

Environmental Science – Chapter 2 Test

“Water Quality Factors”

True & False

1. ___ Bodies of water with extensive plant growth have the lowest daily fluctuations in D.O.
2. ___ The lowest daily concentration of D.O. occurs just before dawn.
3. ___ Fecal coliform is a pathogenic organism.
4. ___ 7 is neutral on the pH scale.
5. ___ Above 7 on the pH scale is acidic.
6. ___ Parts of living plants and animals, their by-products, and their remains makes up organic phosphates.
7. ___ Phosphates and nitrates are naturally present in nature in equally low concentrations.

Fill in the Blank

8. _____ One part of a substance in one million parts of water, or $1/1,000,000^{\text{th}}$.
9. _____ The test that includes the measuring of dissolved solids and suspended solids.
10. _____ Same as ppm when you are talking about water.
11. _____ A measure of the relative clarity of the water.
12. _____ A measure of the amount of oxygen dissolved in water.
13. _____ The aging of a body of water caused by man's activities.
14. _____ A test that tests for the element needed by plants and animals to build protein.
15. _____ This is a measure of the quantity of oxygen that is used by aerobic bacteria as they decompose organic matter.
16. _____ This test measures the amount of phosphate in water.
17. _____ This test measures the amount of bacteria found in the feces of warm-blooded animals that there is in water.

18. _____ Very important to water quality, this test affects the amount of oxygen that can dissolved in water, metabolic rates, and the sensitivity of organisms to toxic wastes, parasites, and diseases.
19. _____ The addition of warm water to a body of water by industry and storm water.
20. _____ A test that measures the H⁺ ions and the OH⁻ ions in liquids and substances.

Short Answer

21-22. If a shallow lake had an early freeze-over date and then had a foot of snow sit on the ice for three months over the winter, what test would probably give the best indication of whether or not you will have a massive die-off of fish? Why?

23.-24. If your water had an unpleasant taste and some laxative effects, what test would you do on it to see what water purification system you would need? Why?

25.-26. What test would you do if you were concerned about "blue-baby syndrome"? Why?

27-28. If you had a very large rainfall event in a short period of time in the early spring before all the crops were up and the fields were bare, what test would probably be affected the most when we test the river? Why?

29.-30. You work for John Morrell in Sioux Falls and you are in control of how well the waste water used in the processing is treated. If the waste water could contain parts of the animals being processed, what test would you be most concerned with? Why?

31-32. This element is found in small amounts naturally in nature but is increased when manure is spread on the fields. After a big rain or manure spill in water there is usually a very large algae bloom. Which test will show this element as being high? Why?

33.-34. Which test would be greatly affected by the cutting down of trees along a body of water or massive amounts of soil eroding into a body of water? Why?

35.-36. Which test would be used widely in an area that has had a history of acid rains? Why?

37.-38. If you were in charge of a swimming beach in an area that has a lot of livestock confinements around the lake, which test would you have to keep a close eye on to make sure it is safe to swim there? Why?

39.-40. As far as Iowa's water is concerned, what is the number one factor that affects it's quality? Why?

41.-42. From when we traveled around Rock Valley in the bus, give one example of good water quality protection and an example of one thing you saw that could be bad for water quality.

43.-44. What are two things a farmer could do to reduce water pollution around Rock Valley?

45.- 46. What are two things that we as town's people can do to reduce water pollution?

Water Quality Data

D.O. – 12mg/L

Fecal Coliform – 200 colonies

pH – 8.1 units

B.O.D. – Day 1-12 mg/L, Day 2-9mg/L

Temp. – Site 1 5 degrees C, Site 2 8 degrees C

Total Phosphate - .5 mg/L

Nitrate – 8 mg/L

Turbidity – Secchi Disk - 5 inches

Total Solids – 100 mg/L

Atmospheric Pressure (mmHg)	Equivalent Altitude (ft.)	Correction Factor
775	540	1.02
760	0	1.00
745	542	.98
730	1094	.96
714	1688	.94
699	2274	.92
684	2864	.90
669	3466	.88
654	4082	.86
638	4756	.84
623	5403	.82
608	6065	.80
593	6744	.78
578	7440	.76
562	8204	.74
547	8939	.72
532	9694	.70
517	10,472	.68

Figure 8. Correction table for dissolved oxygen measurements.

