The Tapwater Tour

Code 5972

Introduction

Research Contract

pH

Chlorine

Iron & Copper

Hardness

Summary

Water Words

Beef Up Links

Warning: This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

UNIT 1: Introduction

Tap Water

Three-fourths of the earth is covered with water. Only 0.8% of this is fresh water and less than one half of that fresh water is available for us to use in our homes. We all take water for granted and use more than you think. The average person uses five gallons of tap water just to brush their teeth! The average family of four uses 300 gallons of tap water each day. Where else is tap water used in your home?

Because water is so important, we have to make sure that it tastes good enough to drink and doesn't damage our plumbing.

Some scientists are water quality scientists. Their job is to test water and adjust it before we drink it. You will be testing your own tap water and other water samples in exactly the same way. You will test for **corrosive** pH, smelly **chlorine**, rusty iron, bitter copper and soap scum hardness. Soon, each of you will become a home drinking water expert.

1. Why might some water taste bad?

HAND OUT: Research Contracts
Remember to bring a tap water sample and research contract tomorrow.

Research Contract

The members of _____'s class are about to begin an exciting research project on tap water. They will be testing drinking water from their home. Upon completion of this research, they will bring home a report on the quality of the tap water.

Please remind them to collect a tap water sample for (date) _____ in the following manner:

#1
Rinse out a pint size plastic bottle or jar several times with tap water. (No rusty lids please!)

#2
Let the water run for several minutes.

#3
Fill the bottle or jar and cap tightly. Write your name on the container.

Questions

Do you have water from a community source of treated water (water treatment plant) or private ground well water?

_____

Do you have a water treatment system in your home?

_____

_____

Student Signature

UNIT 2: pH

What is pH?

pH is a measure of how **acidic** or **basic** things are. We assign numbers to things to tell us just how acidic or basic they are. pH is measured on a scale which goes from 0 to 14.

Battery acid is very acidic with a pH of almost zero. Bleach is very basic with a pH of 12.6. pH 7 is at the middle of the scale. This is the neutral pH. That is, it is neither acidic nor basic. **Distilled water** has a pH of 7 because it has no minerals in it. It is pure water.

The pH of water can be influenced by the plants and animals that live in it and the minerals and rocks it flows through.

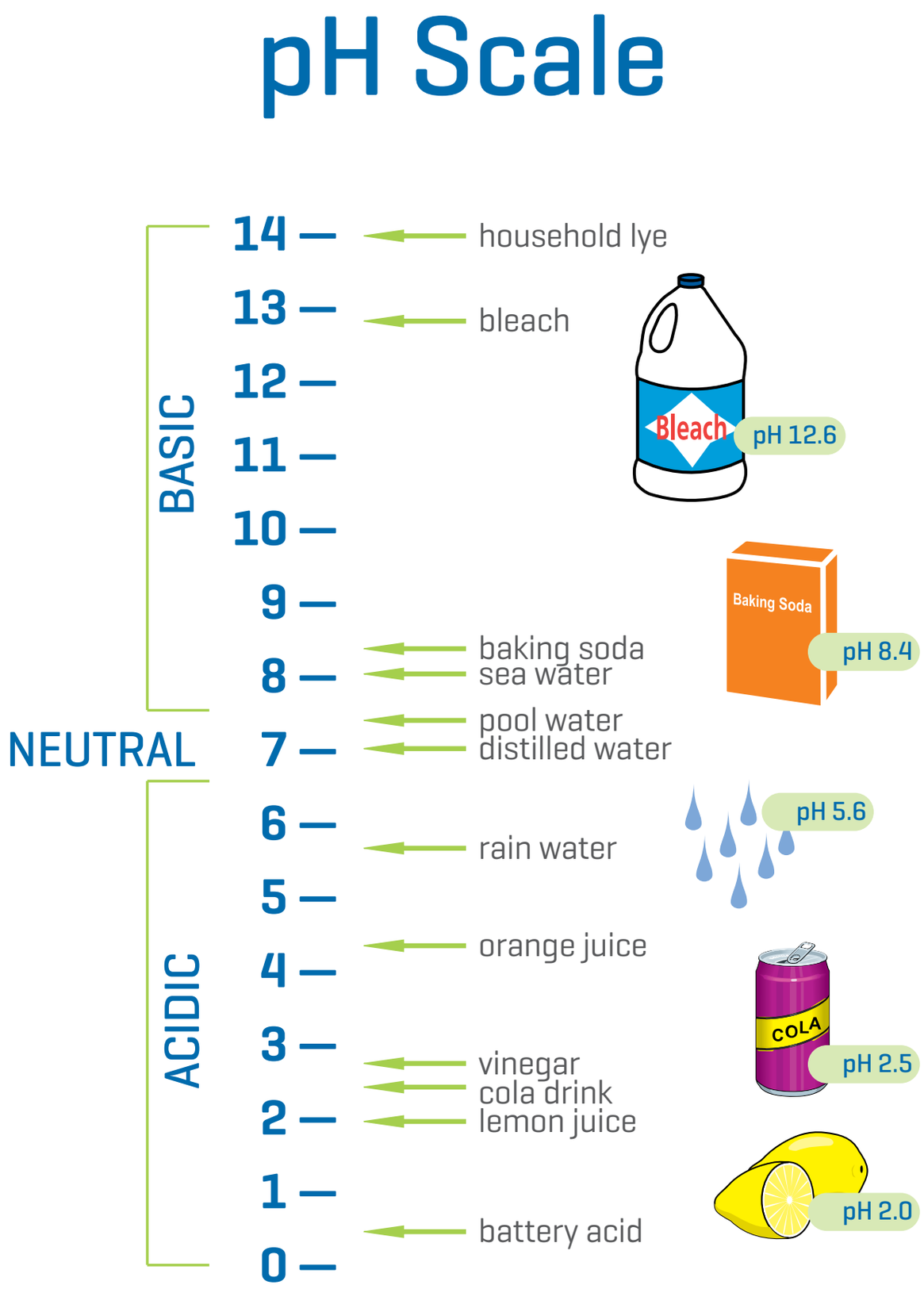
Strong acids and bases are dangerous. In your home the bleach is probably stored high up in a cabinet so your little brother or sister can't drink it. Weak acids, like lemon juice, and bases, like baking soda, are part of everyday life.

Can you tell, by looking at water, if anything is dissolved in it? Let's do the activity and see.

1. **Why do you think the pH of sea water is higher than distilled water?**
2. **Why does it taste different?**
3. **What happens when the sun dries sea water on your skin?**

HAND OUT: pH Data Sheets, Wide Range pH Tablets (6459A) and sample bags

HANG UP: Classroom Data Chart or create a digital Classroom Data Chart



pH Data Sheet

Scientist's Name: _____ Date: _____

Research Team: _____

pH Activity 1

pH Sample #1 Result

What was added: _____

Color: _____

pH: _____

pH Sample #2 Result

What was added: _____

Color: _____

pH: _____

pH Sample #3 Result

What was added: _____

Color: _____

pH: _____

pH Activity 2

My Tap Water Result

Color: _____

pH: _____

Classroom Data

Look at the Classroom Data Chart

1. Name one person whose tap water had a pH was greater than 7? _____
2. Name one person whose tap water had a pH that was less than 7? _____
3. Who had the most acidic water? _____
4. Who had the most basic tap water? _____

Warning: This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

pH Activity 1

Sample Preparation

pH Sample #1	Dissolve one teaspoon of baking soda in one quart of distilled water.
pH Sample #2	Add 5 drops of vinegar to one quart of distilled water.
pH Sample #3	Dissolve one aspirin in one quart of distilled water.

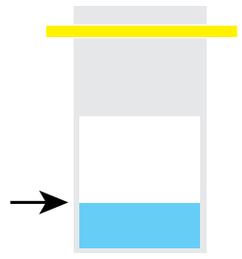
Divide into ten groups.

Test Procedure | pH Samples

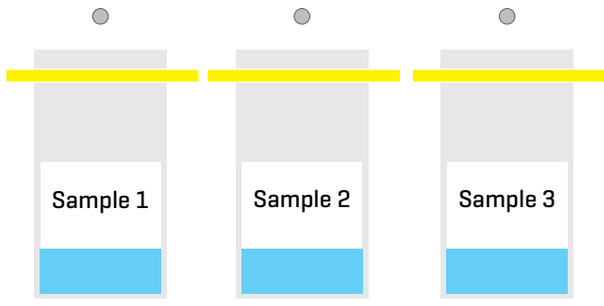
1. Have someone in the group fill a bag to **the bottom of the white strip** with pH **Sample #1**.

   Have someone else fill another bag to **the bottom of the white strip** with pH **Sample #2**.

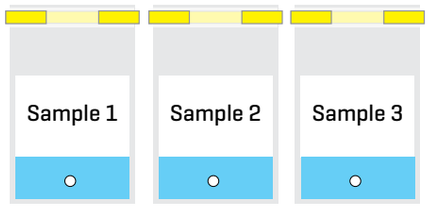
   Have someone else fill another bag to **the bottom of the white strip** with pH **Sample #3**.



