and manufacturing to cool machinery, produce food, manufacture products and refine oil and gas.)*

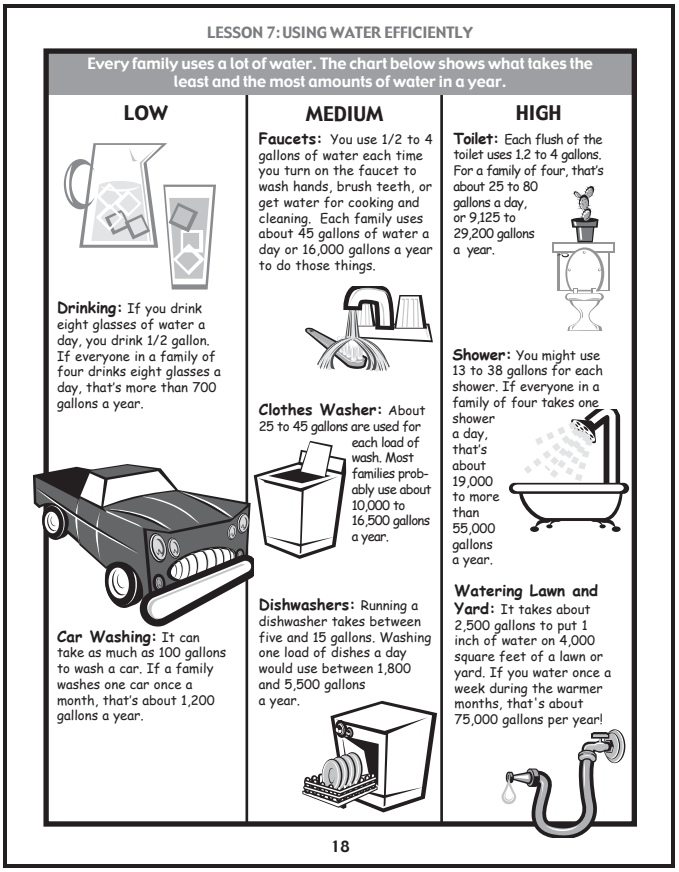
2. Why do we need to conserve water?
   (There is only a limited amount of water, and more and more people every year want and need water.)
3. Why can't we just build more dams and reservoirs to get more water?
   (Not many places are left where we can build more dams and reservoirs. Building dams also costs money and could harm the environment. Reservoirs just store water; they will not create more water.)
4. Why can't we just use more groundwater?
   (We often use more water from aquifers than infiltrates back into the aquifers, so we could eventually run out of groundwater.)
5. Why must we be especially careful using water in the summertime?
   (In the summer when it is hot, people use more water. It takes more water to fill pools and to water lawns and yards. We even drink more water.)

C. Have students make lists of typical household water uses.

- Make a list on the chalkboard of all the uses students can think of.
- Divide students into groups. Ask groups to categorize the water uses as to what are high uses of water in a year's time, medium uses and low uses.
- Have students turn to page 18 in their workbook, Using Water Efficiently.
- Explain to students that this page shows what uses the least and the greatest quantity of water in a year for typical families. Have individuals read each of the categories under Low, Medium and High water uses. Tell them that the figures are based on a family of four.
- Point out to students that all the water uses listed in the medium category involve some kind of washing — dishwashing, clothes washing, and car washing.
- Have the students compare their list on the chalkboard with the one in the workbook. Ask if they are surprised about how much water is used for certain activities.

D. Divide students into groups for practice on water use.

- Tell students that you are going to read several uses of water. As each one is read, they are to hold up the appropriately colored piece of paper to show whether this use of water is high, medium, or low. ***[If you like, you can turn this into a contest by dividing the class into teams and keep score.]***
- Give each student one three-inch by three-inch piece of each color. Have them label the pieces as follows:
  High — red, Medium — yellow, Low — blue



EXERCISE 7 ANSWER KEY

Part A

Directions: Look at each group of activities that use water. Place a check on the line of the one that uses the most water in each group.

1. ✔ taking a shower
   ___ drinking
   ___ running dishwasher

2. ___ washing car
   ✔ watering lawn
   ___ washing clothes

3. ___ drinking
   ✔ flushing a toilet
   ___ washing the car

4. ___ running dishwasher
   ___ drinking
   ✔ using the faucet

5. ___ washing clothes
   ✔ watering lawn
   ___ flushing a toilet

6. ✔ using the faucet
   ___ drinking
   ___ washing the car

Part B

Directions: For each use of water listed, think of a way you could use less water. Write your answers in complete sentences.