Sampling Procedures

Because DO levels vary so much according to time, weather, and temperature, this test should be run during the same period (week and time of day) if yearly comparisons are to be made. In rivers, there is usually adequate mixing of water from the surface to the river bottom. However, in impounded river reaches or in very large deep rivers there may be little mixing of the water. This could cause differences in DO measurements from the surface to the river bottom.

It is best to sample away from shore and below the water surface. In free-flowing rivers with good mixing, samples taken beneath the surface and in the current will probably be representative samples. In slow-moving river reaches and in impounded river areas with little mixing, it is very important to sample away from shore and to sample at various depths. Shore sampling will probably not provide a representative sample in these waters. Nor will a sample taken from only one depth, since aquatic vegetation produces oxygen near the surface, while decaying vegetation on the bottom consumes oxygen through the respiration of aerobic (oxygen-dependent) bacteria.

The extended rod sampler with an elastic strap or wire basket can be used to hold a dissolved oxygen bottle (see Figure 5). If no bridge is available to sample from, or if the bridge carries

too much traffic to be used safely, or is too high above the water, perhaps a boat may be found. If neither a bridge nor a boat are available, the best option is to extend the rod sampler from shore as far as possible and take a sample beneath the river surface. A dissolved oxygen sample can be obtained near shore without a sampling device, but keep in mind that it is probably not a representative sample.

Remember that the dissolved oxygen test should be run immediately after sampling.

Warning: Please wear protective gloves. If your skin comes into contact with any powder or PAO titrant, rinse this area liberally with water. First aid directions are included on the pillow containers. SAFETY GOGGLES SHOULD BE WORN WHILE SHAKING THE DISSOLVED OXYGEN BOTTLE.

Dissolved Oxygen Testing Procedure

1. If you have a barometer, record the atmospheric pressure. Remove the stopper and immerse the DO bottle beneath the river's surface. Use gloves to avoid contact with the river.
2. Allow the water to overflow for two to three minutes. (This will ensure the elimination of air bubbles.)