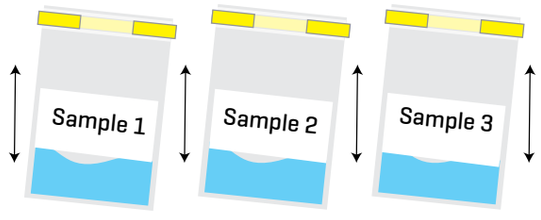
2. Have someone else remove three Wide Range pH Tablet (6459A) from the packaging and drop one into each bag.



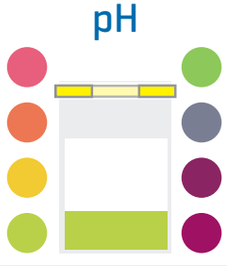
3. Roll the tops of the bags down 3 times. Fold the yellow tabs around the bag.



4. Hold the tops of the bags. Shake to dissolve the tablets.



5. Compare the colors of the reactions to the Color Chart Poster. Answer the questions and record the pH result on your pH Data Sheet.



6. Rinse the bags with tap water.

Do not pinch or squeeze the tablets when they are in the bag or the bag may be damaged.

4. Why do you think everyone's tap water did not have the same pH?

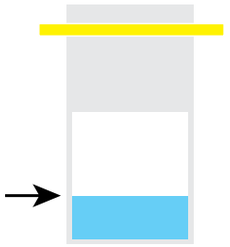
*WARNING: Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax. Emergency information for all LaMotte reagents is available from Chem-Tel: (US, 1-800-255-3924) (International, call collect, 813-248-0585).

pH Activity 2

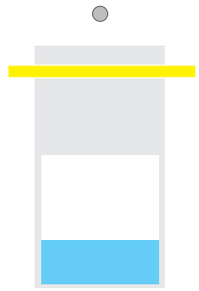
Divide into ten groups. Give your group a Research Team name.

Test Procedure | Tap Water

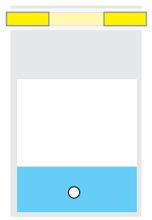
1. Test your own tap water sample. Fill a bag to **the bottom of the white strip** with your **tap water**.



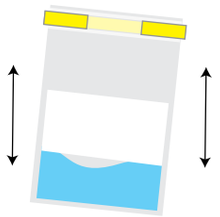
2. Remove one Wide Range pH Tablet (6459A) from the packaging and drop it into the bag.



3. Roll the top of the bag down 3 times. Fold the yellow tabs around the bag.



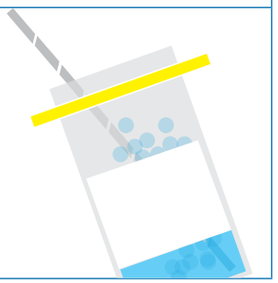
4. Hold the top of the bag. Shake to dissolve the tablet.



5. Compare the color of the reaction to the Color Chart Poster. Answer the questions and record your pH result on your pH Data Sheet. Record your pH result on the Classroom Data Chart.

6. Open the bag and gently blow into the sample with a straw for a minute or two. DO NOT drink the liquid.

Do not drink the solution.



7. Rinse the bag with tap water.

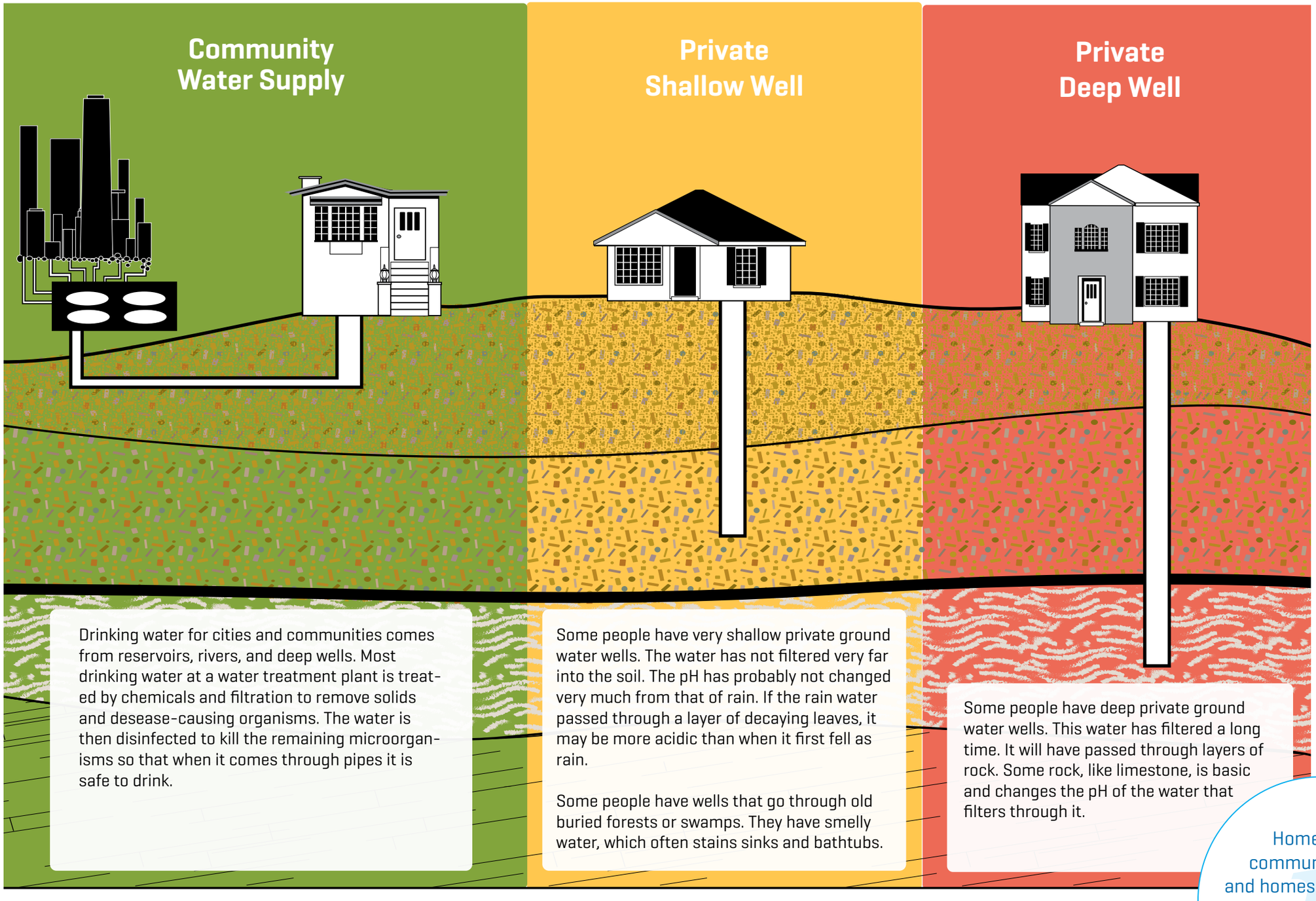
Do not pinch or squeeze the tablets when they are in the bag or the bag may be damaged.

5. How was the appearance of the sample different after you breathed into it? What does this indicate?

6. What do humans exhale?

7. Do you think carbon dioxide gas makes the water more acidic or more basic?

Where Does Your Tap Water Come From?



Drinking water for cities and communities comes from reservoirs, rivers, and deep wells. Most drinking water at a water treatment plant is treated by chemicals and filtration to remove solids and desease-causing organisms. The water is then disinfected to kill the remaining microorganisms so that when it comes through pipes it is safe to drink.

Some people have very shallow private ground water wells. The water has not filtered very far into the soil. The pH has probably not changed very much from that of rain. If the rain water passed through a layer of decaying leaves, it may be more acidic than when it first fell as rain.

Some people have wells that go through old buried forests or swamps. They have smelly water, which often stains sinks and bathtubs.

Some people have deep private ground water wells. This water has filtered a long time. It will have passed through layers of rock. Some rock, like limestone, is basic and changes the pH of the water that filters through it.

Homes with community water and homes with private well water may also have household water treatment systems.

