STREAMWATCH SCHOOLS CHEMICAL TEST PROCEDURE

Description

These chemical tests are a great way to introduce students to water quality! This document is for teachers and will give descriptions of how to perform all the tests. **Bold** text indicates something that might be helpful to keep in mind**.** Each test will also have its own detailed instruction sheet (with steps and images) to pass out to students. **If you don't have a lot of time, it works great if you divide the class into groups and provide each group with 1-2 tests. If you have a lot of time, and enough materials, you may want your students to try all the tests!**

These tests are based around the materials from LaMotte water monitoring tablet test kits. Go to https://lamotte.com/products/environmental-science-education/water-monitoring-kits/tablet-test-kits/earth-forcer-standard-water-monitoring-kit-5848 to view the kit we use for these tests. **It should be noted that the hydrometer for the salinity test is not included in this kit and would need to be borrowed or purchased separately.** The Watershed Institute may be able to provide these materials for your class. More information is available on our website or you can email dbush@thewatershed.org for more information.

Before starting the tests:

Explain the proper way to dispose of the chemicals when we're finished with them. If we add any chemicals to the stream water, they become pollution. Please dispose of the samples in a separate container. The container can be small; the size of a 16 oz water bottle is more than enough. **The exceptions are the salinity and turbidity tests because those tests do not involve adding chemicals to the water.** When you're finished at the stream, your chemical waste can go down a drain **with lots of running water to dilute it.**

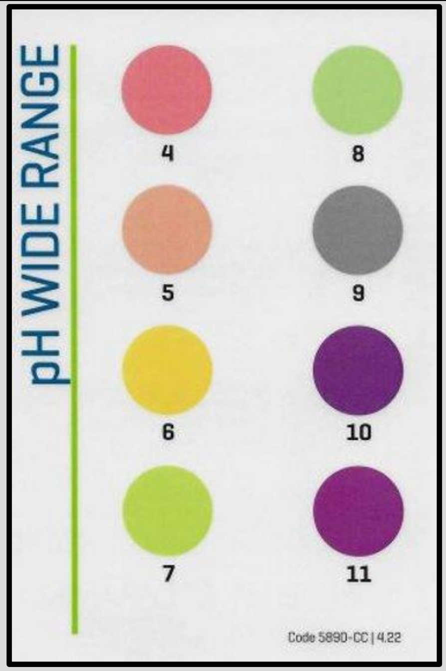
It's also important to note that not every test is appropriate for all grades. **Grades 3 and up** can likely perform every test with guidance and supervision. Tests highlighted in blue are what we recommend for grades K-2.

Temperature:

This one is great for when a group finishes their tests quickly. It gives them something to work on while the others finish up!

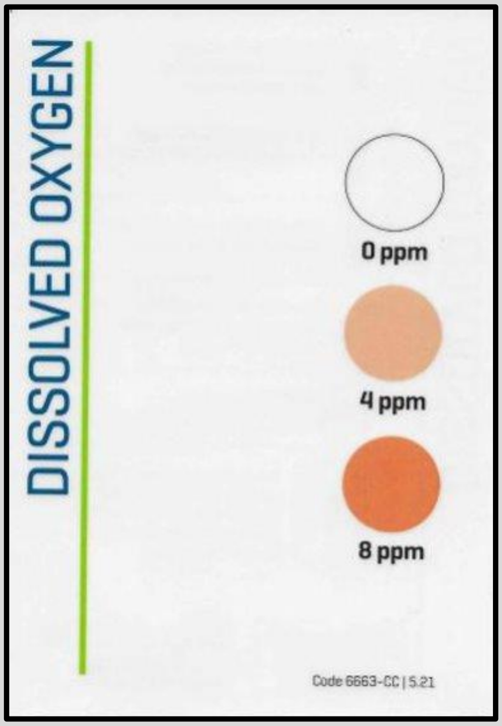
1.) Take the air temperature first. Wait at least 2 minutes before getting a reading to give the thermometer time to change.

2.) Hold the thermometer under the water for at least 2 minutes before getting a reading.

1.) Using stream water, fill the test tube to the 10 mL line.	2.) Add one pH tablet to the sample.	
3.) Cap the tube and mix until the tablet dissolves.	4.) The sample will change color. Compare the color of the sample to the pH Color Chart. **The colors are clearer if you look at them with a white background. Hold a white piece of paper behind the sample if that's helpful to you and your class.**	
5.) Record the pH value on the data sheet.		

***Note: pH can be a tricky concept for younger kids. It can help to compare it to the Goldilocks principle. If the pH is too high, it's hard for most organisms to survive. Too low and the same thing will happen. A pH of about 7 (6.5-8) is "just right."**

1.) Using stream water, fill the test tube so that it is overflowing. It’s easier if you submerge the tube completely.	2.) Add two Dissolved Oxygen tablets.
3.) Cap the tube. Try to make sure there are no air bubbles in the sample. This will affect the result. You can try *gently* tapping the test tube to remove bubbles.	4.) Mix until the tablets have dissolved.
5.) Wait five minutes **(if pressed for time, 2-3 minutes is usually good enough)**.	6.) Compare the color of the sample to the Dissolved Oxygen Color Chart. Record the data.