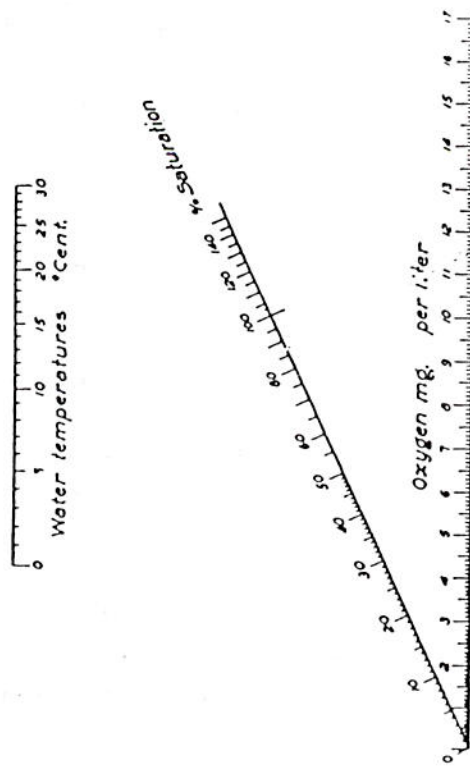
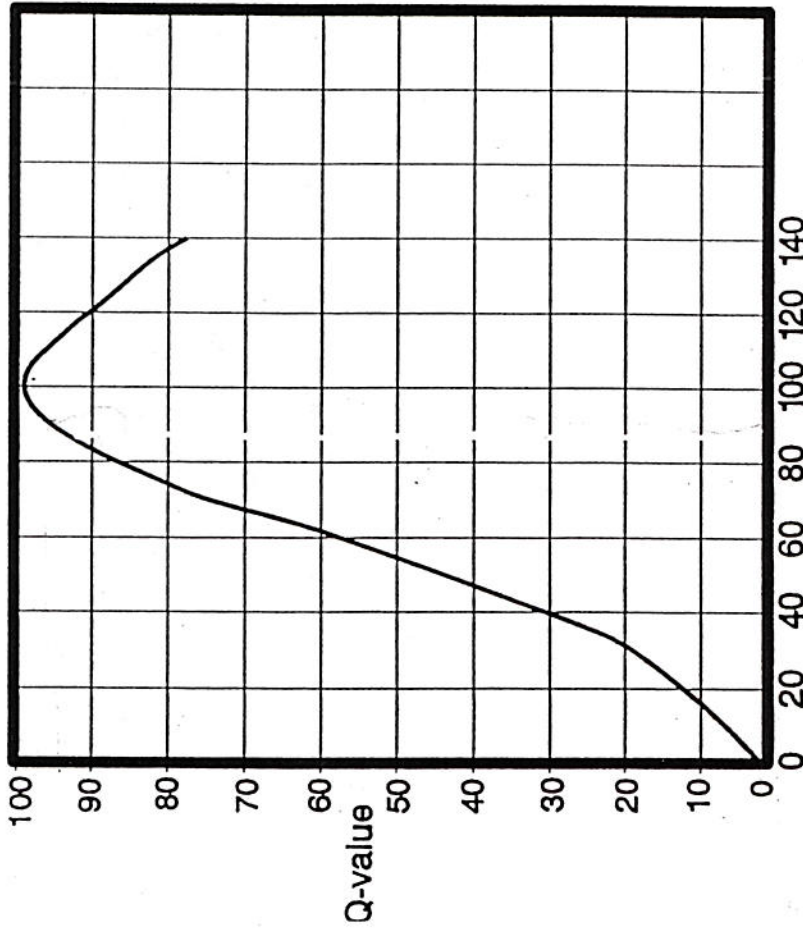


Figure 9. Level of oxygen saturation chart.

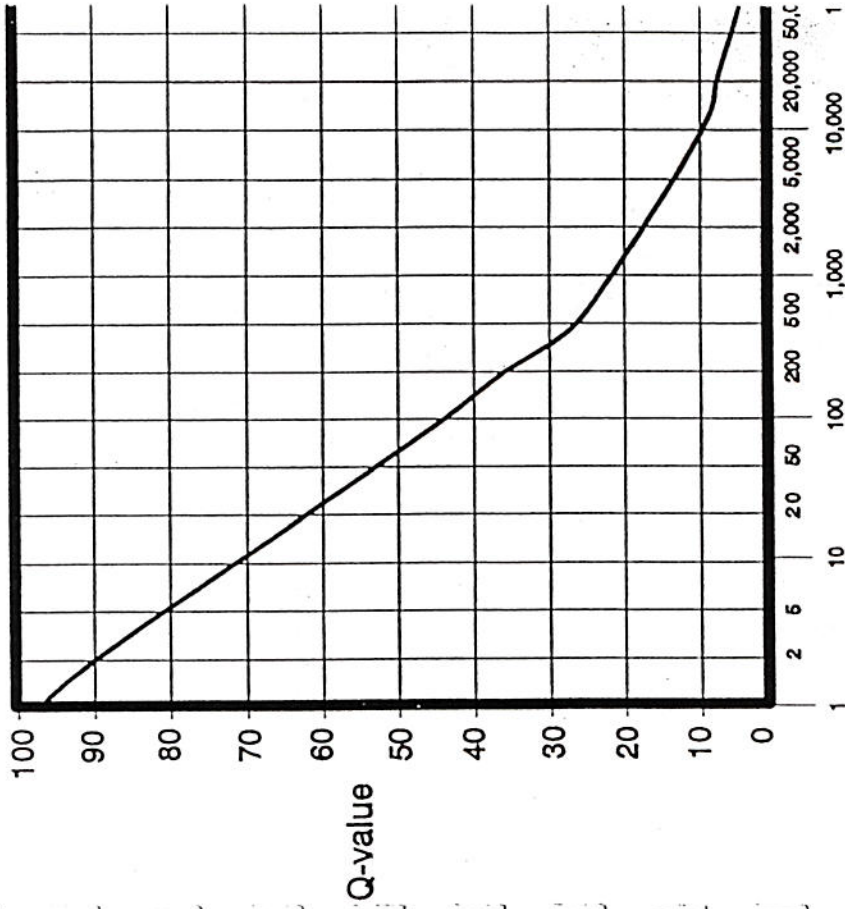
Chart 1: Dissolved Oxygen (DO) Test Results