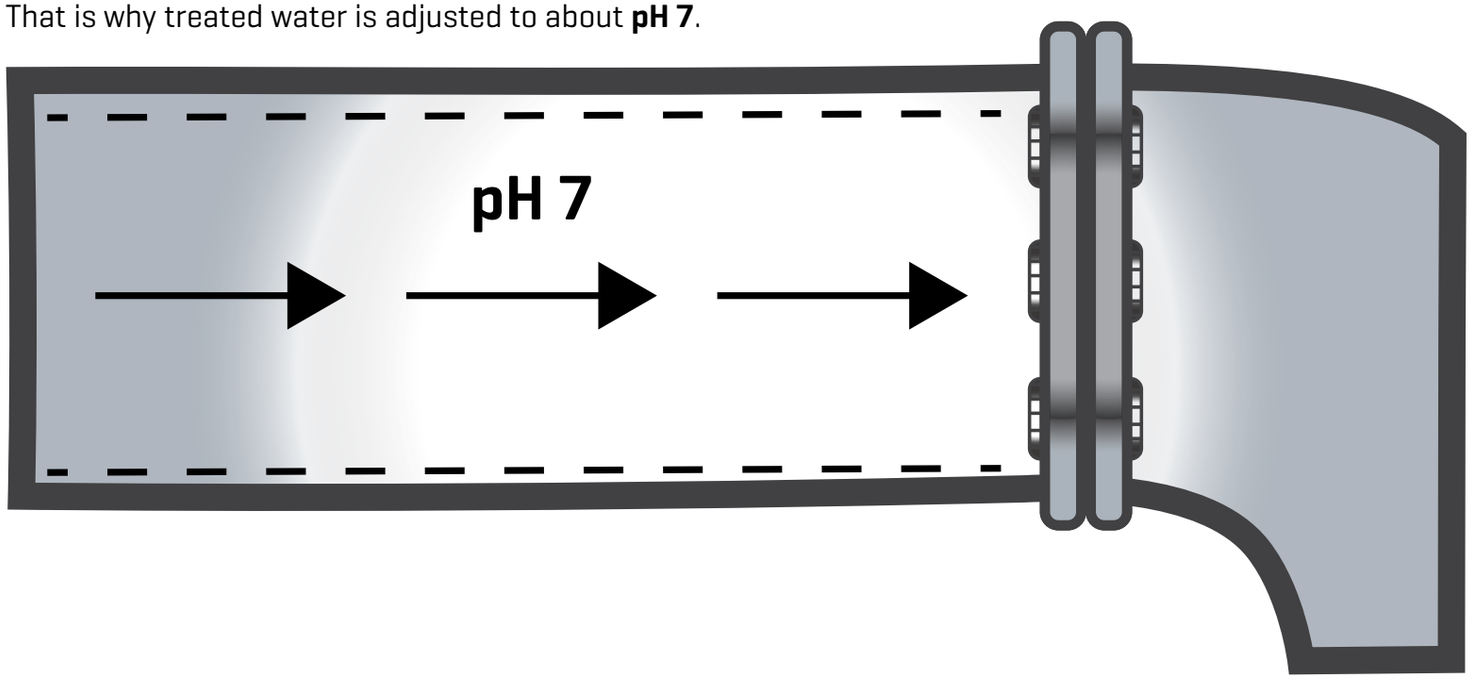
8. Do you think the pH of water in contact with limestone would increase or decrease?

9. What might people who live near the ocean have in their well water water?

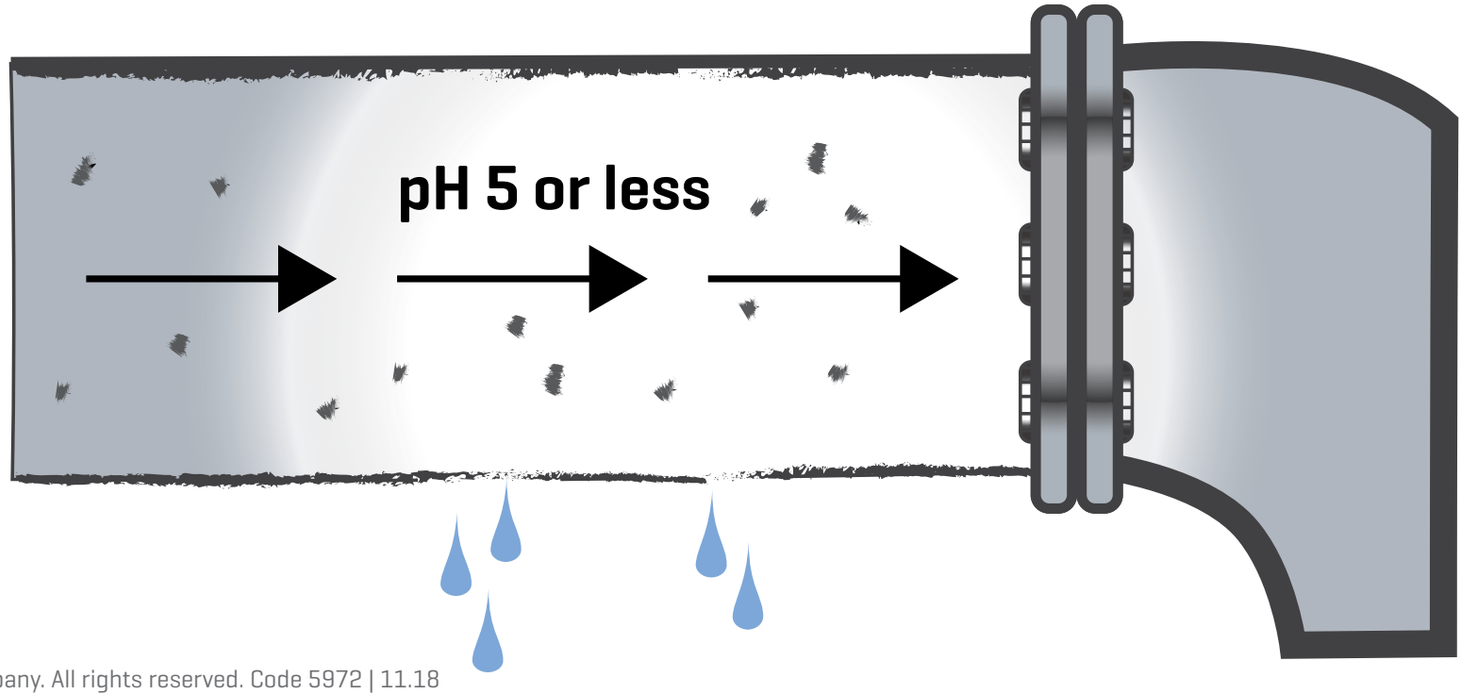
Why do we test pH?

Water at an incorrect pH can damage pipes and plumbing. This is a very expensive problem.

That is why treated water is adjusted to about **pH 7**.

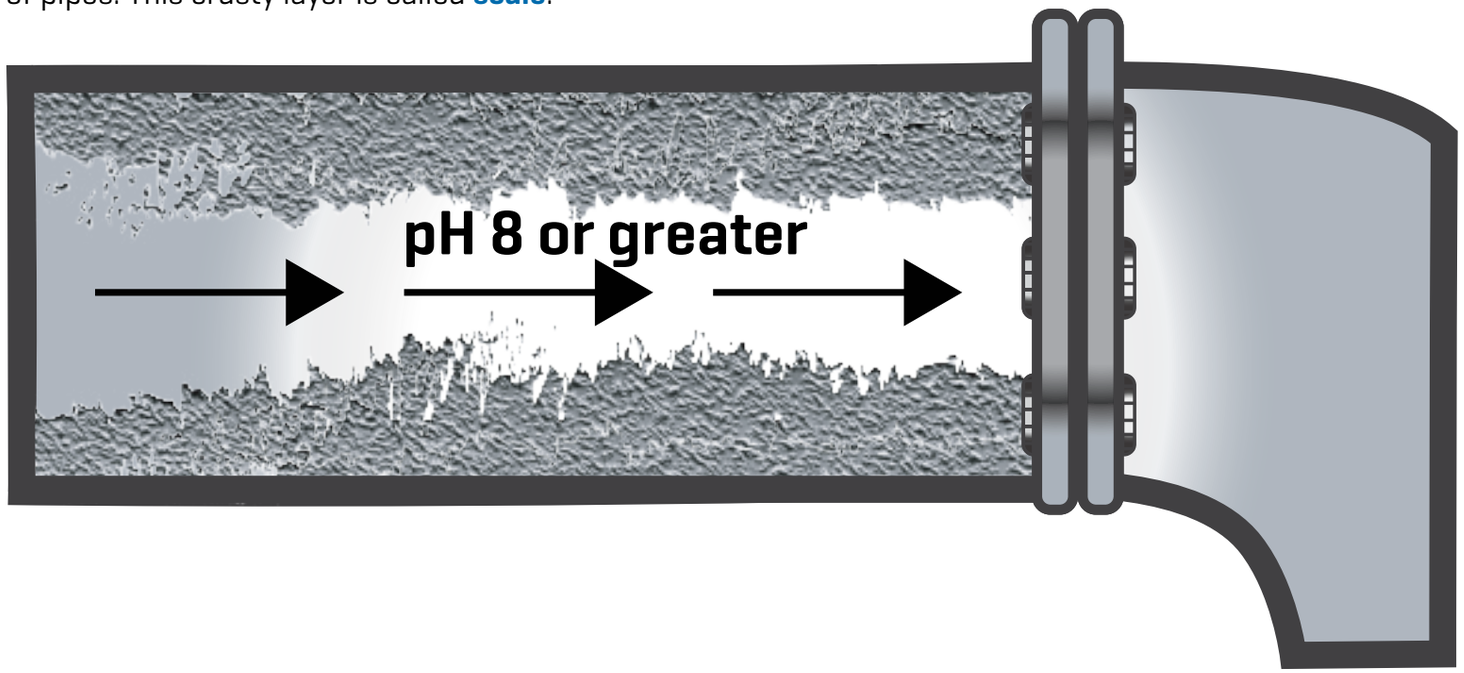


Corrosive water (around **pH 5** or less) will react with the metal pipes in your home and "eat them away". Eventually the pipe will develop a hole in it and it will leak.



Why do we test pH?

