

WATER QUALITY MEASUREMENT UNIT



COMMON CORE / MCPS OBJECTIVES

- CCSS.MATH.CONTENT.K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object
- CCSS.MATH.CONTENT.1.MD.C.4 Organize, represent, and interpret data with up to three categories
- CCSS.ELA-LITERACY.RI.9-10.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text
- CCSS.ELA-LITERACY.RI.9-10.4 Determine the meaning of words and phrases as they are used in a text
- 1.C.1 Develop explanations that explicitly link data from investigations conducted, selected readings and, when appropriate, contributions from historical discoveries
- 6.7.A.1 Recognize and explain the impact of a changing human population on the use of natural resources and on environmental quality
- 6.6.B.1 Recognize and explain that human-caused changes have consequences for Maryland's environment as well as for other places and future times

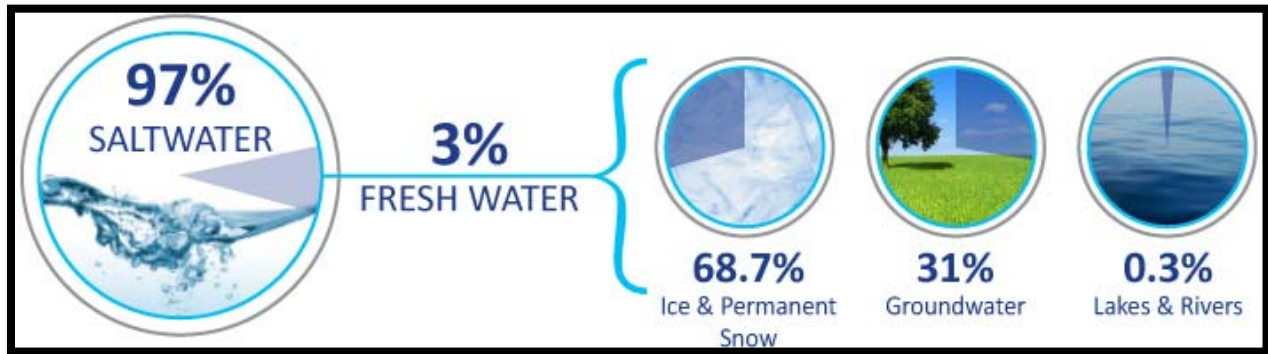
IEP OBJECTIVES

- SWBAT read, write, model, and interpret numbers in the context of water quality measurements
- SWBAT take accurate measurements and record data in charts and online databases
- SWBAT interpret the meaning and implications of water quality measurements
- SWBAT follow multi-step directions and work respectfully in a team

Name: _____ Date: _____

Why is Clean Water Important?

Water is something that all living things need in order to stay alive. These living things include humans, animals, plants, and more. We can find water in oceans, lakes, rivers, glaciers, and underground.



Approximately 97% of the water on Earth is saltwater. All of this water is in the ocean, and we cannot drink it. Only approximately 3% of the water on Earth is freshwater that we can drink. This water is in lakes, streams, ponds, rivers, swamps, glaciers, and in the ground. Since there is only a little bit of freshwater on Earth for everyone to use, it is very important to keep it clean.

1. What percent of the Earth's water is saltwater?

2. Where can you find saltwater?

3. What percent of the Earth's water is freshwater?

4. Where can you find freshwater?

You Tell Me!



Can you name 5 reasons why having clean water is so important?

How Does Water Get Polluted?

Pollution is something in the environment that has harmful or poisonous effects. Pollution can happen anywhere – in the air, ground, or water. If water has too much pollution, it can become toxic for humans, animals, and plants.



People can pollute water in many ways, even if they don't live near a major body of water. Using too much fertilizer, dumping trash into storm drains, littering, and not cleaning up after pet dogs can all cause pollution. These wastes move down the streets into the sewage drains, which move into lakes, streams, and eventually oceans. The polluted water can travel a very long distance from where it started.

How does water move?
Where does it go?



Where do you think all the litter came from?

