Water Quality Testing Lab

Coliform Bacteria:

Fecal coliform bacteria are naturally present in the human digestive tract but are rare or absent in unpolluted waters. Coliform bacteria should not be found in well water or other sources of drinking water. Their presence in water serves as a reliable indication of sewage or fecal contamination. Although coliform bacteria themselves are not pathogenic, they occur with intestinal pathogens that are dangerous to human health. This presence/absence total coliform test detects all coliform bacteria strains and may indicate fecal contamination.

The coliform test in this kit will indicate if you have above or below 20 coliform colonies per 100mL of well or river waters. See chart for significant levels.

Fecal coliform bacteria per 100 mL water

Desirable	Permissible	Water Use
0	0	Potable and well water (for drinking)
<200	<1,000	Primary contact (for swimming)
<1,000	<5,000	Secondary contact (for boating & fishing)

Reactions:

Negative:

- Gel remains at bottom of tube
- liquid above gel is clear
- Indicator remains red or turns yellow with no gas bubbles
- Indicates less than 20 total coliform colonies per 100 mL of water.

Positive:

- Many gas bubbles present
- Gel rises to the surface
- Liquid below gel is cloudy
- Indicator turns yellow
- Indicates more than 20 total coliform colonies per 100mL of water.

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 decoy, 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.

Nitrate Procedure:

1. Fill the test tube to the 5 mL line with the water sample.
2. Add one *Nitrate Wide Range CTA TesTab.
3. Cap and mix by inverting for two minutes to disintegrate the tablet.
4. Compare the color of the sample to the Nitrate color chart. Record as ppm Nitrate.
5. If no color change appears immediately, wait longer.

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 8ppm dissolved oxygen. However water at 8°C can hold up to 12ppm 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
2. Submerge the small tube 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® into the tube. Water will overflow when tablets are added.
4. Cover the tube with parafilm. 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
7. Compare the color of the sample to the Dissolved Oxygen color chart. Record the result as ppm Dissolved Oxygen.
8. Locate the temperature of the water sample on the % Saturation chart. Locate the Dissolved Oxygen result of the water at the top of the chart. The % saturation of the water sample is where the temperature row and the Dissolved Oxygen column intersect. Record the %

% Saturation

	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

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand (BOD) is a measure of the quantity of dissolved oxygen used by bacteria as they break down organic wastes. In slow moving and polluted rivers, much of the available dissolved oxygen is consumed by bacteria, robbing other aquatic organisms of the dissolved oxygen needed to live.

pH

pH is a measurement of the acidic or basic quality of the 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 to the 10 mL line with the water sample.
2. Add one pH wide Range TesTab.
3. Cap and mix by inverting until the tablet has disintegrated. Bits of the material may remain in the sample.
4. Compare the color of the sample to the pH color chart. Record the results as pH. If the color doesn't change right away wait longer.

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 to the 10mL line with the water sample.
2. Add one Phosphorus TesTab.
3. Cap and mix by inverting until the tablet is disintegrated. Bits of material may remain in the sample.
4. Wait 5-10 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. If the color doesn't change right away wait longer.

RANKING TEST RESULTS:

Rank the results of each water quality test on a scale of 1-4:

Test factor:	Result:	Rank:
Dissolved oxygen	91-110% Sat 71-90% Sat 51-70% Sat <50%	4 (excellent) 3 (good) 2 (fair) 1 (poor)
Coliform bacteria	Negative Positive	3 (good) 1 (poor)
pH	4 5 6 7 8 9 10	1 (poor) 1 (poor) 3 (good) 4 (excellent) 3 (good) 1 (poor) 1 (poor)
nitrate	5 ppm 20 ppm 40 ppm	2 (fair) 1 (poor) 1 (poor)
phosphate	1 ppm 2 ppm 4 ppm	4 (excellent) 3 (good) 2 (fair)

Pre Lab:

1. Where is your water from? Include a description of the area the water is from.
2. **Tests:** Summarize the source of each of the following nutrients and what is determined by each test:
    a. Coliform Bacteria
    b. Dissolved Oxygen
    c. Biochemical Oxygen Demand (BOD)
    d. Nitrate
    e. pH
    f. phosphates
3. **Qualitative Observations**: What does your water look like? Smell like?

Data Table:

Location: _____

Test:	Result	Rank
Coliform Bacteria		
Dissolved Oxygen		
Nitrate		
pH		
phosphates		

Conclusion Questions:

1. Compare the results of the 4 water sources? Are there differences? Similarities? What could account for these similarities or differences?
2. Which of your water quality measurements, if any, indicated an imbalance in the ecosystem? What are some potential causes for these changes? What might be the effects of this imbalance on the ecosystem?
3. Why is water quality monitoring important?
4. Is all pollution anthropogenic (man-made)? Support your answer.
5. What are some causes of water pollution?
6. What effect will excess nutrients such as nitrates and phosphates added to a lake through agricultural runoff have on a lake community
7. How might samples collected near the shore vary from those collected from the center of the stream?
8. What is the purpose of the Clean Water Act of 1972?
9. What are some long-term consequences of water pollution? How can water pollution affect humans?
10. What are some ways to prevent water pollution?