(1) Name _____ Block _____

Water Health

NC Essential Standard 6.1.3 / Common Core: W1, R1, R10
Predict the safety and potability of water supplies in North Carolina based on physical and biological factors, including: temperature, dissolved oxygen, pH, nitrates and phosphates, turbidity, bio-indicators.

Introduction: Water quality is used to describe the ability of a body of water to support life. Scientists use several indicators to determine if water is "safe" for aquatic organisms. Each characteristic of the water they measure must fall within certain ranges to be considered safe. In this activity, you will learn about the indicators scientists use and then look at water samples and indicator measurements to determine which water is the safest!

Objective: Analyze data based on physical factors to determine the safety of water supplies.

Prediction: What factors do you think a scientist measures when determining how healthy water is for aquatic organisms? What do you think the safest water would be like?

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Procedure:

1. Read the background information about the indicators scientists use to determine if a water system is healthy and answer the questions that follow.
2. Data has been obtained from 4 water samples across North Carolina. Analyze this data by filling in the chart provided.
3. Based on the knowledge you gained about healthy water systems and your data, answer the conclusion question. Be sure that you are able to support your answer with data!

Background Information:

Water Quality Indicators

Indicator	What is it?	Healthy Range	Importance
Dissolved Oxygen (DO)	Higher levels of DO mean better water quality. Higher levels of DO can be found in shallow water, cold water, and fast moving water.	Greater than 6 parts per million (ppm). Fish kills have occurred in water with <3ppm.	All living organisms need oxygen. Aquatic animals get the oxygen they need from the water, so water systems are healthier when they have more dissolved oxygen.
Temperature	Cold water can hold more dissolved oxygen than warmer water. Very warm water can kill fish.	Should stay below 29° C.	Cold water has more dissolved oxygen. Fish kills are more likely to happen in warm water.
pH	pH measures the acidicity of the water. A pH of 7.0 is neutral. A pH less than 7 is an acid, while a pH greater than 7 is basic.	Neutral or slightly basic. 6.7-8.6	Most plants and animals function best in water that is neutral or slightly basic.
Nitrates and Phosphates	Nitrogen and Phosphorus are nutrients that can cause plant growth. Excess nitrates and phosphates can get into water from fertilizer run-off. Too many nitrates and phosphates can lead to excess growth of algae.	<1.0 ppm is excellent < 10ppm is fair	Nitrogen is needed by plants and animals to build proteins. Excess nitrates and phosphates causes excess algae to grow.
Turbidity	Turbidity measures how cloudy the water is. It can be caused by suspended solids such as soil, sewage, and algae. Water that is more turbid = more cloudy, less turbid = less cloudy.	< 10 NTU for trout waters < 25 NTU for streams (non-trout waters) < 50 NTU for lakes and reservoirs (non-trout waters)	Excess nitrates and phosphates can cause growth of algae which will lower dissolved oxygen. Suspended solids can clog the gills of fish. Particles in the water can prevent plants from getting enough sunlight to complete photosynthesis.
Bio-indicators	Organisms used to assess ecosystem health. Looking at the health of the organisms that are living in the water, can help determine the health of the water system.	Presence of trout indicates a healthy water system. Healthy fish indicates healthy water.	Water that is healthy helps keep its organisms healthy. Diseased fish shows that the water system is unhealthy. Since trout is a sensitive species of fish, the presence of trout in water shows that the water is healthy.

(2)

1. What is the safe amount of dissolved oxygen for aquatic life?
2. Why is cold water important for fish?
3. Would a pH of 3 or 8 be safer for aquatic life? Explain why.
4. What can excess amounts of nitrates and phosphates cause?
5. Why is high turbidity unhealthy for aquatic animals?
6. In your own words, what is a bio-indicator and how do these organisms help you determine if a water system is healthy?

(3)

Data

Sample 1	Sample 2	Sample 3	Sample 4
Temperature: 9.1°C pH: 6.66 Turbidity: 158.2 NTU DO: 11.39 ppm Nitrates: .1ppm	Temperature: 25.3 °C pH: 8.32 Turbidity: 2.2 NTU DO: 6.5ppm Nitrates: 11.3ppm	Temperature: 11.2 °C pH: 6.14 Turbidity: 13.0 NTU DO: 4.6ppm Nitrates: 4ppm	Temp: 25.9 °C pH: 7.72 Turbidity: 160.7 DO: 5.75ppm Nitrates: .05ppm

Analysis: * Seperate Sheet of paper.

For each water sample, rate each indicator as "good," "fair," or "poor." Then write a brief statement explaining your choice. An example is done for you.

	Temperature	pH	Turbidity	Dissolved Oxygen	Nitrates
Sample 1	***Good***				
	Cold water is good because it allows more oxygen to dissolve.				
Sample 2					
Sample 3					
Sample 4					

(4)

Conclusion:

You and your best friend are both avid fisherman who just moved to the great state of North Carolina! You are excited because there are many bodies of water where you can fish, but you are overwhelmed with the task of figuring out which body of water has the healthiest fish.

You and your best friend have been disagreeing about which body of water is best, so you decide to look at data calculated by the Environmental Protection Agency (EPA). This data can be seen above. Each sample represents a different body of water that you might choose to make your permanent fishing location.

Based on your analysis of the data, choose which sample of water you think has the healthiest fish. Write an essay to your friend in order to persuade him that your choice is the best. Be sure to include which sample you find the safest and detailed reasons why you chose the sample. You also must include at least one reason for each other sample explaining why you did not choose it.

Be sure to include references to the data and your analysis in order to really convince your friend that your spot is the best!

A place to brainstorm:

Write your final answer on a separate sheet of paper!