<p>Vocabulary Word</p> <h1>Pollution</h1>	<p>Definition</p>
<p>Examples</p>	<p>Picture</p>

When polluted water reaches bodies of water, it has many negative effects.

Here are some examples of water pollution:

1. Oil spills

What happens? _____



2. Litter

What happens? _____



3. Excess fertilizer

What happens? _____



4. Toxins

What happens? _____



Comprehension Check: What is a negative effect of having litter in the water?

How Do We Know if Water is Clean?

Water quality is a measurement of how clean water is. Scientists collect water samples in order to test the water quality of different bodies of water. Water quality measurements have to meet certain standards set by the Environmental Protection Agency (EPA) in order to be called “safe.”

Scientists need to take measurements regularly to identify problems. If they analyze the measurements and see a problem, can try to solve the problem before it causes any serious harm to people, animals, or the environment.



Measurement is a way that we can describe the world around us using **numbers**. We use different tools and units to take different types of measurements. Let's review what we already know about measurement from our last unit!

Fill out the chart below.

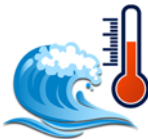

Type of Measurement	Tool	Units
Height <i>How tall or long?</i>		
Weight <i>How heavy?</i>		
Time <i>How fast or slow?</i>		
Volume <i>How much?</i>		



The 4 Water Quality Measurements

There are 4 measurements that show scientists how clean water is: **temperature, turbidity, dissolved oxygen, and pH**. Each of these measurements uses a different tool and different units, and each measurement can tell us a lot about how clean the water is. Let's learn about how to measure water quality!

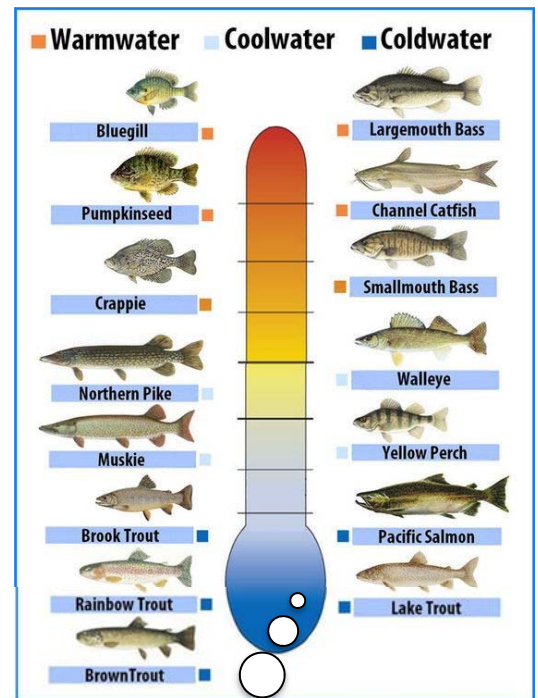
1. Temperature

Type of Measurement	Tool	Units
<p>Temperature <i>How warm?</i></p> 		

Why is temperature important?

Animals that live in the water (like insects, fish, and snails) can only live in a certain temperature range. If the temperature of the water is too hot or too cold for a long time, organisms can become stressed, get sick, and die.

Temperature also affects the amount of oxygen water can hold. Cold water holds more oxygen than warm water. Animals need oxygen in order to survive.



What type of fish can live in very cold water? What type of fish can live in very warm water?

What can affect temperature?

Temperature changes can be caused by warm water discharged from factories, the removal of trees and vegetation that shade streams, and runoff from city streets.

Comprehension Check: What can cause water temperature to change?

Answer:	Picture:

Temperature Data Practice

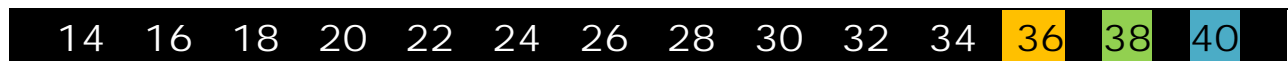
Directions: Look at the thermometer strips below. Identify what the temperature is. Don't forget to include units!

A.