Water which is **pH 8** or greater and contains large amounts of minerals, such as **calcium** and **magnesium**, clogs pipes. A rock-like layer builds on the inside of pipes. This crusty layer is called **scale**.



HAND OUT: **pH Matching Puzzles**

Visit the plumbing section of a hardware store and look at the different materials used in plumbing parts. Obtain two copper or brass washers for your experiment.

Place a folded white paper towel on each of two saucers. Moisten one towel with vinegar and one with distilled water. Place a copper or brass washer on each paper towel and cover the saucers tightly with plastic wrap. Check every day and add more vinegar or distilled water if the towels start to get dry. In this experiment, the vinegar (an acid) represents corrosive water and the distilled water is a control. Observe the color of the paper towel and the formation of corrosion on the washers.

Why are different materials are recommended for plumbing parts?

Use the same procedure to test other metals used in construction — iron, steel, galvanized steel, zinc plated, stainless steel, aluminum, or painted metal.

Do research to find how acid rain is formed and to learn what metals are used in statues, bridges, and buildings. Find out how metal surfaces can be protected from acid rain. Design an experiment to test the methods of protection.

pH Matching

Match the question from **Column A** with an answer from **Column B**. Draw a line to connect the matched items if using a tablet. Type the letter of the answer from column B in the space in front of the question in Column A if using a computer.

Column A	Column B
____ 1. its pH is about 2.3	a. very acidic
____ 2. a pH value of 7 is _____	b. basic
____ 3. acidic water is ____	c. corrosive
____ 4. bleach is _____	d. distilled water
____ 5. the gas that we exhale	e. cola drink
____ 6. pure water	f. limestone
____ 7. a rock that changes the pH of water	g. neutral
____ 8. battery acid is ____	h. carbon dioxide

UNIT 3: Chlorine

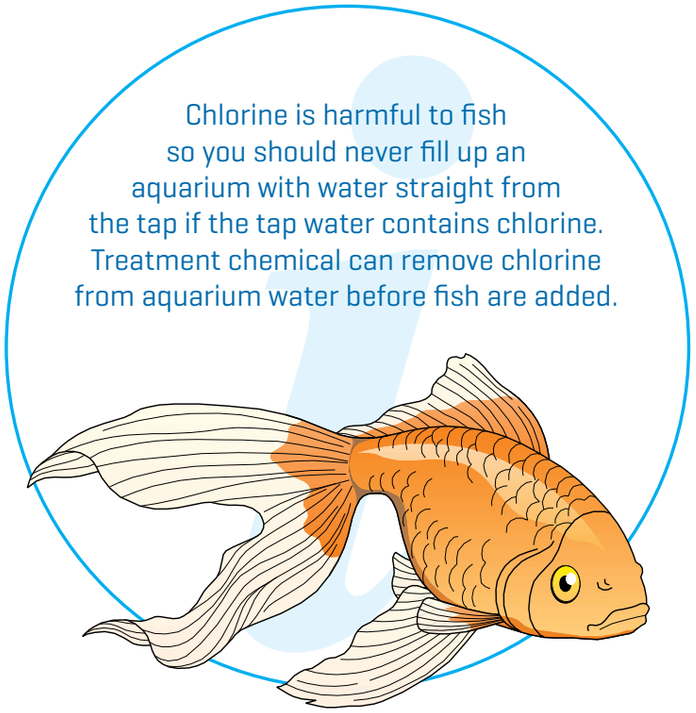
What is Chlorine?

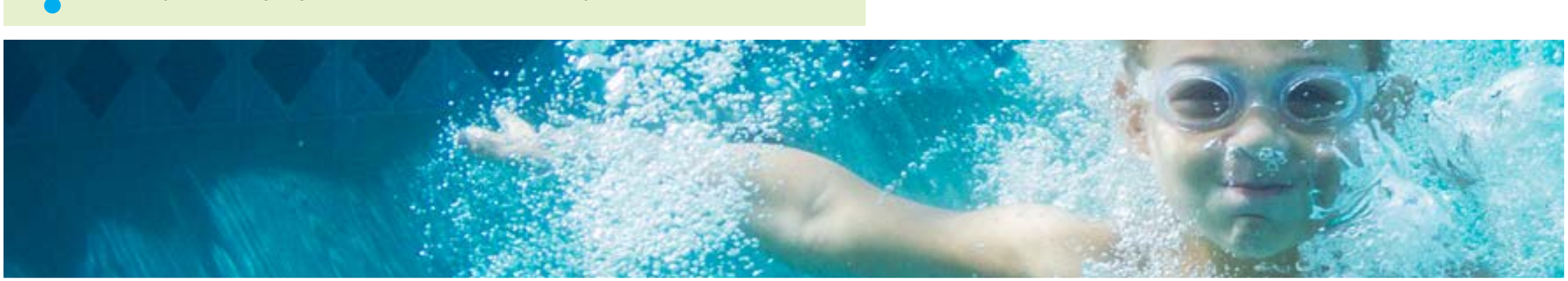
Chlorine is not found naturally in water. Chlorine is added at community water treatment plants to disinfect the water by killing **bacteria**. Chlorine is the most widely used **disinfectant** because it is effective against a wide range of germs.

Too much chlorine smells and tastes bad and can irritate your skin. It can also kill plants and fish.

The average swimming pool has twice as much chlorine as your drinking water. The bleach your parents add to the laundry has 15,000 times as much chlorine as drinking water.

1. **Why is chlorine is added to drinking water?**
2. **Why do some people add bleach to their laundry?**





BEEF UP!

1. Pour real pool water (or tap water with chlorine in it) into two shallow bowls. Measure the chlorine level of each sample at the beginning of the experiment and each day thereafter. Choose one sample and put your dirty hand in it each day and splash around like a swimmer. Do not touch the other bowl. Record and graph your daily chlorine measurements.
2. Use a fine net to collect a sample of algae from a stream, fish pond, or aquarium. Divide it into several portions, and add it to samples of distilled water, treated tap water, and pool water. Measure the chlorine level of each sample at the beginning of the experiment and each day thereafter. Record your measurements and observations.

HAND OUT: Chlorine Data Sheets, DPD #4R Tablets (6899A), and sample bags.

Chlorine Data Sheet

Scientist's Name: _____ Date: _____

Research Team: _____

Chlorine Activity

Chlorine Sample #1 Result

How many drops of diluted chlorine bleach were in the water sample?

_____

Was the sample pink?

_____

What level of chlorine was in the water sample?

_____

Chlorine Sample #2 Result

How many drops of diluted chlorine bleach were in the water sample?

_____

Was the sample pink?

_____

What level of chlorine was in the water sample?

_____

Was there more chlorine in Sample #1 or Sample #2?

_____

My Tap Water Result

Was the reaction pink?

_____

Does your tap water contain chlorine?

_____

Was the color of your sample closer to the color of Sample #1 or Sample #2?

_____

What level of chlorine was in your water sample?

_____

Classroom Data

Look at the Classroom Data Chart

1. Did all of the tap water samples have chlorine in them? _____
2. Did the tap water samples with chlorine come from private ground water wells or a community water supplies? _____

Warning: This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Chlorine Activity 1

Sample Preparation

Chlorine Sample #1	1. Mix one teaspoon (5 mL) of liquid chlorine bleach with three teaspoons (15 mL) of water in a cup. 2. Use an eye dropper to add one drop of this dilute bleach solution to one liter (one quart) of distilled water. This equals about the same amount of chlorine you'll find in the average drinking water. NOTE: Undiluted bleach is too strong for the tablets. It will bleach out the color of the reaction.
Chlorine Sample #2	1. Use the eye dropper to add 10 drops of the dilute bleach solution (from step #1 above) to one quart (one liter) of water. This is about the same amount of chlorine you'd find in a hot tub. This is far too much chlorine for drinking water.

+ *Chlorine bleach may irritate eyes and skin and damage clothing. Read label before use. Use with care.*

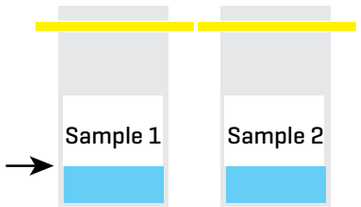
Chlorine **evaporates** quickly from water. Tap water samples that initially had chlorine may not contain any chlorine by the time it is tested.

Divide into ten groups.

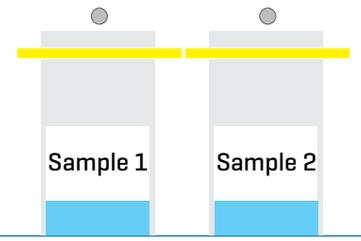
Test Procedure | Chlorine Samples

1. Have someone in the group fill a bag to **the bottom of the white strip** with **Chlorine Sample #1**.

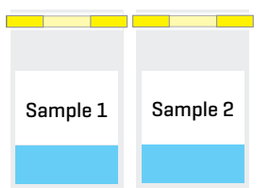
   Have someone else fill another bag to **the bottom of the white strip** with **Chlorine Sample #2**.



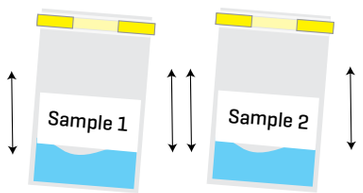
2. Have someone else remove two DPD #4 Tablets (6899A) from the packaging and drop one tablet into each bag.