DO: % saturation

Note: if DO % saturation > 140.0, Q=50.0

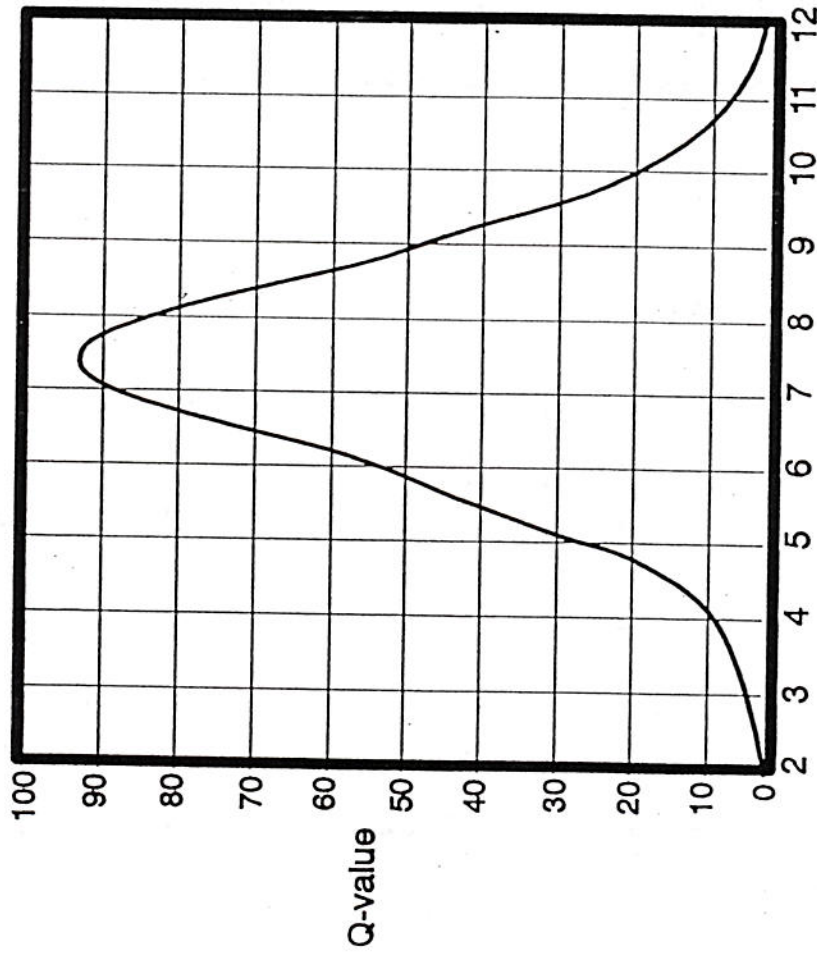
Chart 2: Fecal Coliform (FC) Test Results