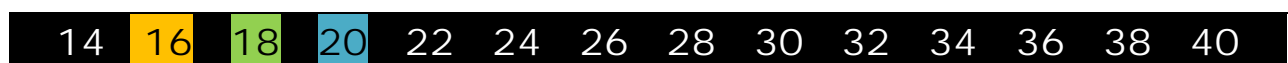
Temperature:

B.





Temperature:

C.



Temperature:

2. Turbidity

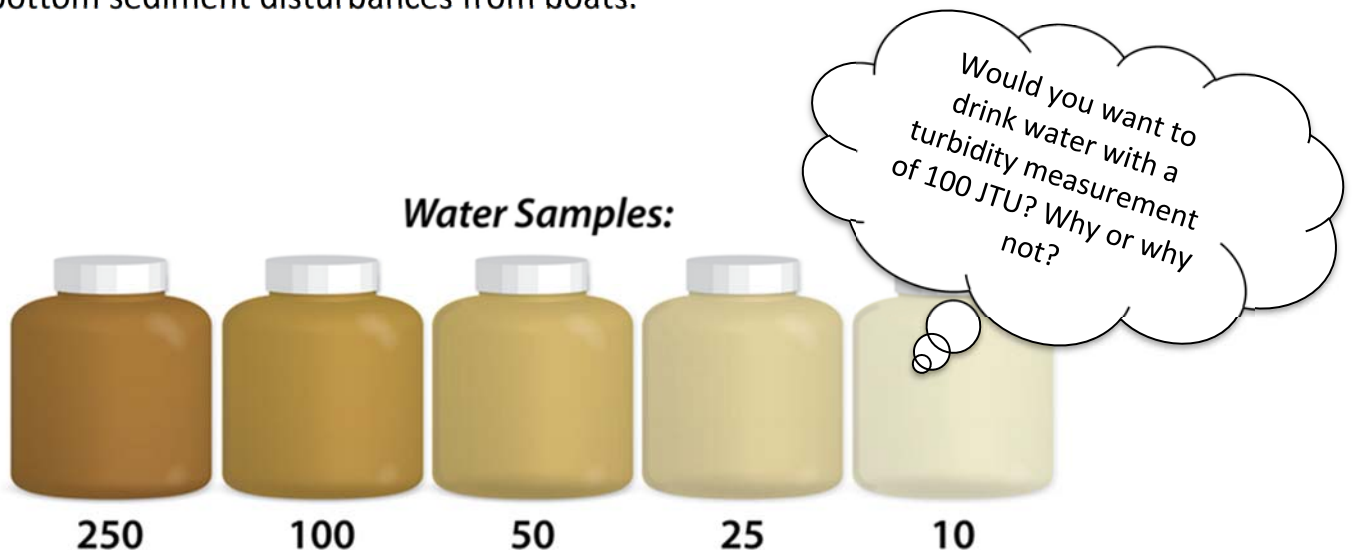
Type of Measurement	Tool	Units
Turbidity <i>How clear?</i> 		

Why is turbidity important?

If water has high turbidity, there are solid particles such as clay, dirt, and microscopic organisms suspended in the water that make it cloudy and hazy. These particles in the water can clog fish gills, making it hard to breathe. Particles in the water can also block light from aquatic plants that need sun to grow.

What can affect turbidity?

Turbid water may be caused by soil erosion, urban runoff, algal blooms, and bottom sediment disturbances from boats.

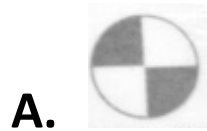


Comprehension Check: What can cause water to become more turbid?

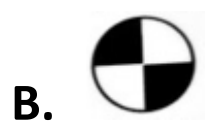
Answer:	Picture:

Turbidity Data Practice

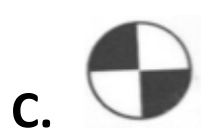
Directions: Look at the secchi disks below. Use the chart to identify what the turbidity is. Don't forget to include units!



