Review

- Quickly discuss these questions
  - Where does our drinking water come from?
  - When you flush the toilet, does that water end up in a home's tap water?
  - How do we know that the water in the tap is safe?
  - If water is contaminated, can it be cleaned?

Human activities do impact water sources.

- Golf course (fertilizers)
- Water parks (human waste)
- Home (sewage)
- Car washing
- Rain water in cities (gutters on the roads)
- Garbage dumps / landfills
- Paint, pesticides, litter, chemical fertlizers
- Corrosion from plumbing

Water Will have Contaminants

- Contaminants will have to be removed or treated
- Some will be visible to the naked eye:
  - Sediment
  - Large particles like tree branches, twigs, animal carcass
  - Smaller particles leaves, grass, animal waste
  - Particles not visible: dissolved in the water

Today

You will test different water for contaminates.

- These are the contaminants you are testing for:
  - pH (acidity vs alkalinity)*
  - Nitrate* nitrogen
  - Phosphate
  - Dissolved Oxygen

Contaminants and their Effects

Contaminant	Source	Effect on health
pH (acidity vs alkalinity)*	Acid (low pH) Alkalinity, limestone (high pH)	Low pH: Bitter metallic taste
Nitrate* nitrogen	Runoff from fertilizer	Infants (< 6 mo.) May become seriously ill/ die
Phosphate* phosphorous	Sewage; Runoff from agriculture sites; lawn fertilizers	Severe exposure: kidney weakened

Contaminants and their Effects

Contaminant	Source	Effect on health
Dissolved oxygen 	The sources of dissolved oxygen (D.O.) in natural waters is from **atmosphere** and **photosynthesis** of plants. Oxygen is absorbed in water by direct diffusion and by surface-water agitation. An excess of decaying organic material (from dying algae and other organisms).	When a body of water is over productive, the oxygen in the water may get used up faster than it can be replenished. This occurs when a body of water is overstocked with organisms or if there is a large algal bloom die-off.

Test water samples

- You will test water samples for:
  - pH
  - Nitrate
  - Phosphate
  - Dissolved Oxygen
- We will have multiple samples:
  - Canal
  - Well water
  - Lake water
  - Treated Water

Each student will keep track of their results using the science notebooks

WaterSCIENCE Water Test Results

Test for …	Sample A	Sample B	Sample C	Sample D
pH				
Nitrate				
dissolved oxygen (O_2)				
Phosphates				

dissolved oxygen

Dissolved Oxygen (DO) is important to the health of aquatic ecosystems. All aquatic animals need oxygen to survive. Natural waters with consistently high dissolved oxygen levels are most likely healthy and stable environments, and are capable of supporting a diversity of aquatic organisms. Natural and human-induced changes to the aquatic environment can affect the availability of dissolved oxygen.

Dissolved Oxygen % Saturation is an important measurement of water quality. Cold water can hold more dissolved oxygen than warm water. For example, water at 28°C will be 100% saturated with 8 ppm dissolved oxygen. However, water at 8°C can hold up to 12 ppm of oxygen before it is 100% saturated. High levels of bacteria from sewage pollution or large amounts of rotting plants can cause the % saturation to decrease. This can cause large fluctuations in dissolved oxygen levels throughout the day, which can affect the ability of plants and animals to thrive.

dissolved oxygen procedure

1. Record the temperature of the water sample (see page 28).

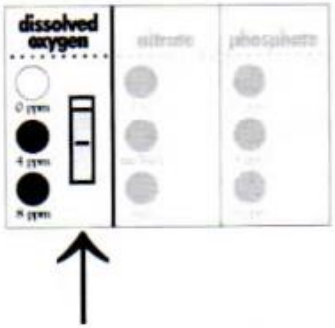
2. Submerge the small tube (0125) into the water sample. Carefully remove the tube from the water sample, keeping the tube full to the top.

3. Drop two Dissolved Oxygen TesTabs® (3976A) into the tube. Water will overflow when tablets are added.

4. Screw the cap on the tube. More water will overflow as the cap is tightened. Make sure no air bubbles are present in the sample.

5. Mix by inverting the tube over and over until the tablets have disintegrated. This will take about 4 minutes.

6. Wait 5 more minutes for the color to develop.



7. Compare the color of the sample to the Dissolved Oxygen color chart. Record the result as ppm Dissolved Oxygen.

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.

For example: if the water sample temperature is 16°C and the Dissolved Oxygen result is 4 ppm, then the % Saturation is 41.