1. Washing dishes **Run dishwasher with a full load or fill a tub with water for hand washing.**

2. Taking a bath **Fill the tub only half full, then take a shallow bath.**

3. Using the faucet **Turn off the water while brushing.**

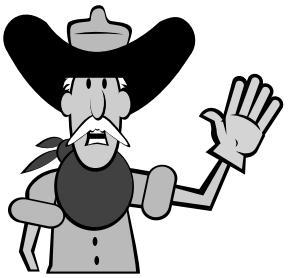
4. Washing clothes **Run clothes washer with a full load or adjust the water level.**

5. Taking a shower **Take a quick (five-minute) shower. Turn off water to lather.**

6. Washing the car **Use a spray nozzle with an automatic shut off and a bucket.**

7. Watering the lawn or yard **Water only when needed, and not when windy or raining. Don't water sidewalks and driveways. Water in early morning or late evening.**

Name _____



POSTTEST

MAJOR RIVERS
TEXAS WATER EDUCATION PROGRAM

PART A: The Water Cycle

Directions: Circle the letter of the word that best completes each sentence.

1. Water falls to earth as either rain or snow. This is called _____.
   a) surface runoff b) infiltration (c) precipitation

2. Some water on the ground flows into rivers, lakes, and oceans. This is called _____.
   a) condensation b) evaporation (c) surface runoff

3. Some water soaks into the ground. This is called _____.
   (a) infiltration b) precipitation c) condensation

4. The sun heats water on the ground and changes it into vapor. The vapor rises into the sky. This is called _____.
   (a) evaporation b) precipitation c) infiltration

5. Vapor cools, forms clouds and changes back into water. This is called _____.
   a) infiltration (b) condensation c) precipitation

PART B: Texas Water Supply

Directions: Circle the letter of the word that best completes each sentence.

6. Most large cities in Texas are in the _____ half of the state where there is more water.
   (a) eastern b) northern c) western

7. The river that supplies Austin, our capital city, is the _____.
   a) Sabine (b) Colorado c) Trinity

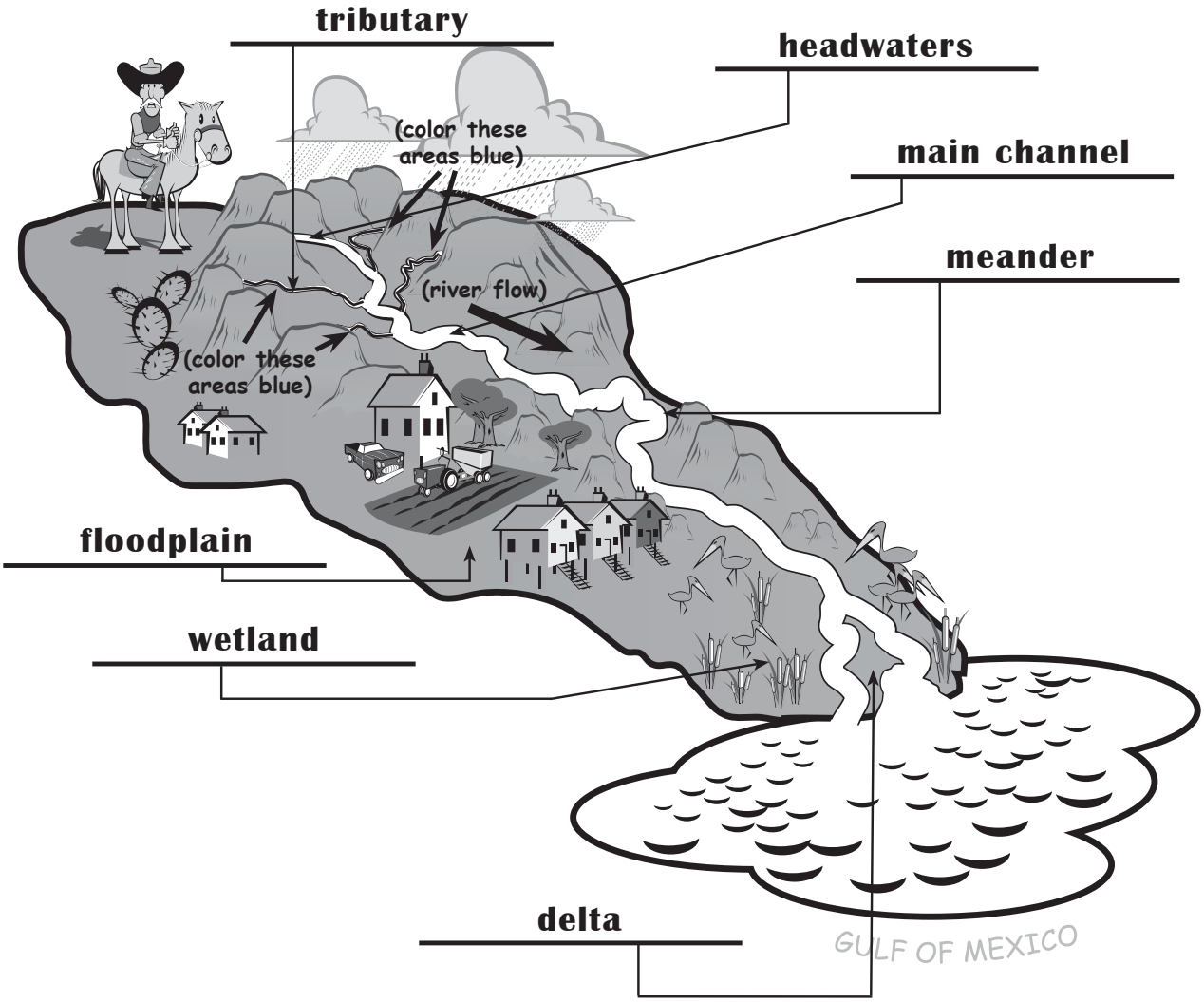
8. An underground layer of gravel, sand or rocks that is filled with water is called _____.
   a) a reservoir (b) an aquifer c) a lake