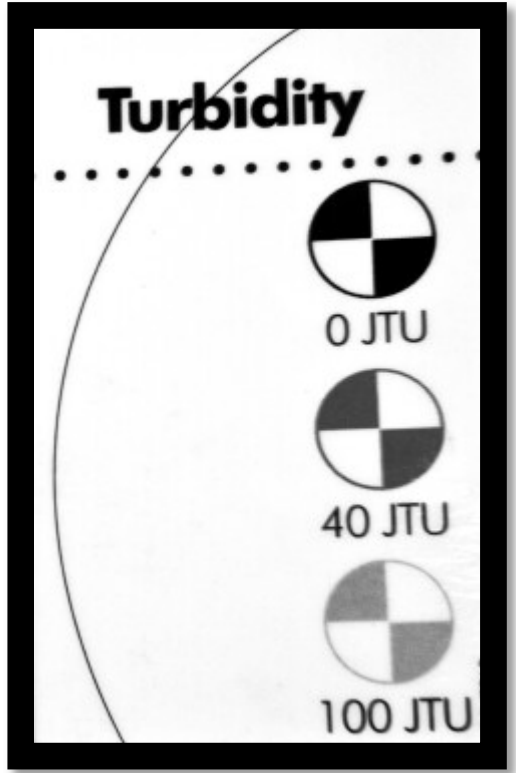
Turbidity:





Turbidity:



Turbidity:



3. Dissolved Oxygen

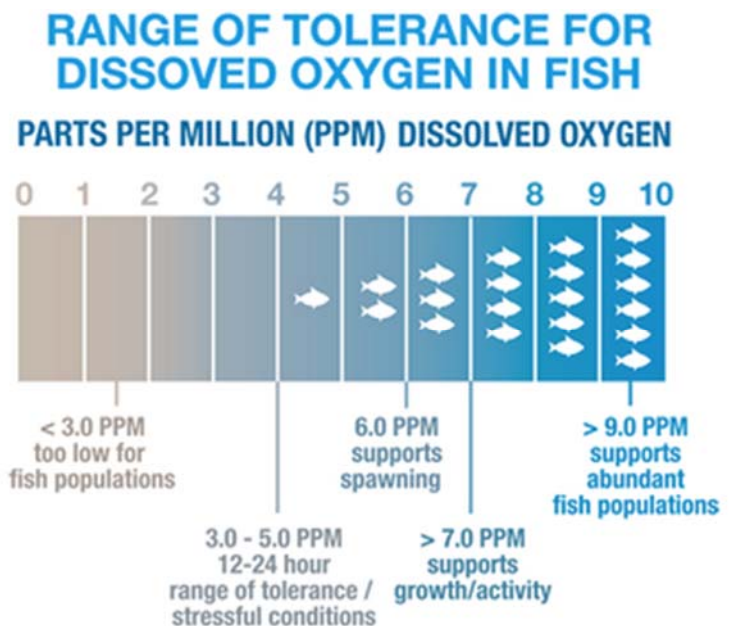
Type of Measurement	Tool	Units
<p>Dissolved Oxygen <i>How much air?</i></p> 	<p>Dissolved Oxygen</p> <hr/> 	

Why is dissolved oxygen important?

Most animals and plants that live in water need oxygen to survive. Water bodies with consistently high dissolved oxygen levels are most likely healthy environments. These environments can support a lot of different types animals and plants.

What can affect dissolved oxygen?

Low dissolved oxygen levels can be caused by having too much bacteria or rotting plants in the water. Water temperature can also change oxygen levels, as cold water can hold more dissolved oxygen than warm water.



What range of dissolved oxygen is deathly for fish?

All mate

Comprehension Check: What can cause the dissolved oxygen level to decrease?

Answer:	Picture:

Dissolved Oxygen Data Practice

Directions: Look at the dissolved oxygen test vials below. Use the chart to identify what the dissolved oxygen level is. Don't forget to include units!