FC: colonies/100 ml

Note: if FC > 10⁵, Q=2.0

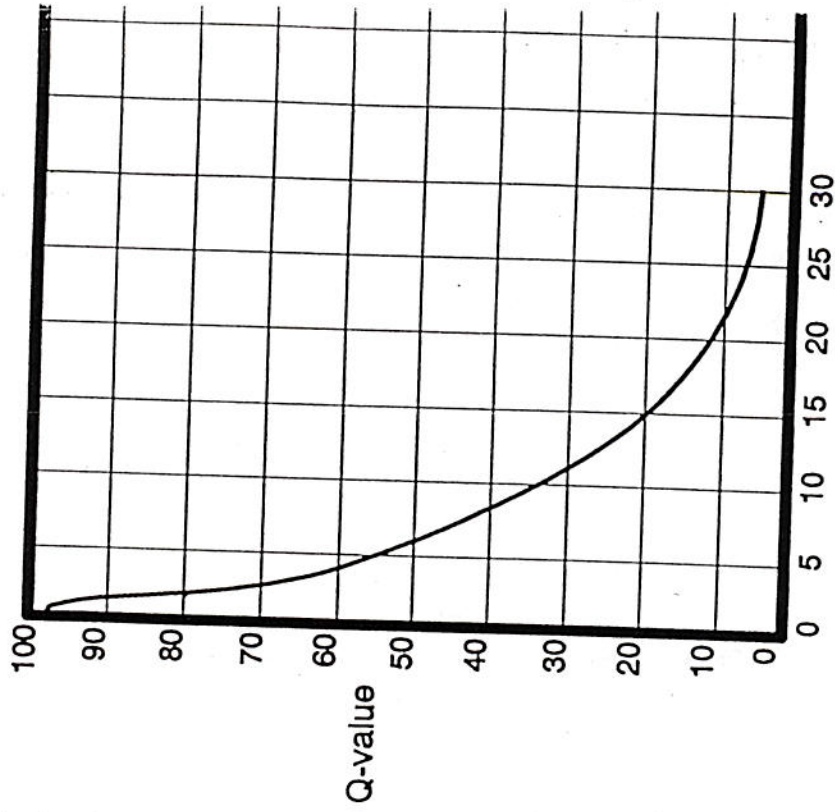
Chart 3: pH Test Results



pH: units

Note: if pH < 2.0, Q=0.0; if pH > 12.0, Q=0.0

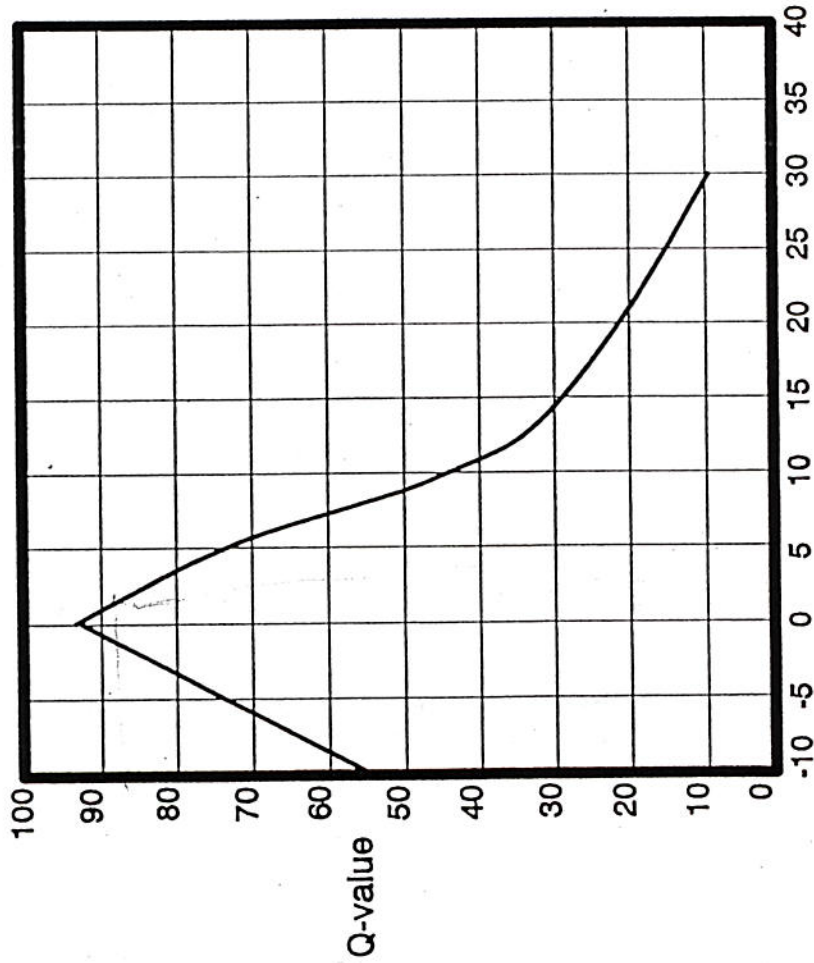
Chart 4: 5-Day Biochemical Oxygen Demand (BOD) Test Results