9. The river between Texas and Mexico is the _____.
   a) Red b) Brazos (c) Rio Grande

10. More than half of the water used in Texas comes from _____.
    a) the ocean b) rivers (c) aquifers

PART C: What is a Watershed?

Directions: Put the following words in the correct blank to label the watershed: tributary, floodplain, meander, headwaters, wetland, delta, and main channel. Color the tributaries that flow into the main river blue. Place an arrow showing the direction of the river's flow.



PART D: Water Treatment and Distribution

Directions: *Match the words on the left with their definitions on the right. Write the correct letter in the blank space.*

d water treatment plant	a) place where surface water is stored
b wastewater treatment plant	b) place where sewage is cleaned
e recycled water	c) carries water to homes and businesses
c pipeline	d) place where water is cleaned and made safe to drink
a reservoir	e) wastewater that is cleaned and reused

PART E: Using Water Efficiently

Directions: *Look at each group of activities that use water. Place an X next to the activity in each group that uses the most water in a year.*

X flushing the toilet	____ using the faucet	____ washing clothes	____ using the faucet
____ washing dishes	**X** watering the lawn	**X** watering the lawn	**X** flushing the toilet
____ drinking water	____ taking a shower	____ drinking water	____ washing the car

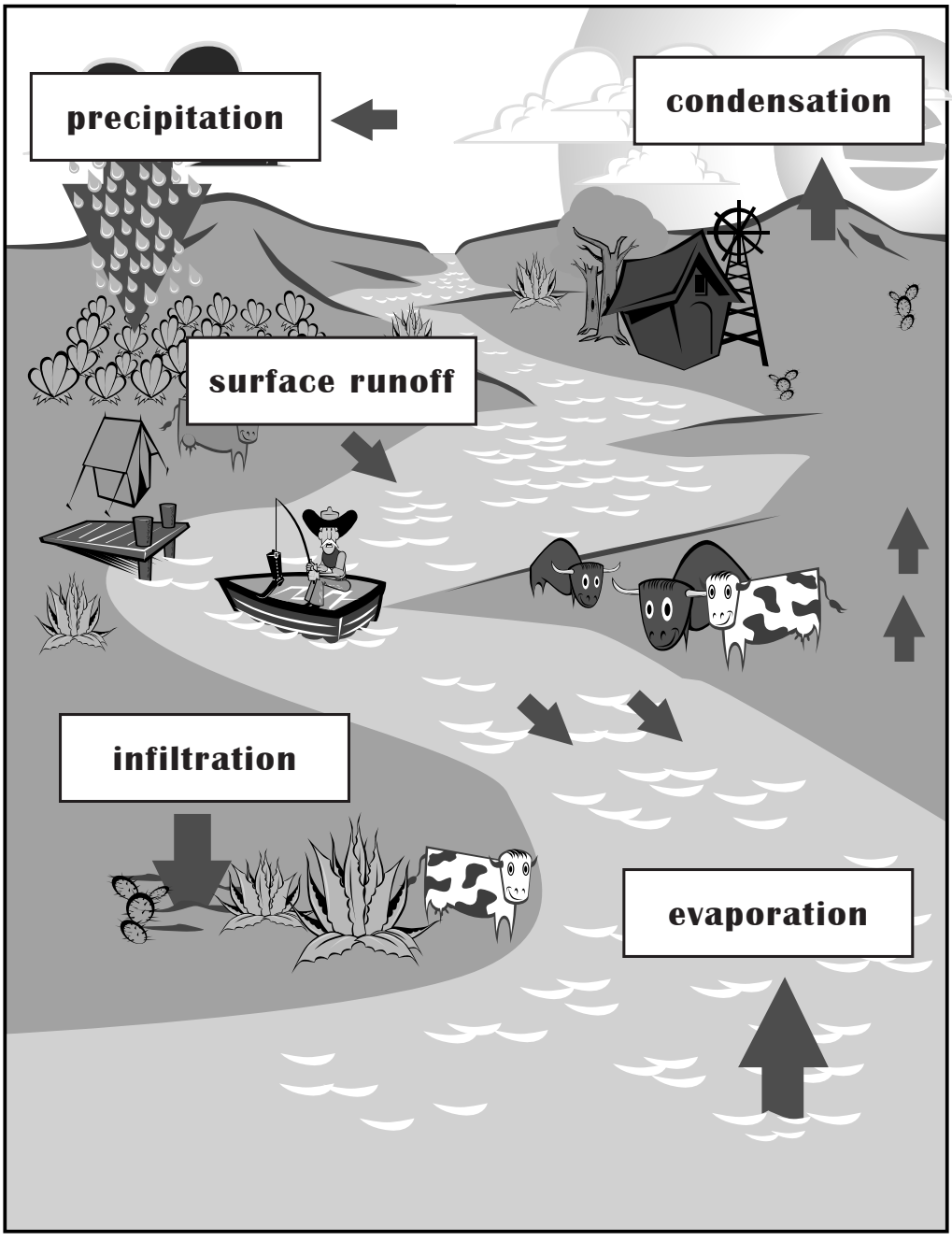
ANSWER KEY

REVIEW WORKSHEET

Part A. The Water Cycle

Directions: *The picture below shows the cycle of water. Fill in the blank spaces on the diagram with the words below.*

condensation *infiltration* *surface runoff*
evaporation *precipitation*



ANSWER KEY

REVIEW WORKSHEET

PART B. Water Supply
Directions: *Fill in the crossword puzzle by completing each sentence.*

Across:

2._____ supply almost half of the water for Texas.

4. The _____River supplies water to our capital city.

7._____ supply more than half the water for Texas.

9. The west side of Texas gets very little ____.

Down:

1. The _____ River forms the border between Texas and Mexico.

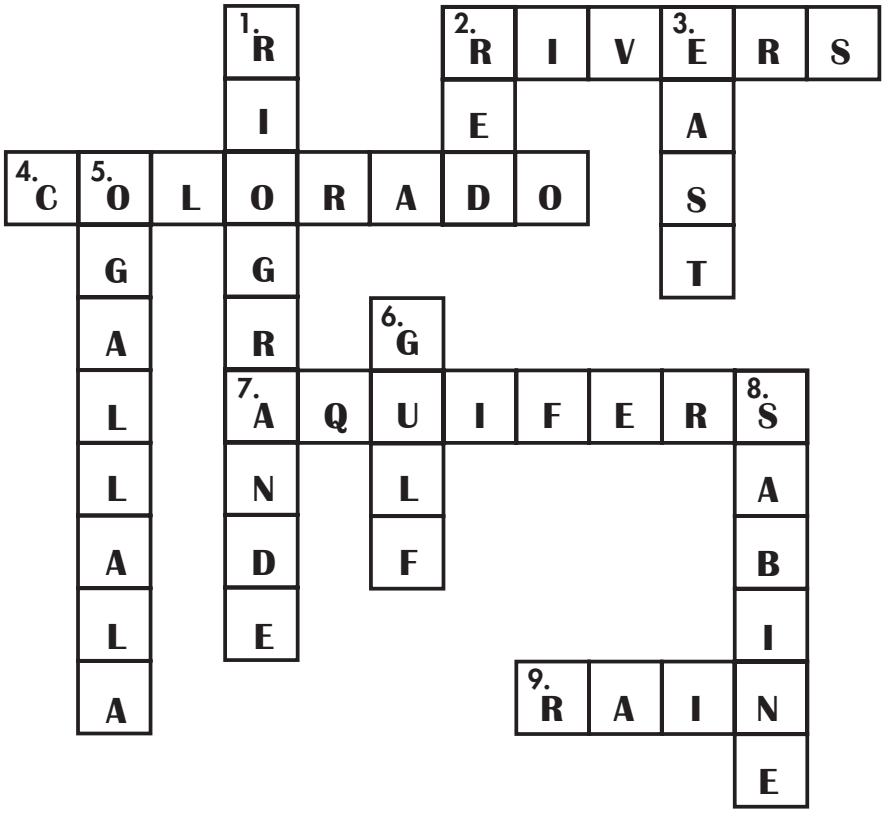
2. The _____ River runs between Texas and Oklahoma.