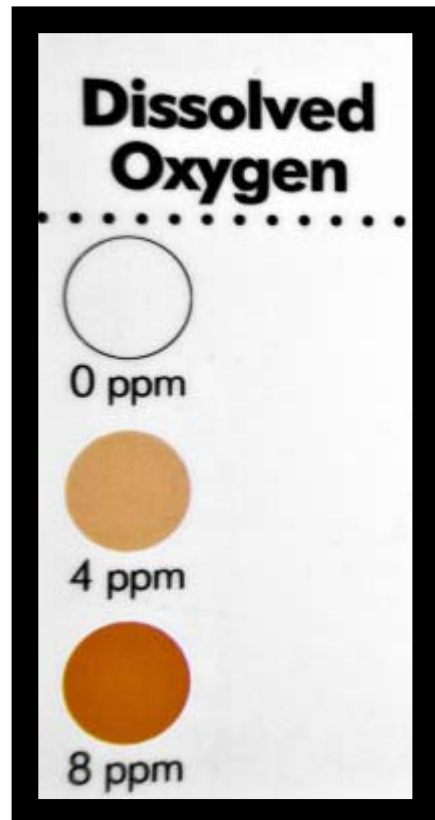
Dissolved Oxygen:



Dissolved Oxygen:



Dissolved Oxygen:



Saturation % of Dissolved Oxygen

The saturation percentage of dissolved oxygen (% saturation) is an important measurement of water quality. Cold water can hold more dissolved oxygen than warm water.

To calculate the % saturation **locate the temperature** of the water sample on the % saturation chart. **Locate the dissolved oxygen** result of the water sample at the top of the chart. The % saturation of the water sample is where the temperature row and the dissolved oxygen column intersect.

% Saturation Data Practice

Directions: Look at the temperatures and dissolved oxygen levels below. Use the chart to find the % saturation of dissolved oxygen. Don't forget to include units!

- A.** Temperature: 18°C
Dissolved Oxygen: 4 ppm

% Saturation

- B.** Temperature: 6°C
Dissolved Oxygen: 8 ppm

% Saturation

- C.** Temperature: 28°C
Dissolved Oxygen: 4 ppm

% Saturation

DISSOLVED OXYGEN, PPM			
	0 ppm	4 ppm	8 ppm
2	0	29	58
4	0	31	61
6	0	32	64
8	0	34	68
10	0	35	71
12	0	37	74
14	0	39	78
16	0	41	81
18	0	42	84
20	0	44	88
22	0	46	92
24	0	48	95
26	0	49	99
28	0	51	102
30	0	53	106

MORE % Saturation Data Practice

Directions: Look at the temperatures and dissolved oxygen levels below. Use the chart to find the % saturation of dissolved oxygen. Don't forget to include units!

- A.** Temperature: 30°C
Dissolved Oxygen: 8 ppm

% Saturation

- B.** Temperature: 20°C
Dissolved Oxygen: 0 ppm

% Saturation

- C.** Temperature: 10°C
Dissolved Oxygen: 8 ppm

% Saturation

- D.** Temperature: 14°C
Dissolved Oxygen: 4 ppm

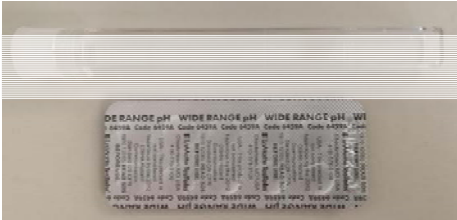
% Saturation

- E.** Temperature: 2°C
Dissolved Oxygen: 0 ppm

% Saturation

	0 ppm	4 ppm	8 ppm
2	0	29	58
4	0	31	61
6	0	32	64
8	0	34	68
10	0	35	71
12	0	37	74
14	0	39	78
16	0	41	81
18	0	42	84
20	0	44	88
22	0	46	92
24	0	48	95
26	0	49	99
28	0	51	102
30	0	53	106