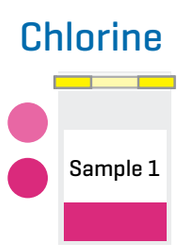
3. Roll the top of the bags down 3 times. Fold the yellow tabs around the bags.



4. Hold the tops of the bags. Shake to dissolve the tablets.



5. Compare the color of the reactions to the Color Chart Poster. Answer the questions and record your results on your Chlorine Data Sheet.

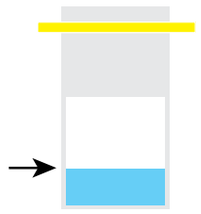
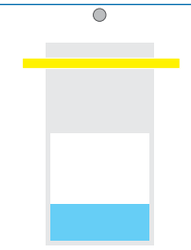
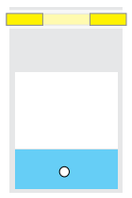
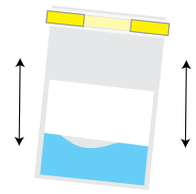


6. Save the reacted samples to compare to your tap water sample.

To avoid touching tablets, push the tablet through the foil into the bag. Do not pinch or squeeze the tablets when they are in the bag or the bag may be damaged.

Chlorine Activity 2

Test Procedure | Tap Water

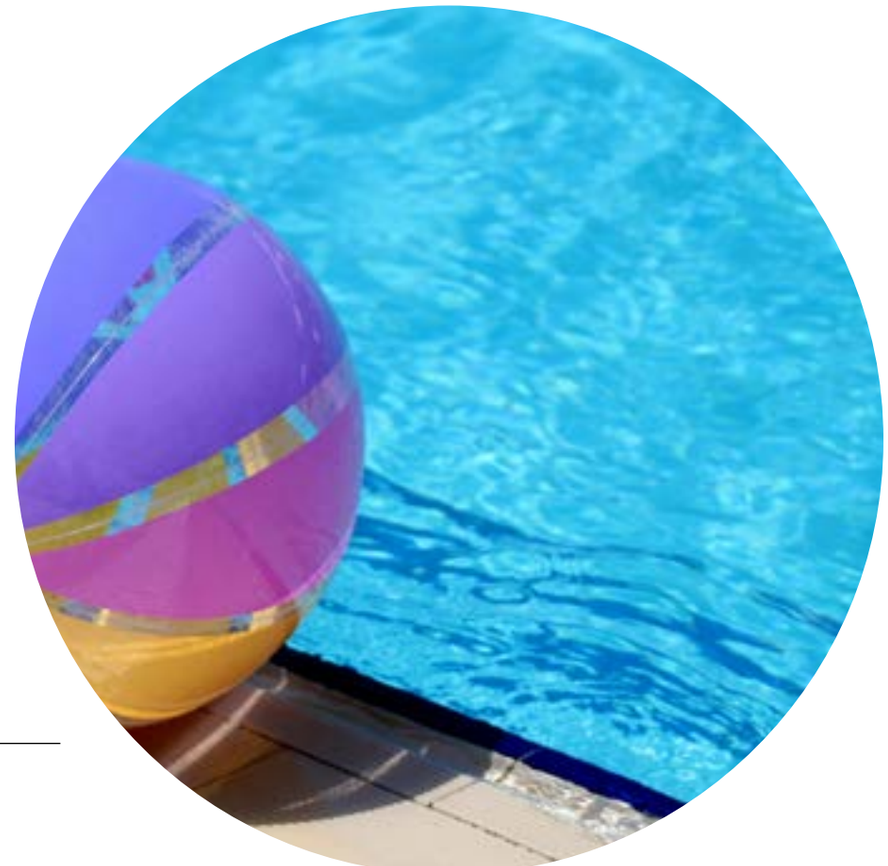
1. Test your own tap water sample. Fill a bag to **the bottom of the white strip** with your **tap water**. 	2. Remove one DPD #4 Tablet (6899A) from the packaging and drop it into the bag. 
3. Roll the top of the bag down towards you 3 times. Fold the yellow tabs back around the bag. 	4. Hold the top of the bag. Shake to dissolve the tablet. 
5. Compare the color of the reaction to the reacted Chlorine Sample #1 and Chlorine Sample #2 bags and the Color Chart Poster. Answer the questions and record your chlorine result on your Chlorine Data Sheet. Record your chlorine result on the Classroom Data Chart. 	6. Rinse all of the bags with tap water.

To avoid touching tablets, push the tablet through the foil into the bag. Do not pinch or squeeze the tablets when they are in the bag or the bag may be damaged.

HAND OUT: Water Scramble Puzzles

Water Scramble

Unscramble the letters to make words that appeared in the Chlorine unit.



NHRLIECO ___ ___ ___ ___ ___ ___ ___ ___

RSEGM ___ ___ ___ ___ ___

TCNFSIIDE ___ ___ ___ ___ ___ ___ ___ ___ ___

NIPK ___ ___ ___ ___

IAETACBR ___ ___ ___ ___ ___ ___ ___ ___

UMMYNOCIT ETMSSY ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

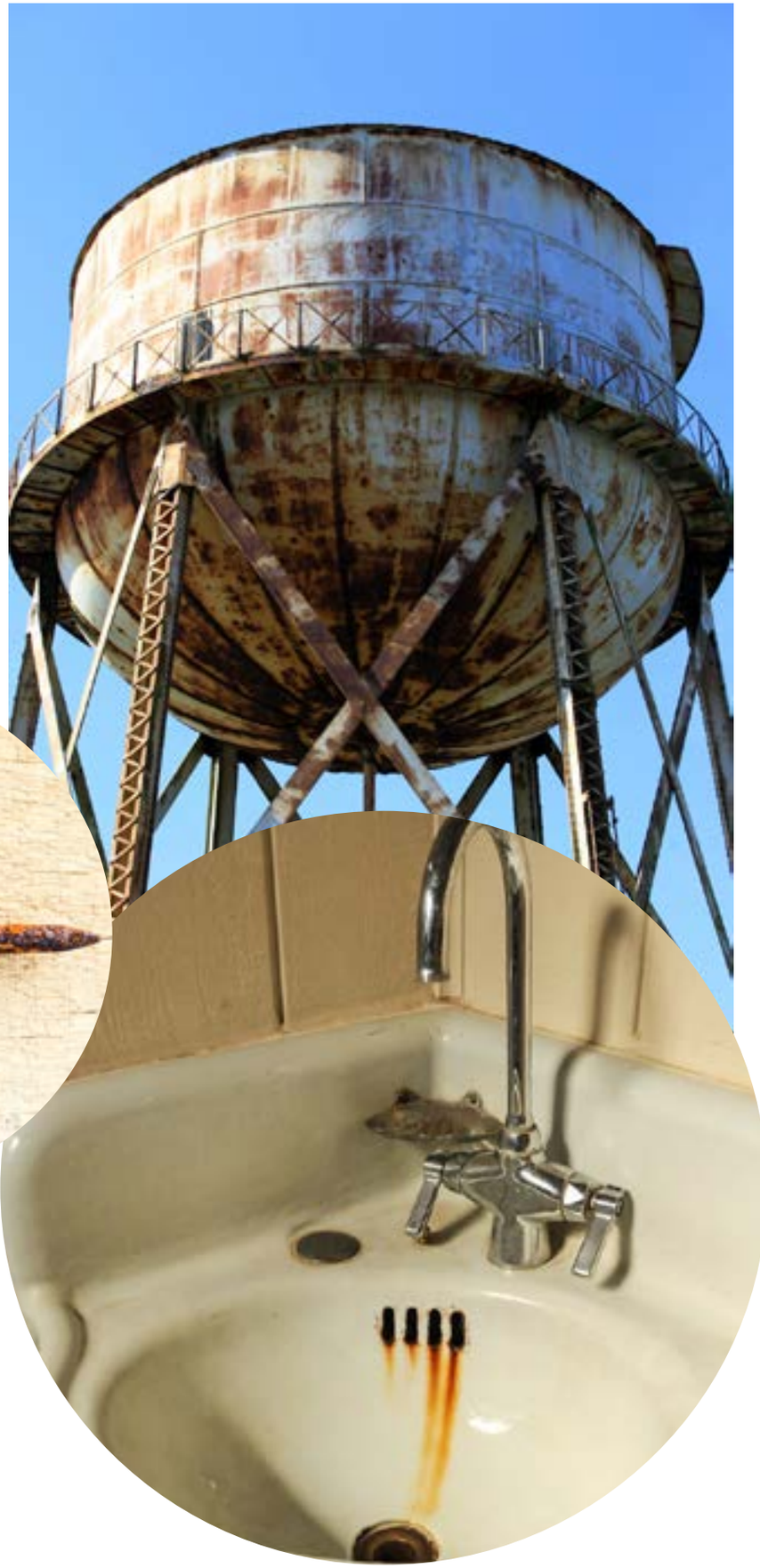
UNIT 4: Iron & Copper

What is Iron?

Iron is found naturally in most water. Too much iron can stain sinks, bath tubs, showers, and clothes. You may have noticed an orange stain where the water drips in your bathtub. A lot of iron will make tap water taste bad.

