

What You Need to Know

Essential Standard: 8.E.1 Understand the hydrosphere and the impact of humans on local systems and the effects of the hydrosphere on humans.

Clarifying Objective: 8.E.1.3 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

Students need to know:

· that the health of a water system is determined by the balance between physical, chemical and biological variables.

- Physical variables include temperature, turbidity, and water movement. Chemical variables include dissolved oxygen and other gases, pH, nitrates, and salinity. Both natural and man-made forces are constantly changing these variables. Freshwater systems are of particular concern because they are the source of most of the potable water consumed by humans. Testing for the occurrence of chemicals and other factors that can influence water quality, such as nutrients and pesticides in water resources is a normal part of public health maintenance and stewardship of freshwater resources. Water that is safe to drink is called potable water, or drinking water, in contrast to safe water, which can be used for bathing or cleaning. In the United States, the Environmental Protection Agency sets maximum levels for the 90 most commonly occurring contaminants.

· that the temperature of water in rivers and lakes determines the kinds of organisms that can survive there.

- Particular aquatic species have preferred water temperature ranges within which they will live and thrive. Warm water dissolves more of a solid substance as it gets warmer, but it also dissolves less of important gases like oxygen and carbon dioxide. Very warm water may not contain enough dissolved oxygen for aquatic life to survive.

· that measuring dissolved oxygen is an important factor in determining water quality.

- Dissolved oxygen (commonly called DO, pronounced dee-oh) is oxygen that is dissolved in water. Dissolved oxygen (DO) is a measure of the amount of oxygen in water that is available for chemical reactions and for use by aquatic organisms. In the aquatic ecosystem, dissolved oxygen balance in

water is important for the survival of certain microorganisms and higher organisms such as zooplankton and fish. Normally oxygen in water gets there through diffusion with the air and as a waste product of photosynthesis by aquatic plants. Dissolved oxygen in surface water is used by all forms of aquatic life; therefore, it is measured to assess the "health" of lakes and streams. Dissolved oxygen levels vary with seasons, and over 24 hour cycles. When dissolved oxygen levels in a body of water decline, sensitive animals may move away, weaken, or die. High DO levels in potable water usually make it taste better.

· **that pH is a measure of how acidic or basic water is.**

- pH is important because it controls many chemical and biological processes that occur in the water. pH is measured on a scale that ranges from 0 to 14, with 7 considered neutral. Values of pH less than 7 are acidic, while values higher than 7 are basic. The pH scale ranges from 0 (high concentration of positive hydrogen ions, strongly acidic) to 14 (high concentration of negative hydroxide ions, strongly basic). In pure water the pH measures exactly 7. Students know that the pH of a body of water is important because pH has a synergistic effect. This means that the impact of other materials in a body of water (such as iron, aluminum, ammonia, or mercury) is amplified or diminished depending on the pH of the water. For example, when acidic waters come into contact with certain chemicals and metals, it makes these chemicals and metals more poisonous than normal. This has special significance in water treatment processes, because specific water treatment processes require specific pH ranges.

· **that nitrogen and phosphorous are essential plant nutrients.**

- The nitrates and phosphates derived from them are chemicals that pose possible health risks to humans if their presence in drinking water is not controlled. The major sources of nitrates in surface water include runoff contaminated with fertilizers, septic tank leakage, sewage, and erosion of natural deposits. Phosphates, on the other hand, usually enter waterways from human and animal waste, laundry, cleaning and industrial effluents.

· **that turbidity is a measure of how clear water is.**

- The more suspended solids there are in a water sample, the less transparent it is. Turbidity is considered a good measure of water quality. In drinking water, high turbidity is generally not considered a favorable sign because it can be associated with organic pollution that might include pathogenic materials. In surface bodies of water, high turbidity can lead to increased water temperatures, low dissolved oxygen, and even physical impairment of aquatic organisms.

· **that the water quality of a body of water can also be assessed by using bioindicators (macroinvertebrates).**

- The presence, condition, and numbers of the types of fish, insects, algae, plants and other aquatic life provide accurate information about the health of freshwater, coastal and marine waters. Bioindicators include living macroinvertebrates. Macroinvertebrates are easy for people to collect and identify. Because many macroinvertebrates are sensitive to pollution in water, they are a good indicator of whether or not a body of water is livable. Good water quality is indicated by a variety of macroinvertebrates. Poor water quality is indicated by a few of one type of macroinvertebrates in one place.

BOTTOMLINE: *The health of a water system is determined by the balance between physical, chemical and biological variables. Physical variables include temperature, turbidity, and water movement. Chemical variables include dissolved oxygen and other gases, pH, nitrates, and salinity. Both natural and man-made forces are constantly changing these variables. The health of water systems is dependent on the balance of its many natural systems. Ocean habitats are defined by environmental factors-interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, substrate and circulation. Population diversity provides insights into the health of a water system. Tolerance to water quality conditions varies among organisms. Clear water may contain odorless, tasteless, and colorless harmful contaminants. Water must be tested for specific contaminants such as bacteria, nitrates, arsenic and others. Bio-indicators (insects) are studied to indicate environmental quality such as water flow, pollution, and vegetation. Some play a very important role in stream and pond ecosystems, often serving as a biological indicator of the quality of a water system.*

Reference: North Carolina Department of Public Instruction, Essential Standards: Grade 8 Science, Unpacked Content, September 2012 Revision, http://scnces.ncdpi.wikispaces.net/file/view/Unpacked_Content_Grade8Science_RevisedSeptember2012.docx.pdf/368725266/Unpacked_Content_Grade8Science_RevisedSeptember2012.docx.pdf