% saturation

Dissolved Oxygen

Temp°C	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

*Calculations based on solubility of oxygen in water at sea level, from Standard Methods for the Examination of Water & Wastewater, 18th edition.

nitrate

Nitrate is a nutrient needed by all aquatic plants and animals to build protein. The decomposition of dead plants and animals and the excretions of living animals release nitrate into the aquatic system. Excess nutrients like nitrate increase plant growth and decay, promote bacterial decomposition, and therefore, decrease the amount of oxygen available in the water.

Sewage is the main source of excess nitrate added to natural waters, while fertilizer and agricultural runoff also contribute to high levels of nitrate.

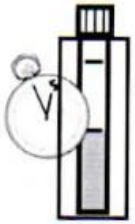
Drinking water containing high nitrate levels can affect the ability of our blood to carry oxygen. This is especially true for infants who drink formula made with water containing high levels of nitrate. **You should always have a professional lab test your drinking water for the presence of nitrate.**

nitrate procedure

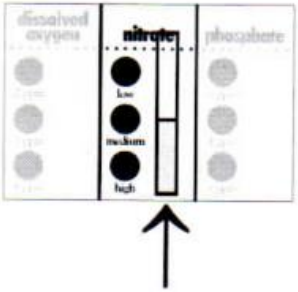
1. Fill the test tube (0106) to the 5 mL line with the water sample.

2. Add one *Nitrate Wide Range CTA TesTab (3703A). Immediately slide the test tube into the Protective Sleeve (0106-FP).

3. Cap and mix by inverting for two minutes to disintegrate the tablet. Bits of material may remain in the sample.



4. Wait 5 minutes for the red color to develop. Remove the tube from the Protective Sleeve.



5. Compare the color of the sample to the Nitrate color chart. Record the result as ppm Nitrate.

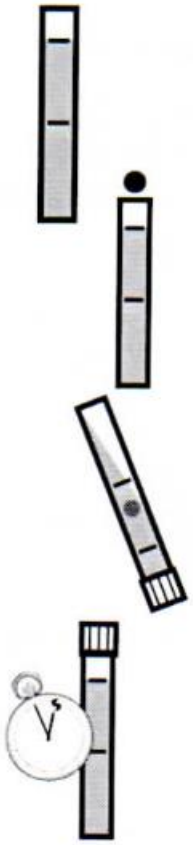
NOTE: Nitrate Wide Range CTA TesTabs (3703A) are sensitive to UV light. The Protective Sleeve (0106-FP) will protect the reaction from UV light. If testing indoors, there is no need to use the Protective Sleeve in this procedure.

phosphate

Phosphate is a nutrient needed for plant and animal growth and is also a fundamental element in metabolic reactions. High levels of this nutrient can lead to overgrowth of plants, increased bacterial activity, and decreased dissolved oxygen levels.

Phosphate comes from several sources including human and animal waste, industrial pollution, and agricultural runoff.

phosphate procedure



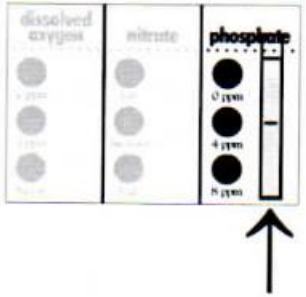
1. Fill the test tube (0106) to the 10 mL line with the water sample.

2. Add one Phosphorus TesTab (5422A).

3. Cap and mix by inverting until the tablet has disintegrated. Bits of material may remain in the sample.

4. Wait 5 minutes for the blue color to develop.

NOTE: If the sample does not develop a blue color (sample is colorless), record the result as 0 ppm.



5. Compare the color of the sample to the Phosphate color chart. Record the result as ppm Phosphate.

pH

pH is a measurement of the acidic or basic quality of water. The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), with 7 being neutral. The pH of natural water is usually between 6.5 and 8.2. Most aquatic organisms are adapted to a specific pH level and may die if the pH of the water changes even slightly.

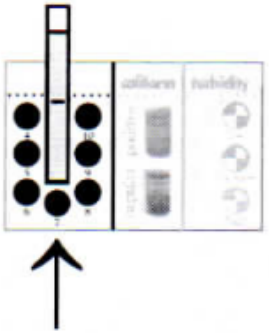
pH can be affected by industrial waste, agricultural runoff, or drainage from improperly run mining operations.

pH procedure

1. Fill the test tube (0106) to the 10 mL line with the water sample.

2. Add one pH Wide Range TesTab (6459A).

3. Cap and mix by inverting until the tablet has disintegrated. Bits of material may remain in the sample.



4. Compare the color of the sample to the pH color chart. Record the result as pH.