Sometimes iron metal reacts with oxygen in the air to form rust. Where have you seen rust? To react means to change chemically. In rusting, iron goes from a strong metal to a flaky orange solid.

Low pH (acidity) causes **corrosion** of the metal pipes in the water system and in our houses. Water with low pH dissolves metal in the pipes and may result in high iron levels in drinking water. To prevent this from happening, operators of water systems test for dissolved iron in tap water and adjust the pH of our drinking water to be slightly basic. Some people have water treatment systems in their homes to remove iron.



1. **Why do you think we remove the colored tablet coating in Step 3 while making Sample #1?**
2. **What happens to the tablet in Step 4 while making Sample #1? Do you think there is any iron in the water?**

HAND OUT: Iron Data Sheets, *Iron LR Tablets (3725A), and sample bags.

Iron Data Sheet

Scientist's Name: _____ Date: _____

Research Team: _____

Iron Activity

Iron Sample #1 Result

Was the reacted sample purple?

_____

What level of iron was in the sample?

_____

Iron Sample #2 Result

Was the reacted sample purple?

_____

How much iron was in the sample?

_____

Was Sample #1 or Sample #2 darker? Why?

_____

My Tap Water Result

Do you think you have iron?

_____

Do you have orange iron stains in your bathroom sink or bathtub?

_____

Did your tapwater sample turn purple?

_____

What level of iron do you have in your tap water?

_____

Classroom Data

Look at the Classroom Data Chart

1. Whose tap water sample had the highest level of iron? _____
2. Do the homes with high levels of iron in the tap water have orange iron stains on the sinks, bathtubs, showers, clothes, or dishwasher? _____
3. What is the pH of their tap water? _____

Warning: This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Iron Activity 1

Sample Preparation

Iron Sample #1	1. Fill one quart container with distilled water. Leave one empty. 2. Put one iron supplement tablet in a cup and add 3 teaspoons (15 mL) of distilled water. 3. Swirl to dissolve the tablet coating. 4. Put your uncoated tablet in 1 quart (1 liter) of distilled water. Mix for 30 seconds. 5. Promptly pour the water into the empty container. Be careful not to pour in the iron supplement tablet.
Iron Sample #2	1. Measure out ½ cup of sample #1. 2. Put it in an empty, clean, 1 quart container. 3. Fill the container with distilled water.

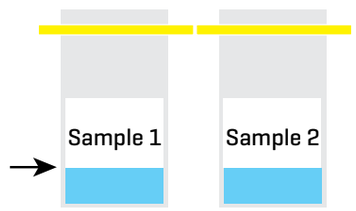
+ **Iron LR tablets (3725) may irritate skin. Avoid handling tablets with wet hands.*

Divide into ten groups.

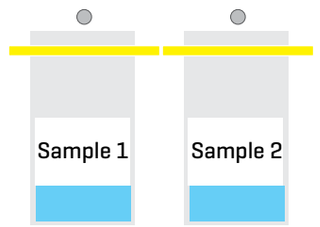
Test Procedure | Iron Samples

Have someone in the group fill a bag to **the bottom of the white strip** with **Iron Sample #1**.

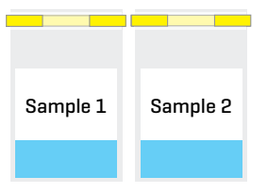
Have someone else fill another bag to **the bottom of the white strip** with **Iron Sample #2**.



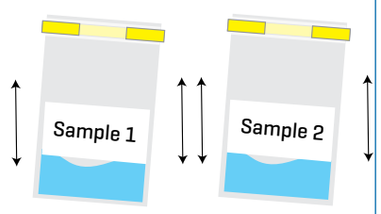
4. Have someone else remove two *Iron LR Tablets (3725A) from the packaging and drop one tablet into each bag.

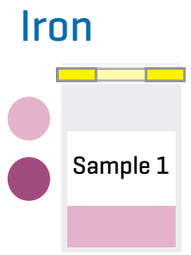


5. Roll the top of the bags down 3 times. Fold the yellow tabs around the bags.



6. Hold the tops of the bags. Shake to dissolve the tablets.

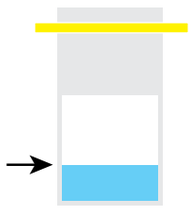
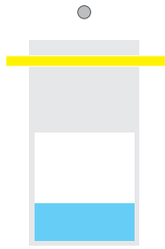
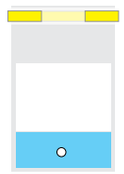
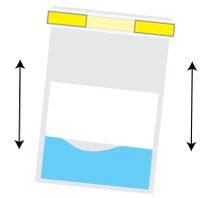


5. Compare the color of the reaction to the Color Chart Poster. Answer the questions and record your results on your Iron Data Sheet. 	6. Rinse bags with tap water.

To avoid touching tablets, push the tablet through the foil into the bag. Do not pinch or squeeze the tablets when they are in the bag or the bag may be damaged.

Iron Activity 2

Test Procedure | Tap Water

1. Test your own tap water sample for iron. Fill a bag to **the bottom of the white strip** with your **tap water**. 	2. Remove one *Iron LR Tablet [3725A] from the packaging and drop it into the bag. 
3. Roll the top of the bag down 3 times. Fold the yellow tabs around the bag. 	4. Hold the top of the bag. Shake to dissolve the tablet. 
5. Compare the color of the reaction to the Color Chart Poster. Answer the questions and record your iron result on the Iron Data Sheet. Record your iron result on the Classroom Data Chart. 	6. Rinse the bag with tap water.

To avoid touching tablets, push the tablet through the foil into the bag. Do not pinch or squeeze the tablets when they are in the bag or the bag may be damaged.

What is Copper?

Small amounts of copper are found in natural water. Sometimes people put copper in water to control **algae**. Algae in water supply resevoirs can cause drinking water to taste or smell bad. Copper can also dissolve in your water from copper pipes and fittings. Only acidic water dissolves copper from the inside surface of pipes.

People who have copper in their water sometimes have blue-green stains in their bathtub, showers, sinks, and swimming pools. Copper may make tap water taste bitter.

BEEF UP!

Place a penny in vinegar. Check it several times a week. The acidic vinegar will eventually dissolve some of the copper. If enough copper dissolves, the solution will become blue. This demonstrates how acidic waters can dissolve metals out of pipes.

HAND OUT: Copper Data Sheets, *Copper HR Tablets (3701A), and sample bags.

Copper Data Sheet

Scientist's Name: _____ Date: _____

Research Team: _____

Copper Activity

My Tap Water

Do you think you have copper in your tap water?

_____

What is the pH?

_____

Do you have acidic water?

_____

Do you have blue-green stains in your bathtub or sinks?

_____

What color was the reacted sample?

_____

What level of copper do you have in your tap water?

_____

Classroom Data

Look at the Classroom Data Chart

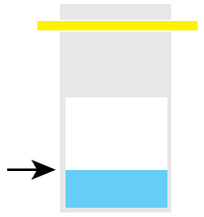
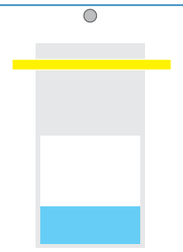
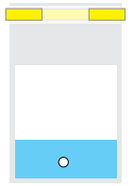
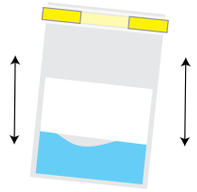
1. Whose tap water had the highest level of copper? _____
2. Do the homes with high levels of copper in the tap water have blue-green stains in the sink, showers and bathtubs? _____
3. What is the pH of their tap water? _____

Warning: This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Copper Activity

Divide into ten groups.

Test Procedure | Tap Water

1. Test your own tap water sample. Fill a bag to **the bottom of the white strip** with your **tap water**. 	2. Remove one Copper HR Tablet (3701A) from the packaging and drop it tablet into the bag. 
3. Roll the top of the bag down 3 times. Fold the yellow tabs around the bag. 	4. Hold the top of the bag. Shake to dissolve the tablet. 
5. Compare the color of the reaction with the Color Chart Poster. Answer the questions and record your Copper result on your Copper Data Sheet. Record your copper result on the Classroom Data Chart. 	6. Rinse the bag with tap water.

To avoid touching tablets, push the tablet through the foil into the bag. Do not pinch or squeeze the tablets when they are in the bag or the bag may be damaged.

HAND OUT: Water Word Search Puzzles

Water Word Search

Circle the words with the pencil tool or select a letter by clicking the checkbox above that letter.

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

ACID
BLUE GREEN
CONCENTRATION
DISSOLVED
DRIP
INDICATOR
IRON
METAL
ORANGE
PIPES
REACT
RUST
SAMPLE
STAIN
TABLET

UNIT 5: Hardness

What is Hardness?

"Hardness" is a measure of the amount of calcium and magnesium in water. Calcium and magnesium are minerals that get into water when rocks above and below the ground dissolve. Rocks such as sandstone and limestone, which contain large amounts of calcium and magnesium, dissolve easily to produce hard water.