Optional (best for older kids): Find the percent saturation of the dissolved oxygen. Use the dissolved oxygen concentration and the water temperature and reference the chart to the right.

***Note: The Dissolved Oxygen test is a great way to remind students that animals living underwater still need oxygen; they just don’t breathe it the same way we do. Generally, higher levels of dissolved oxygen are better.**

High dissolved oxygen means that more creatures can live there, and it helps them grow!

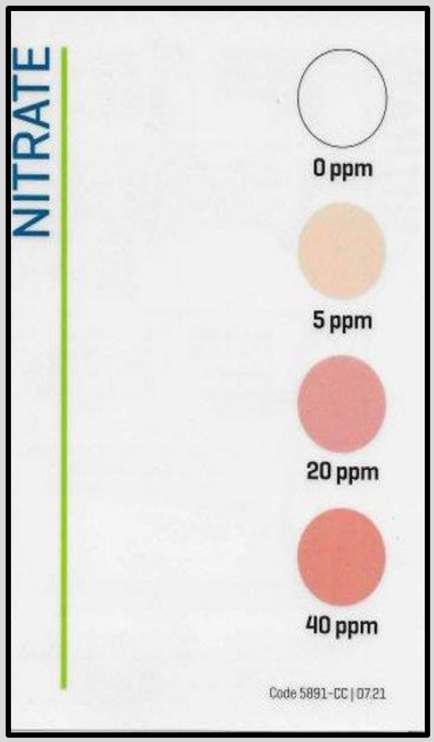
PERCENT SATURATION

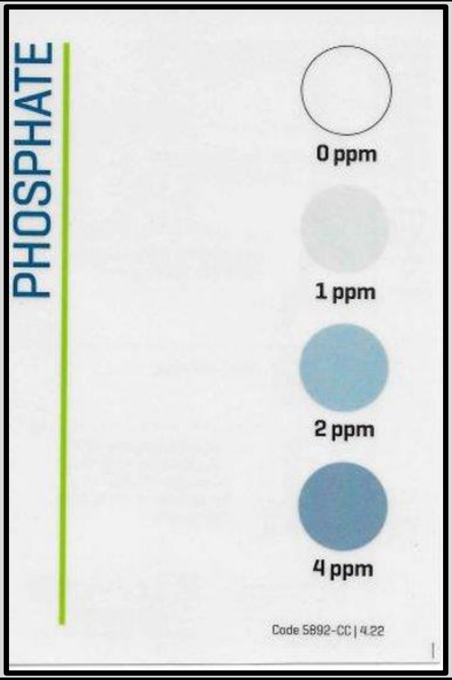
TEMP°C	DISSOLVED OXYGEN 0 ppm	4 ppm	8 ppm
2	0	29	58
4	0	31	61
6	0	32	64
8	0	34	68
10	0	35	71
12	0	37	74
14	0	39	78
16	0	41	81
18	0	42	84
20	0	44	88
22	0	46	92
24	0	48	95
26	0	49	99
28	0	51	102
30	0	53	106

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

DISSOLVED OXYGEN (% SATURATION)	SCORE
91-110	4 (excellent)
71-90	3 (good)
51-70	2 (fair)
<50	1 (poor)

1.) Using stream water, fill the test tube to the 5 mL line.	2.) Add one Nitrate *#1* tablet to the sample.
3.) Cap the test tube and mix until the tablet has dissolved.	4.) Add one Nitrate *#2* tablet to the sample. Cap the test tube and slide it into the protective sleeve (0106-FP).
5.) Mix until the tablet dissolves.	6.) Wait five minutes; the sample will change color **(if pressed for time, 2-3 minutes is usually good enough).**
7.) Take the sample out of the protective sleeve and compare the color to the Nitrate Color Chart. If the reaction is yellow, record the result as 0 ppm.	8.) Record the data on the data sheet.

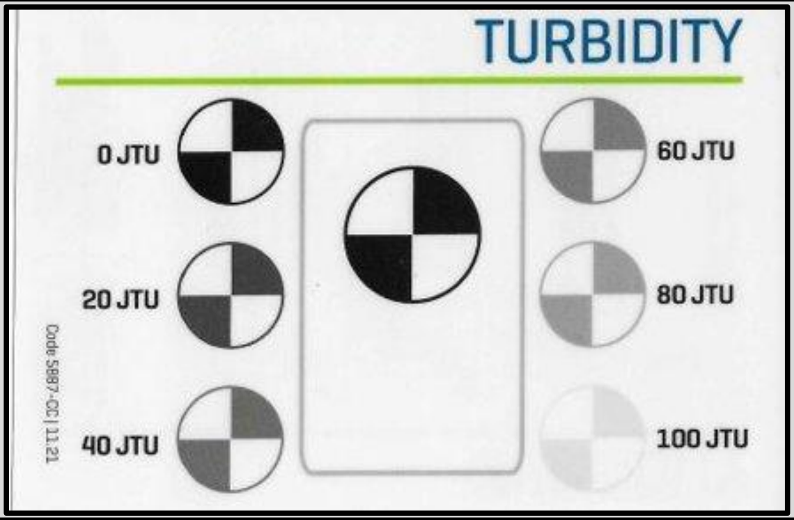


1.) Using stream water, fill the test tube to the 5 mL line.	2.) Add one Phosphorus tablet.	
3.) Cap the test tube and mix until the tablet dissolves.	4.) Wait five minutes; the sample will change color **(if pressed for time, 2-3 minutes is usually good enough).**	
5.) Compare the color of the sample to the Phosphate Color Chart.	6.) Record the data on the data sheet	

