a. Temperature

i. Why is this test used?

Water temperature influences many systems in the watershed including: the amount of oxygen that can be dissolved in the water, the rate of photosynthesis by algae and larger aquatic plants, the metabolic rates of aquatic organisms, and the sensitivity of organisms to toxic wastes, parasites and diseases. Some animals can only live in cool water, like trout. (NOTE: Cold water can hold more oxygen than warm water.) One of the ways that humans can raise water temperature is by industrial pollution by adding warm water to the river or lake. Another source may be runoff from warm urban surfaces (streets, parking lots). Another source of temperature increases may be soil erosion. Soil erosion raises water temperatures because it increases the amount of suspended solids which is better at absorbing the sun's rays. Stream shading also affects water temperature, a tree lined stream will be cooler than one with just grass on the banks. In general, cool water is better.

ii. Water Quality Standards/What is an ideal temperature?

Water temperature determines what kind of fish (and other organisms will live in a particular habitat. Ideally there is under 5 degrees temperature difference in a stream reach.

A *coldwater* fishery has a temperature range of less than 70 degrees F. Most trout prefer a coldwater fishery.

A *coolwater* fishery has a temperature range of 65-75 degrees F. Walleye and perch prefer a coolwater fishery.

A *warmwater* fishery has a temperature range of greater than 75 degrees F. Bass and bluegill prefer a warmwater fishery.

iii. How to conduct the test

The purpose of this test is to get, as best we can, a measure of how far the temperature at your testing location is from the "equilibrium temperature" of the river.

The temperature test to be conducted measures the change in water temperature between two points –the test site and a site one mile upstream. By discovering river reaches that undergo rapid temperature changes, we can begin to uncover the sources of thermal pollution.

1. At the testing site, lower the thermometer four inches below the water's surface.

2. Keep the thermometer in the water until a constant reading is obtained (approximately two minutes).

3. Record your measurement in degrees Centigrade (to covert degrees Fahrenheit to degrees Centigrade (C = (*F -32.0)/ 2.80 OR *F = (*C x 1.80) + 32.0).

4. Repeat your measurements until you have three or four readings. Then calculate an average value. (Report this value to the Dissolved Oxygen testing team.)

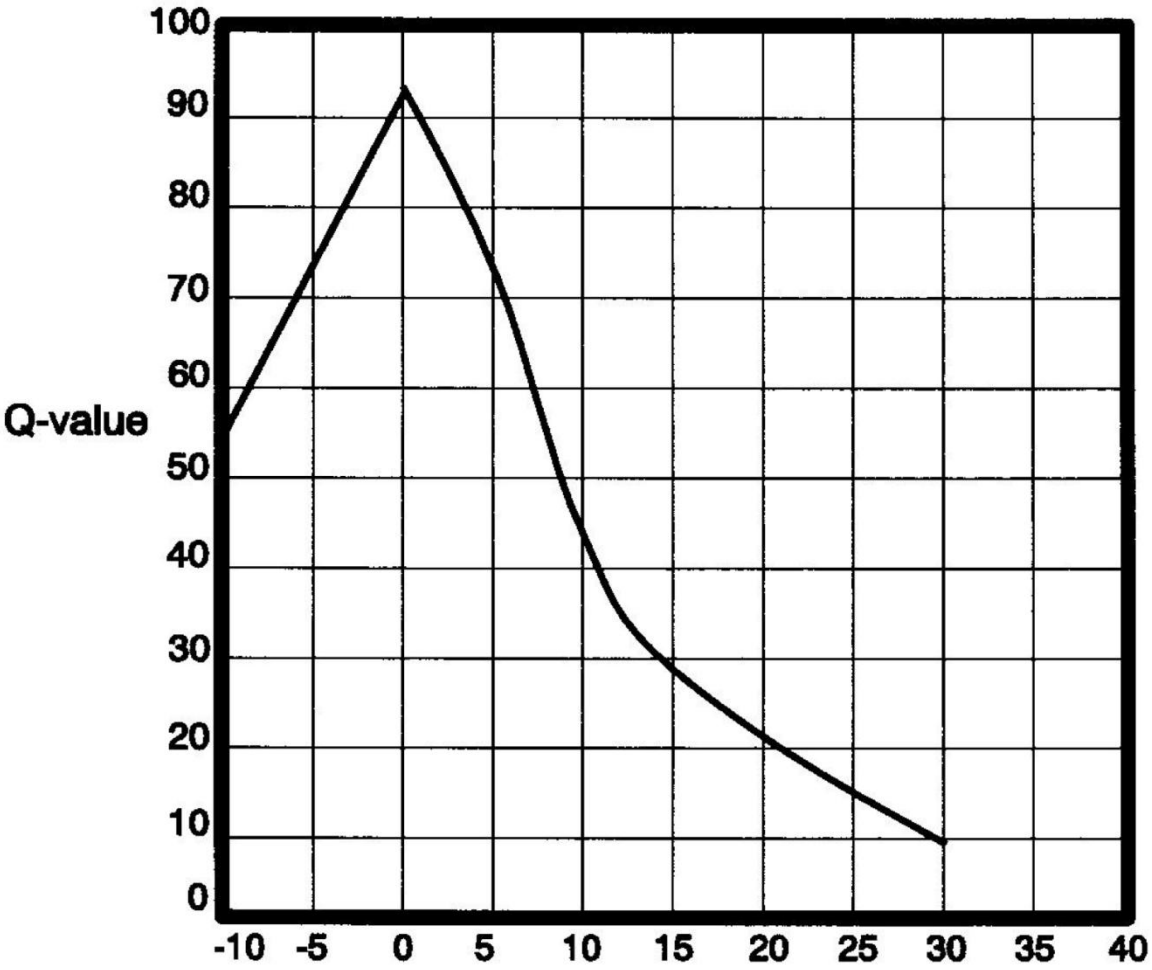
5. Repeat the test approximately one mile upstream as soon as possible. Try to make sure that the shading conditions are the same as at the downstream site (i.e., if you tested in partial shade downstream, pick a spot with the same amount of shading upstream). *Note: Make note of any possible sources of thermal pollution you see between or near the two sites.*

6. Subtract the upstream from the downstream temperature using this equation: Temp. downstream – Temp. upstream = Temp. change

7. Record your results (the Temp. change)

iv. Determining the Q-Value

Chart 5: Change in Temperature (ΔT, °C) Test Results



v. What To Watch Out For: Common Mistakes

1. Make sure you convert the temperature from Fahrenheit to Celsius before choosing the Q-value

2. When determining the Q-value, you are looking for the change in temperature between the two points, not the actual temperature.

3. Try to take both temperatures from a portion of the stream with the same amount of shading (if possible)

4. Try to take the second temperature reading as soon as you can after the first.

5. Wait for the temperature to stabilize. At least two minutes in the water.

6. Try to keep the thermometer below the surface of the water, but not touching the bottom of the stream.

vi. Consistency When Doing Multiple Tests

Water temperature can vary throughout the day, particularly if a weather event brings in water of a different temperature into a stream. Do temperature temps as close to the same time as possible for a consistent result.

vii. Analyzing the results

If there is a temperature change of more than 10 degrees C between the two locations, your students probably want to hypothesize about why that is the case. Possible explanations include:

1. Lack of stream shading

2. Stormwater input (runoff from the road or a parking lot)

3. A tributary stream enters the creek bringing water of significantly different temperature

4. Groundwater input (leads to cooler water)

5. Thermal pollution from a commercial or industrial source

Students can look at aerial photographs (such as Google maps) and look for potential inputs of water of differing temperatures.