Hard water leaves deposits of calcium and magnesium in pipes, heaters, and appliances. The deposits, called "scale", clog openings and reduce the flow of water through pipes. Hard water reduces the amount of sudsing from soap, leaves a film on clean dishes and clothes, and causes a buildup of white deposits on cooking pots and coffee makers.

A **water softener** removes calcium and magnesium from water, making it softer. The minerals in water softeners replace the calcium and magnesium with minerals which do not form scale deposits.

Water with little or no dissolved minerals is called "soft" water. Soft water is very good at dissolving materials and for cleaning. Distilled water, containing no dissolved material, is an example of very soft water. Rain and melted snow are also very soft.

When soft water contacts surfaces containing calcium or magnesium, such as plaster swimming pool walls, it dissolves the plaster material and may damage the surface. Swimming pool operators add chemicals to soft water to raise hardness levels and protect the pool walls. They adjust the pH of the pool water for the same reason. Industrial and drinking water systems must also be monitored and treated so soft water does not dissolve metal surfaces and hard water does not form deposits or scale.

HAND OUT: Hardness Data Sheets, *Hardness T Tablets (6917A) and sample bags.

Hardness Data Sheet

Scientist's Name: _____ Date: _____

Research Team: _____

Hardness Activity 1

My Tap Water

Does the bathtub or shower get a soapy scum ring?

_____

Based on the presence or absence of a soap scum ring, did you think your tap water is hard or soft?

_____

What color was the reacted sample?

_____

Did the test result show that your tap water is hard or soft?

_____

Hardness Activity 2

Bubble Test

Who's hard water sample did you use?

_____

How many drops of soap did the distilled water take to make bubbles?

_____

How many drops of soap did the hard water sample take to make bubbles?

_____

Did the hard water sample or the distilled water sample take more drops of soap to make bubbles?

_____

Is distilled water soft?

_____

Classroom Data

Look at the Classroom Data Chart

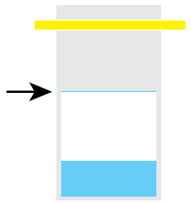
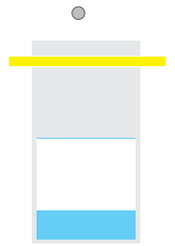
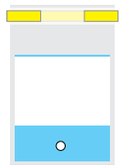
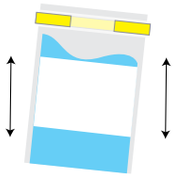
1. Name one person whose tap water was hard? _____
2. Name one person whose tap water was soft? _____
3. Which of your classmates need more shampoo to get soap bubbles when they wash their hair? _____
4. Was their tap water was from a private well or community water system? _____

Warning: This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Hardness Activity 1

Divide into ten groups.

Test Procedure | Tap Water

1. Test your own tap water sample. Fill a bag to **the top of the white strip** with your **tap water**. 	2. Remove one *Hardness T Tablet (6917A) from the packaging and drop it tablet into the bag. 
3. Roll the top of the bag down 2 times. Fold the yellow tabs around the bag. 	4. Hold the top of the bag. Shake to dissolve the tablet. 
5. Compare the color of the reaction with the Color Chart Poster. Answer the questions and record your hardness result on your Hardness Data Sheet. Record your hardness result on the Classroom Data Chart. 	6. Rinse the bag with tap water.

To avoid touching tablets, push the tablet through the foil into the bag. Do not pinch or squeeze the tablets when they are in the bag or the bag may be damaged.

The ring in your bathtub is formed when soap reacts with the calcium and magnesium in tap water. If the soap is reacting with calcium and magnesium, it gets all used up and it can't remove dirt. It might take twice as much shampoo to wash your hair in hard water as in soft water.

1. What tasks might use more soap if you had hard water?

1. Get a sample of very hard water. Use seawater collected at the beach or get a sample of salt water from a tropical fish store. Put the sample in a clean glass or jar. Put an equal amount of distilled water in a second glass or jar. Leave both containers in a warm dry place and allow the water samples to evaporate. Observe the results.

2. If you have a tea kettle, coffee maker or vaporizer, ask an adult to help you look for scale or deposits inside them. Collect the scale and experiment by using drops of distilled water, tap water, and vinegar to try to dissolve it.

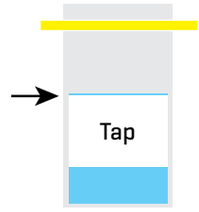
Hardness Activity 2
Bubble Test

Test Procedure | Hard Tap Water

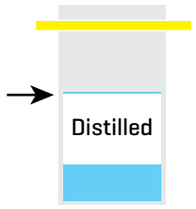
1. Have someone get two bags for the team.

Look at the Classroom Data Chart to determine who in your group had the tap water with the greatest hardness.

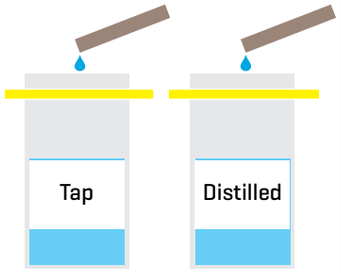
Have someone else fill one bag to **the top of the white strip** with the **hard tap water sample.****



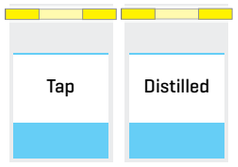
2. Have someone else fill the other bag to **the top of the white strip** with **distilled water**.



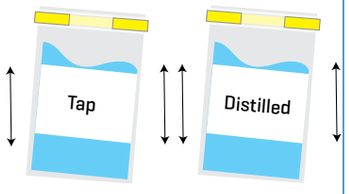
3. Have someone else use the cardboard strip to add one drop of soap to each bag. (They may need to practice making drops.)



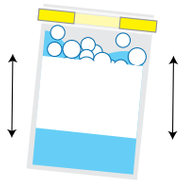
4. Roll the tops of the bags down 2 times. Fold the yellow tabs around the bags.



5. Hold the tops of the bags and shake. Are there bubbles in the bags? If not, add one more drop of soap to the sample that doesn't have bubbles yet. Shake.



6. If there still are no bubbles, keep adding soap one drop at a time and shake after each drop. Do this until there are bubbles. Record the number of drops of soap that was needed to for each sample to form bubbles on your Hardness Data Sheet.



7. Rinse the bags with tap water.

****If no one has hard tap water try using bottled mineral water.**

2. **Would you have to use more soap in hard water or soft water if you were washing a dog?**

HAND OUT:
Bubblegram Puzzles

Bubblegram

1 ___ ___ ___ ○ ___ ___ ___

2 ___ ○ ___ ___ ___ ___ ___

3 ___ ___ ○ ___

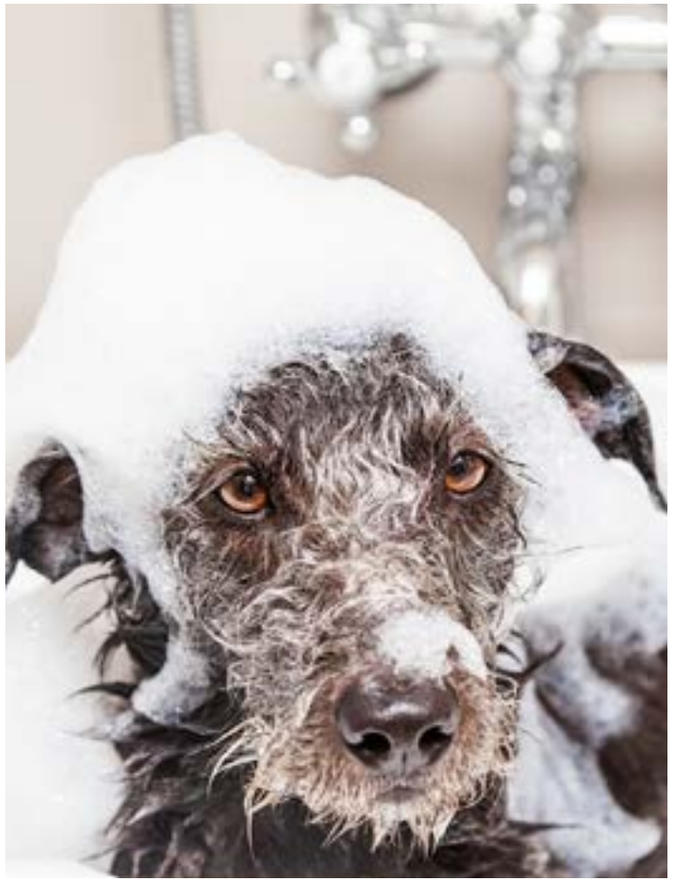
4 ○ ___ ___ ___ ___ ___ ___ ___

5 ___ ___ ___ ○ ___ ___ ___ ___

6 ___ ___ ___ ○ ___ ___ ___

7 ○ ___ ___ ___ ___

8 ○ ___ ___ ___



1. Place where the combination of hard water and soap make a dirty ring.
2. _____ and magnesium are minerals that make water hard.
3. _____ water takes more soap to produce bubbles.
4. Minerals that _____in water make it hard.
5. Calcium and _____ are minerals that make water hard.
6. Calcium and magnesium are ____.
7. The crusty stuff that clogs up pipes.
8. It stings when it gets into your eyes.