***Note: nitrates and phosphates typically go hand-in-hand. Both are considered chemical pollutants. Generally, the smaller the amount, the better!**

Turbidity

1.) Using stream water, fill the turbidity tube to the line.	2.) Place the tube in the middle of the Turbidity Chart.
3.) Look into the sample tube from above. Notice the “Secchi Disk” icon at the bottom.	4.) Compare the appearance of this “Secchi Disk” icon to the icons on the Turbidity Chart on either side of the tube. Determine which one matches best. This will give you the turbidity in JTU (Jackson Turbidity Units).
5.) Record your data and return the water to the stream.	



*Notes:

We’re specifically looking at how clearly you can see that Secchi Disk icon. Don’t focus too much on the color of the sample. The water can be dark in color but still clear.

Turbidity can be a tricky concept for students. High turbidity is associated with murky water and is usually a bad thing. It can help to think of a fish’s perspective. If the water is murky (high turbidity), the fish will have a harder time finding food and the particles can get in their eyes and gills. You may also choose to explain that the murkiness is not *always* a bad thing because it can also help the fish hide from predators better.

Salinity

1.) Using stream water, fill the hydrometer up to where “Specific Gravity” is written.

2.) Gently tap the hydrometer to get rid of any air bubbles if they are present.

3.) Hold the hydrometer straight up and down so that it is level.

4.) Read the Salinity **(use the leftmost numbers: the ones on the outside of the curve, not the ones that all start with a 1).** When finished, return the sample water to the stream and record your data

Reminders and FAQs

- **How do salts, oxygen, and other chemicals get into the stream?**
    - **Oxygen:** Oxygen comes from submerged plants and algae. It also dissolves into the water directly from the atmosphere. If there's a lot of mixing and splashing in the water, more oxygen will be dissolved. Also, it's important to note that colder water can dissolve more oxygen.
    - **pH:** The pH of surface water (lakes, rivers, and oceans) is slightly below 7 most of the time—meaning it's slightly basic. This is usually because of the surrounding rocks and land that erode and enter the water. However, because of the fumes humans put into the air with our vehicles and factories, rainwater can be slightly acidic and raise the pH of our streams. It's interesting to see how the pH changes after a big rainstorm!
    - **Nitrates and phosphates:** These chemicals can travel into the water through fertilizer runoff; when there's a rainstorm, fertilizers may wash away from grass and plants and find their way into a stream. Wastewater and animal waste can also contribute to higher levels of nitrates and phosphates.
    - **Turbidity:** Higher levels of floating algae, soil washing into the water, and human activity like dredging or recreational activities will reduce water clarity and therefore increase turbidity.
    - **Salinity:** Salts can enter the water naturally from the nearby rocks. Humans also increase salinity when we salt our roads in the winter. Rainwater carries salt into the streams.
- **What is the protective sleeve for in the nitrate test?**
    - Don't worry; no danger here! The nitrate tablets are sensitive to the sun's UV light, so we use the sleeve when performing these tests outdoors.

- **What is percent saturation?**
    - Water is considered "saturated" with something when no more of a substance can be dissolved or combined. Percent saturation is a way to describe how close the water is to being saturated with dissolved oxygen. Colder water will dissolve more oxygen, however, which is why we must use the percent saturation chart.
- **What happens when water's nitrate and phosphate levels are too high?**
    - This can lead to eutrophication, which describes when a body of water has too many nutrients. This causes too many algae to grow in the area (a harmful algal bloom or HAB). When algae die, the bacteria that consume the algae end up depleting the dissolved oxygen in the water, meaning fewer creatures can survive.
- **What do ppm and ppt stand for?**
    - We use ppm as the unit for phosphates, nitrates, and dissolved oxygen and ppt as the unit for salinity. Ppm stands for "parts per million" and ppt for "parts per thousand." They are both concentrations; if the nitrate value is 1 ppm that means there is 1 mg of nitrates for every liter of water. A salinity of 1 ppt means 10 grams of salt per liter of water.
- **What is JTU?**
    - JTU stands for "Jackson Turbidity Units," named for scientist Daniel D. Jackson. We use JTU to measure turbidity (water clarity).
- **Is there such a thing as too much dissolved oxygen?**
    - Yes, but it is rare. If the water becomes supersaturated with *any* gas, it can cause gas bubble disease, which makes bubbles form in eyes, skin, and gills.