Station 1: DISSOLVED OXYGEN

Just like we need oxygen in the air to breathe, fish and other aquatic life need oxygen in the water to "breathe". Oxygen found in the water is called "dissolved oxygen" because it is mixed (well…dissolved) into the water. Aquatic life obtains the oxygen needed from the water in which they live. High levels of dissolved oxygen indicate a healthy water system.

The picture above shows a fish kill where hundreds of fish die due to lack of dissolved oxygen in the water.

Cold water can hold more dissolved oxygen than warm water can. That said, dissolved oxygen levels are related to water temperature. Measurements that show high water temperature or low dissolved oxygen are indicators of an unhealthy water system. As water temperatures increase, the dissolved oxygen level decrease. This can cause stress to fish and other life forms, making them vulnerable to disease. This low dissolved oxygen content in very warm water – temperatures above 29–32°C (84–89°F) – can result in enough stress to cause mass fish kills. Sewage or pollution can also cause a decrease in dissolved oxygen level.

Answer the following questions on your paper in complete sentences.

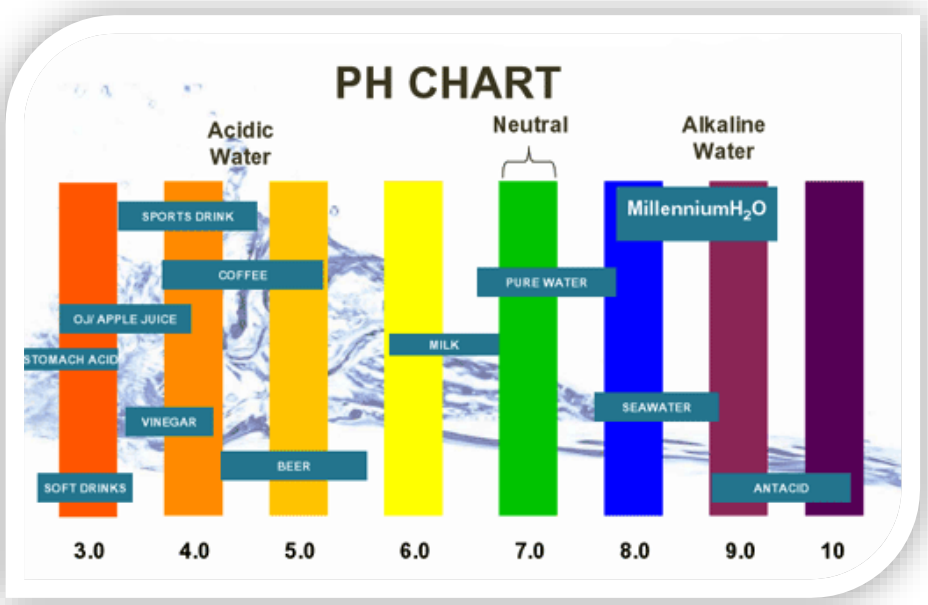
1. Fill in your table:

Indicator	What is it?	Why is it important?	Acceptable level/condition
Dissolved Oxygen			

2. Does cold water hold more or less dissolved oxygen than warm water?
3. What are 3 factors that influence dissolved oxygen levels? Explain how each factor impacts the water system.
4. High turbidity in a local pond has caused a decrease in ability for plants to do photosynthesis as well as increased the temperature of the water. Hypothesize the most likely outcome for organisms that live in that water system and formulate 2 options to reverse the current effects of the high turbidity.

Station 2: pH LEVELS

pH measures how acidic or basic (alkaline) the water is. High or low pH readings are signs of an unhealthy water system. Neutral water has a pH of 7. Most aquatic life functions best in water at a neutral or slightly basic (8 to 9) pH. Some swamp organisms do well in more acidic water, with a pH of 3 to 5. Water may become too acidic (low # pH) from acid rain. Water may become too basic (high pH) from an overgrowth of algae. In general, acceptable pH levels for most aquatic life ranges from 6.5 to 9.



Answer the following questions on your paper in complete sentences.

1. Fill in your table:

Indicator	What is it?	Why is it important?	Acceptable level/condition
pH level			

2. What causes water to become too acidic? WHY?
3. What causes water to become too basic (alkaline)? WHY?
4. Create a diagram that compares and contrasts the ideal living conditions of a swamp creature versus an average aquatic fish. In your diagram, be sure to include at least 3 points/ideas in each category.
5. Explain how the pH level of a water system can influence the types of organisms that live in that entire ecosystem.