BOD₅: mg/l

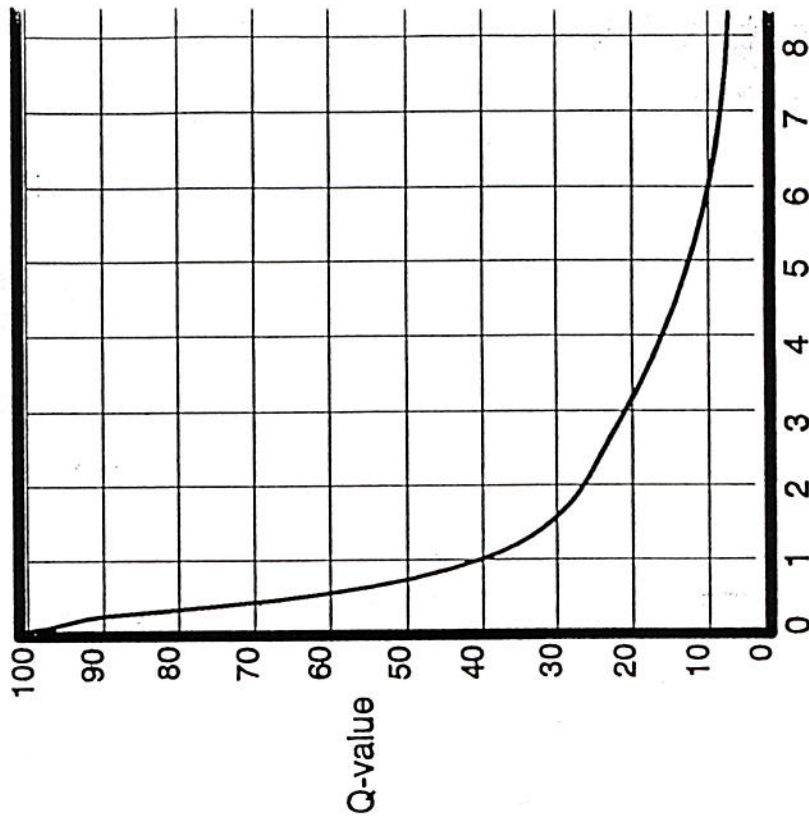
Note: if BOD₅ > 30.0, Q=2.0

Chart 5: Change in Temperature ($\Delta T, ^\circ C$) Test Results



$\Delta T: ^\circ C$

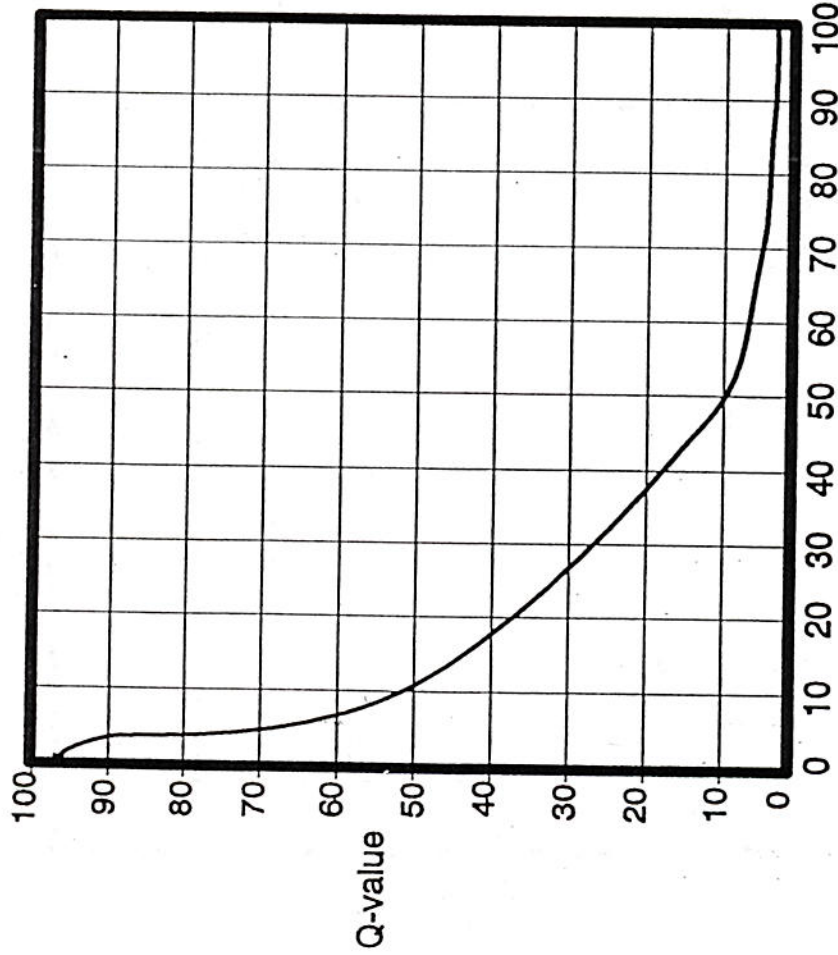
Chart 6: Total Phosphate (as PO_4-P) Test Results