3. The_____ side of Texas gets the most rain.

5. The _____Aquifer supplies water to the Panhandle.

6. Most rivers in Texas empty into the_____ of Mexico.

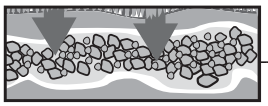
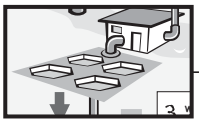
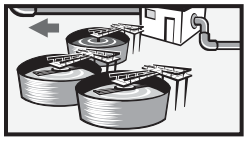
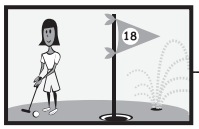
8. The _____ River separates Texas and Louisiana.



ANSWER KEY

REVIEW WORKSHEET

Part C. Water Distribution
Directions: *Fill in the blank spaces to complete each sentence.*

Texas has 80,000 miles of rivers and streams, and 221 large lakes and reservoirs. This water we can see on top of the ground is called  **surface water** *. Texas also uses water from under the ground. This water is called*  **groundwater** *. Most of the water from rivers, reservoirs, and aquifers is sent to a*  **water** **treatment plant** *to be cleaned. Then the water travels through*  **pipelines** *to our homes and businesses. After we use the water, it goes to a*  **wastewater treatment plant** *. Sometimes, wastewater can be used to irrigate some crops and to water parks. This water is called*  **recycled water** *.*

PART D. Water Use

Directions: *Fill in the chart showing which uses of water are high, medium and low.*

bathing	drinking	washing clothes
brushing teeth	flushing toilet	washing dishes
using the faucet	washing car	watering lawn

HIGH	MEDIUM	LOW
bathing	**using the faucet**	**brushing teeth**
flushing toilet	**washing clothes**	**drinking**
watering lawn	**washing dishes**	**washing car**

ANSWER KEY

WATER MATH

Directions: *Solve the problems and then use the key to make a sentence about water in Texas.*

130 = many	*484 = Texas*	*864 = water*
165 = flows	*494 = of*	*855 = into*
216 = The	*544 = rivers*	*901 = Gulf*
315 = in	*700 = Mexico*	*976 = the*

18 x 12	36 x 24	15 x 21	10 x 13	22 x 22	17 x 32
216	**864**	**315**	**130**	**484**	**544**
The	**water**	**in**	**many**	**Texas**	**rivers**

11 x 15	45 x 19	61 x 16	17 x 53	19 x 26	14 x 50
165	**855**	**976**	**901**	**494**	**700**
flows	**into**	**the**	**Gulf**	**of**	**Mexico.**

ANSWER KEY

A WATER CYCLE PUZZLE

Directions: *Complete each statement by filling in the blanks. When you have finished, there will be a word spelled in the arrow. Choose the correct words from the list.*

snow	*surface*	*water*	*cycle*	*taste*
Texas	*ice*	*fog*	*rain*	
infiltrates	*rivers*	*vapor*	*evaporates*	

1. *Water goes into the air when it* **e v a p o r a t e s**.
2. *Water* **i n f i l t r a t e s** *into the soil.*
3. *Water conservation is important in* **T e x a s**.
4. *The water* **c y c l e** *never stops.*
5. *Frozen water is called* **i c e**.
6. *Water in the air is called* **v a p o r**.
7. **r a i n** *falls from the clouds.*
8. *All living things need* **w a t e r**.
9. *Water on the ground is* **s u r f a c e** *water.*
10. *Water has no odor, color or* **t a s t e**.
11. *Water flows in* **r i v e r s**.
12. **f o g** *is a cloud close to the ground.*
13. *In cold places,* **s n o w** *falls from the clouds.*

precipitation

ANSWER KEY

WATERY WORD SEARCH

Directions: Find and circle the water words in this puzzle. The words go down and across.

Word List:

AQUIFER	GROUNDWATER	IRRIGATION	RESERVOIR
CONDENSATION	GULF	LAKE	RIVER
DAM	ICE	PRECIPITATION	SNOW
EVAPORATE	INFILTRATE	RAIN	WELL