Station 3:
BIO-INDICATORS

Recall that the prefix bio means "life". Bio-indicators are organisms or parts of organisms that are used to assess ecosystem health. Trout are a sensitive fish species. The presence of such species in water can show that a water system is healthy. The presence or abundance of certain shellfish or insects can also show a water system's health. Another bio-indicator is the condition or health of water organisms. If fish suffer from disease, their condition shows that the water system is unhealthy.

Many bio-indicators measure the presence and abundance of different kinds of algae. For example, water with high levels of chlorophyll indicates a water with high numbers of algae. This, in turn, may suggest that an algal bloom is occurring. In some cases, a high number of algae can indicate a healthy water system. This occurs when the algal species present are a good food source for animals and do not cause toxic booms.

Bioindicators offer several types of rather unique information not available from other methods: (1) early warning of environmental damage; (2) the integrated effect of a variety of environmental stresses on the health of an organism and the population, community, and ecosystem; (3) relationships between the individual responses of exposed organisms to pollution and the effects at the population level; (4) early warning of potential harm to human health based on the responses of wildlife to pollution; and (5) the effectiveness of remediation efforts in decontaminating waterways.

Answer the following questions on your paper in complete sentences.

1. Fill in your table:

Indicator	What is it?	Why is it important?	Acceptable level/condition
Bio-indicator			

2. What makes trout a bio-indicator?
3. Does a high level of algae always indicate an unhealthy water system? Why or why not?
4. Create a procedure (at least 5 steps) using bio-indicators that you could do to determine the health of a body of water or an ecosystem.

Station 4:
TURBIDITY

Turbidity is a measure of how clear water is. Clear water has low turbidity and is desirable for an aquatic environments. High turbidity, or unclear water (think very cloudy), is a sign of an unhealthy water system. Silt and sediment (dirt and soil) that enter water in run-off can increase turbidity. Algal blooms, rapid growth of algae encouraged by too many nutrients in the water can also cause high turbidity.

When turbidity is too high, the particles of sediment and dirt in water may keep plants and algae from getting enough light to perform photosynthesis. When plants cannot perform photosynthesis, oxygen is not created and the level of dissolved oxygen in the water decreases. Lowered levels of dissolved oxygen harm aquatic life and the aquatic environment. Too many particles of sediment in water can also clog the gills of fish. Some organisms, like shellfish (continual filter-feeders) can become choked by sediment and eventually die in heavily turbid waters.

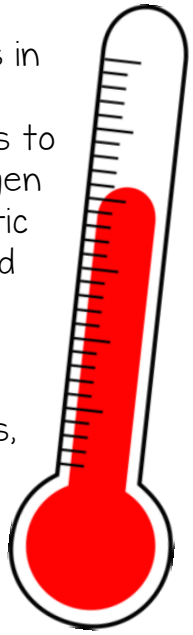
Answer the following questions on your paper in complete sentences.

1. Fill in your table:

Indicator	What is it?	Why is it important?	Acceptable level/condition
Turbidity			

2. What are 2 causes of increased turbidity?
3. Explain how the level of dissolved oxygen in the water can decrease with high turbidity.
4. Construct a visual representation of 3 glasses of water: Glass A has high turbidity, Glass B has mid-level turbidity, Glass C has low turbidity.
5. Use the following terms below to construct a "Connections Map" by drawing lines between those that can be connected AND writing/describing HOW they are related on each connection line.
   Photosynthesis high turbidity dissolved oxygen sediment algae

Station 5:
TEMPERATURE



Aquatic organisms are dependent on certain temperature ranges for optimal (ideal/best) health. Temperature affects many other indicators in water, including the amount of dissolved oxygen available, as well as the types of plants and animals present, and the susceptibility of organisms to parasites, pollution and disease. Cold water can hold more dissolved oxygen than warmer water can, thus making the environment better for aquatic life. Measurements that show high water temperatures or low dissolved oxygen levels are indicators of an unhealthy water system. As water temperatures increase, the dissolved oxygen levels decrease.

Causes of temperature changes in the water include weather conditions, shade and discharges into the water from urban sources or ground water inflow. Temperature varies by season but acceptable temperatures for water range from 0 to 35 degrees Celsius. Any temperature above 35 degrees Celsius (95 degrees Fahrenheit) can harm aquatic life and the environment.

Answer the following questions on your paper in complete sentences.

1. Fill in your table:

Indicator	What is it?	Why is it important?	Acceptable level/condition
Temperature			

2. List 3 other indicators that are affected by temperature.
3. Why is cold water better for aquatic life than warmer water? Explain.
4. Construct a graph that shows show temperature is related to dissolved oxygen levels. Be sure to 1) label all parts of your graph and 2) provide a description of how each variable (temperature or dissolved oxygen) changes as it relates to the other.