PO_4-P : mg/l

Note: If $PO_4-P > 10.0$, $Q=2.0$

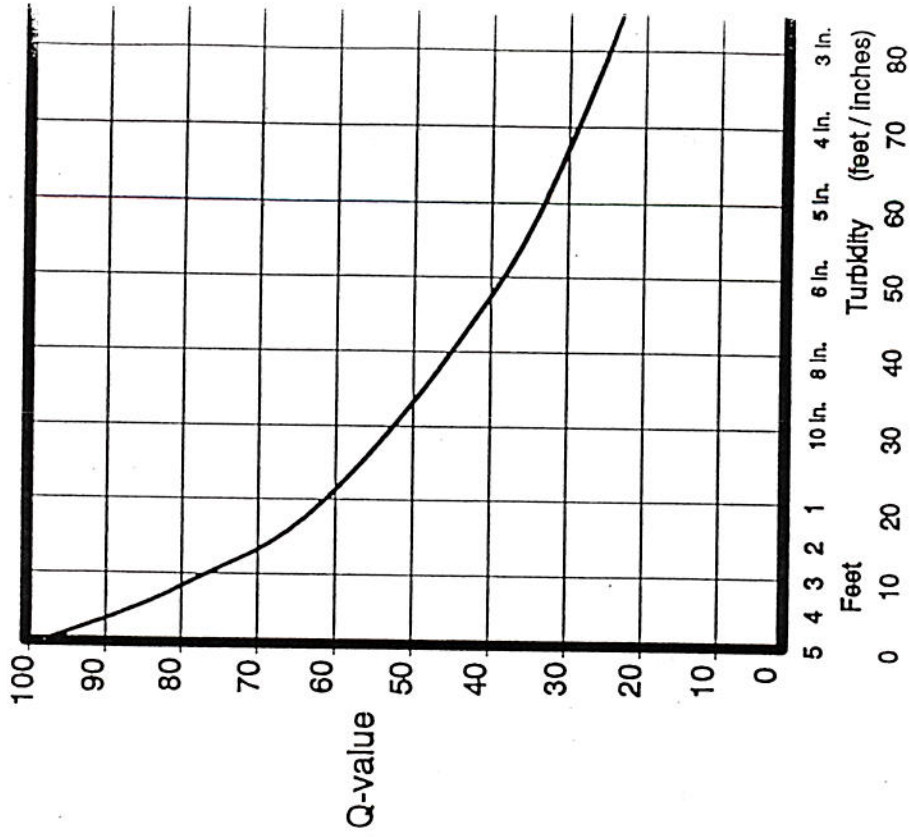
Chart 7: Nitrate (as NO₃) Test Results



NO₃ mg/l

Note: if NO₃ > 100.0, Q=1.0

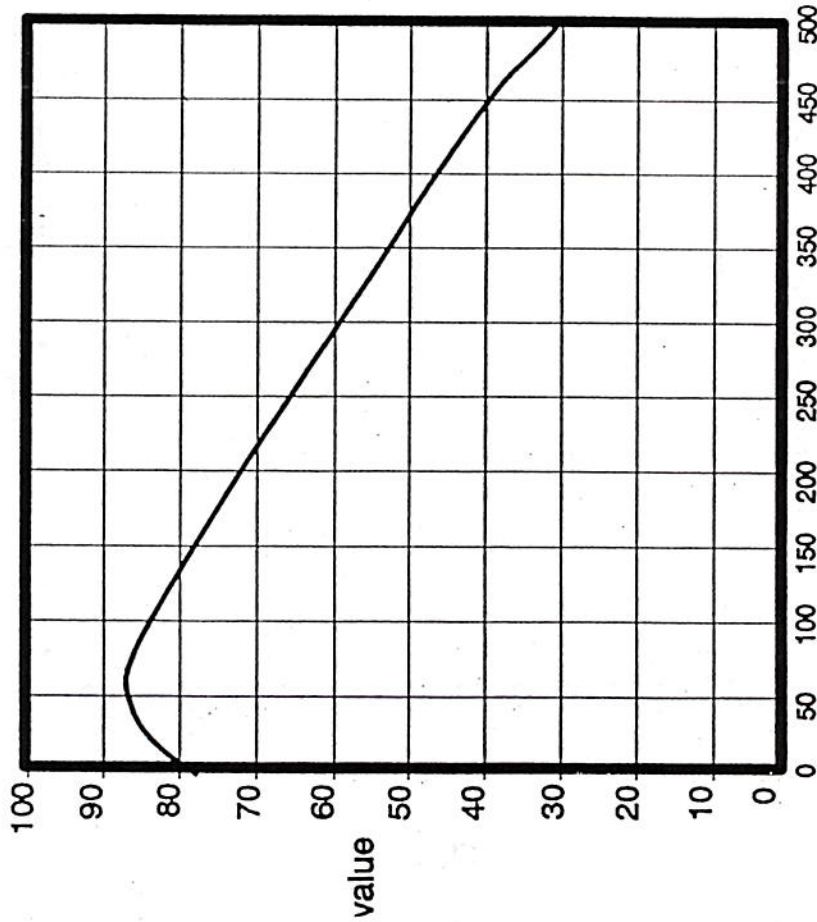
Chart 8: Turbidity Test Results



Turbidity: NTU's/JTU's or feet/inches

Note: if Turbidity > 100.0, Q=5.0

Chart 9: Total Solids (TS) Test Results



TS: mg/l

Note: if TS > 500.0, Q=20.0

CALCULATING THE RESULTS

Chart 10: Calculating the Overall Water Quality of a Section of a River System

Date _____ Time _____
 Test Location _____
 Weather Conditions _____

Water Tests	Text Page	Chart Page
Dissolved Oxygen	27	76
Fecal Coliform	34	77
pH	43	78
BOD	47	79
Temperature	51	80
Total Phosphate	54	81
Nitrates	60	82
Turbidity	66	83
Total Solids	70	84
Water Quality Index	74	85

Test Results (Column A)	O-Value (Column B)	Weighting Factor (Column C)	TOTAL (Column D)
1. DO	% sat.	0.17	
2. Fecal Coliform	colonies/100 ml	0.16	
3. pH	units	0.11	
4. BOD	mg/l	0.11	
5. Temperature	Δ°C	0.10	
6. Total Phosphate	mg/l	0.10	
7. Nitrates	mg/l	0.10	
8. Turbidity	NTU or FL	0.08	
9. Total Solids	mg/l	0.07	

Overall Water Quality Index _____