4. pH

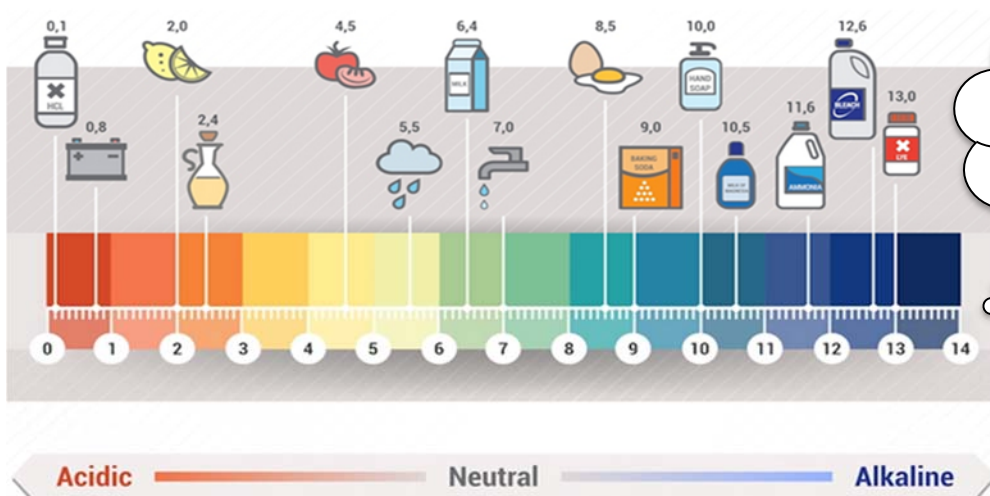
Type of Measurement	Tool	Units
<p>pH <i>How acidic?</i></p>	<p>pH _____</p> 	<p>pH</p>

Why is pH important?

Most animals and plants need a pH range between 6.5 to 8.00 to survive. Animals or plants that are used to living in a specific pH level could die if the pH in the water is too high or too low. Drinking too much water that is too acidic could also increase the risks for getting cancer or stroke.

What can affect pH?

pH can be affected by acid rain, wastewater discharges, and leaching from sediment found in the area.



What items are very acidic? What items are very basic (alkaline)?

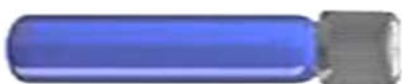
Comprehension Check: What can cause water's pH level to decrease?

Answer:	Picture:

pH Data Practice

Directions: Look at the pH test tubes below. Identify what the pH is.

A.



pH:

B.

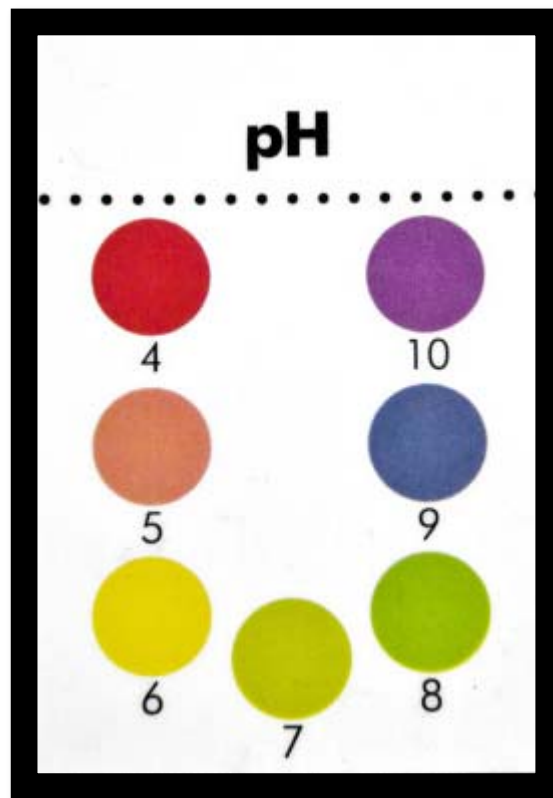


pH:

C.



pH:



Name: _____

Date: _____

The 4 Water Quality Measurements

Type of Measurement	Tool	Units
Temperature <i>How warm?</i>		
Turbidity <i>How clear?</i>		
Dissolved Oxygen <i>How much air?</i>		
pH <i>How acidic?</i>		