UNIT 6: Summary

Taste Test

Put some distilled water into a clean cup. Pour tap water in another clean cup. Taste them.

Do they taste different? _____

Why? _____

Which one tastes better to you? _____

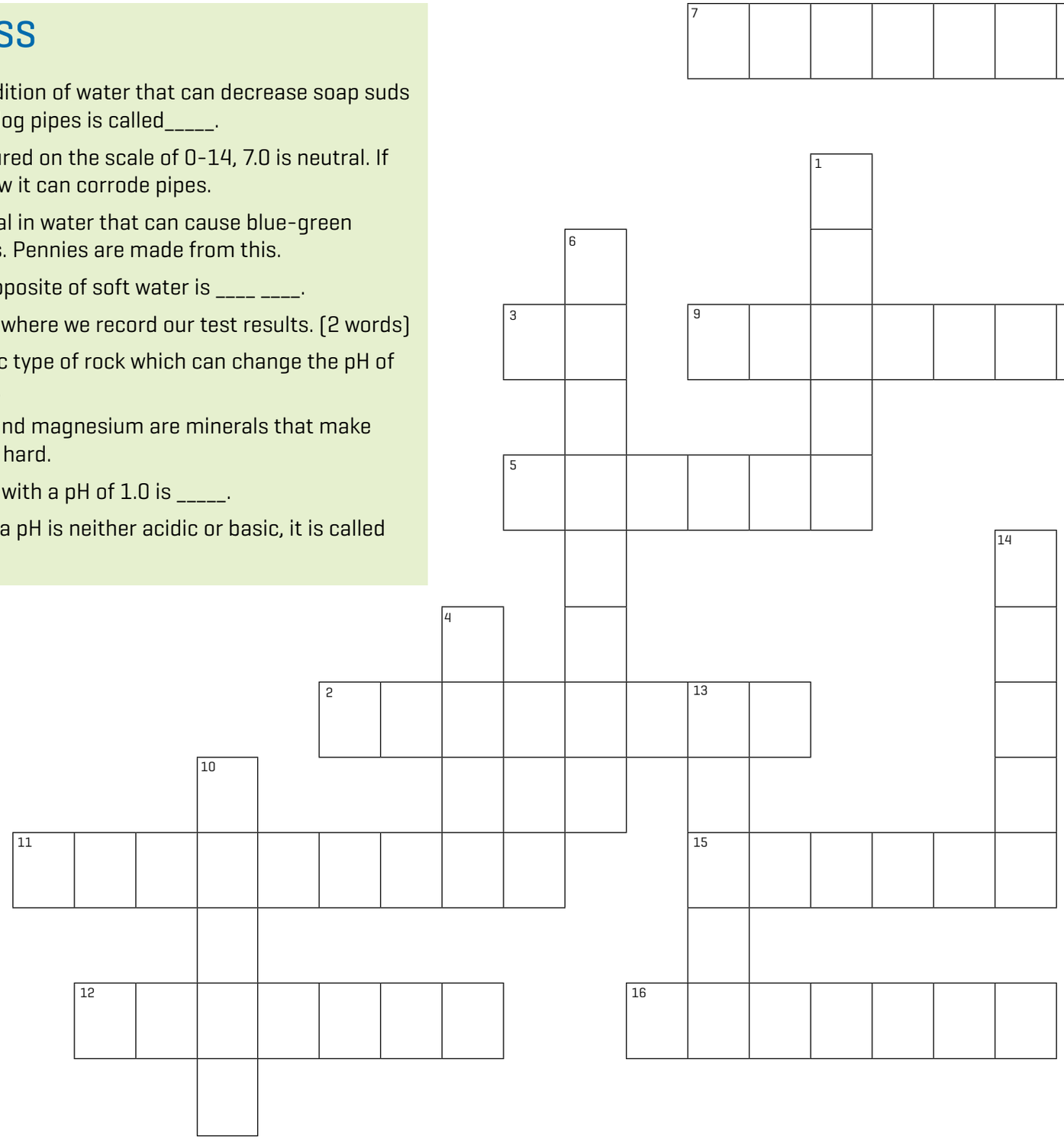
HAND OUT: Crossword Puzzles and Water Quality Report.

Summarize the Tapwater Tour by filling out your Water Quality Report.

Crossword Puzzle

ACROSS

2. A condition of water that can decrease soap suds and clog pipes is called_____.
3. Measured on the scale of 0-14, 7.0 is neutral. If too low it can corrode pipes.
5. A metal in water that can cause blue-green stains. Pennies are made from this.
7. The opposite of soft water is ____ ____.
9. Paper where we record our test results. (2 words)
11. A basic type of rock which can change the pH of water.
12. _____and magnesium are minerals that make water hard.
15. Water with a pH of 1.0 is _____.
16. When a pH is neither acidic or basic, it is called ____.



DOWN

1. Three fourths of the earth is covered with ___.
4. A metal dissolved in water can cause this orange stain.
6. A substance added to tap water, swimming pools, and laundry to make water safe.
8. Iron metal will _____ with oxygen to form rust.
10. A source of water; some are shallow, some are deep.
13. Crusty stuff on the inside of some pipes.
14. Water with a pH of 14.0 is _____.

Water Quality Report

Scientist's Name: _____ Date: _____

Questions

1. Where do we get tap water?

_____

2. Where do we use tap water?

_____

3. How do these factors affect the characteristics of tap water?

- pH _____
- Chlorine _____
- Iron _____
- Copper _____
- Hardness _____

My Tap Water

Test Results

What is the pH of your tap water?

_____

Look at the pH Scale. Which example has a pH closest to the pH of your tap water?

_____

What results did you get for the following tests?

Chlorine	no	yes	Level
Iron	no	yes	Level
Copper	no	yes	Level
Hardness	Hard	Soft	

Questions

1. Does your tap water come from a community water supply or a private well?

_____

2. Did you find something in your water that your didn't expect? What?

_____

3. Did you expect to find something in your water that you didn't find after all? What? What made you think it was there? (Example: colored stains, smells, etc.)

_____

Clear All Forms

Warning: This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Water Words

- Acidic see pH

- Algae Simple rootless plants that grow in sunlit waters in relative proportion to the amount of nutrients available. They can affect water quality adversely by lowering the dissolved oxygen in the water. They are food for small aquatic fish and animals.

- Bacteria Microscopic living organisms. Some can cause disease.

- Basic see pH

- Calcium A naturally occurring metal which is found in limestone, chalk and gypsum. Calcium in water contributes to the overall hardness.

- Carbon Dioxide (CO_2) A colorless, odorless, non-poisonous gas, which results from fossil fuel combustion and is normally a part of ambient air.

- Chlorine Added to disinfect water by destroying bacteria and algae.

- Corrosive Having the tendency to deteriorate metal parts which are slowly eaten away by oxidation or rusting.

- Corrosion The process where metal parts are slowly eaten away by oxidation or rusting. Corrosion usually occurs when oxygen comes into contact with metal surfaces.

- Disinfectant A substance that kills pathogenic organisms in water by a chemical or physical process. Chlorine is often added to disinfect sewage treatment effluent, drinking water supplies, wells and swimming pools.

- Distilled Water Water that has been purified by the process of boiling so that the steam condenses to a pure liquid and the pollutants remain in a concentrated residue.

- Evaporate To change from a liquid to a gas or vapor.

- Hard Water Alkaline water containing dissolved salts that interfere with some industrial processes and prevent soap from lathering.

- Magnesium A naturally occurring metal. Magnesium in water contributes to the overall hardness.

- pH Based on the number of hydrogen ions there are in a substance. A pH scale from 1-14 is used to define whether a substance is acidic, basic, or neutral. The midpoint of the scale 7.0 indicates a neutral substance, readings below 7.0 are acidic and readings above 7.0 are basic.

- Scale Crusts or flakes which are deposited on the surface of metal parts, often composed of calcium and magnesium.

- Water Softener Special devices which remove minerals such as calcium and magnesium from the water supply.

Click on the word to go to page where it appears.

Links

Interactive Water Games and Activities

Environmental Protection Agency

https://www3.epa.gov/safewater/kids/gamesandactivies.html

Drinking Water Bloopers

Environmental Protection Agency

https://www3.epa.gov/safewater/kids/bloopers.html

Drinking Water Activities for Students and Teachers

Environmental Protection Agency

https://www3.epa.gov/safewater/kids/bloopers.html

Water Science School

US Geological Society

https://water.usgs.gov/edu/

Water Education Poster, Quizzes, Plays and Surveys

US Geological Society

https://water.usgs.gov/edu/teachers-water.html

Compare your Drinking Water Taste to Drinking Water from Around the World

US Geological Society

https://water.usgs.gov/edu/activity-watertaste.html

The Story of Drinking Water

American Water Works Association – Kids Place

http://www.drinktap.org/kids-place/the-story-of-drinking-water.aspx

Water Videos

American Water Works Association – Kids Place

http://www.drinktap.org/kids-place/water-videos.aspx

Drinking Water Standards and Regulations

Environmental Protection Agency

https://www.epa.gov/dwstandardsregulations

Groundwater Tools, Resources, Ideas and Activities

The Groundwater Foundation

http://www.groundwater.org/kids/welcome.html