Defining Water Quality Parameters

TRANSPARENCY (*LA TRANSPARENCE*)
(measures the transparency of water to light)

Background: Suspended particles in the water reflect and scatter light. Solid particles like eroded soil suspend in the water and can block out light that phytoplankton and aquatic plants need. They can absorb hear from sunlight raising the water temperature. As water becomes warmer, its ability to hold oxygen decreases. Waters rich in plankton may also appear turbid because the plankton absorb light.

Values: Most natural waters have transparency ranging from 1 – several metres. <1 m is common for highly productive water or a high concentration of suspended solids.

Extremely clear, unproductive lakes or coastal waters can have transparency of 30-40 m. Think of the visibility at coral reef waters. Very clear water is indicative of low productivity in the water. It is not possible to make direct comparisons from one water body to another, rather to note changes at individual places.

Equipment: turbidity tube (measure in cm) or Secchi disk (measure in m)

TEMPERATURE (*LA TEMPÉRATURE*)

Background: Temperature of water influences species presence (tuna in warm waters, salmon in cold), as well as other properties of the water. Cold water has greater capacity to hold dissolved oxygen than warm water. Cold water is denser than warm water, and differences in temperature can cause currents and upwellings of nutrients from the bottom layer towards the surface.

Values: There are temperature ranges and thresholds for life in water. The optimum temperature for salmon is 5-15°C. All salmon die at temperatures >25°C.

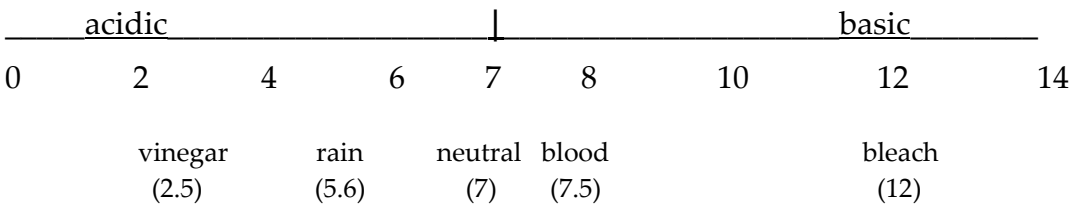
Equipment: liquid-filled thermometer

pH (*LE pH*)

Background: pH is a measure of the acidity or the alkalinity of a substance. pH influences chemical reactions and processes. It is measured by a scale of 1 to 14, where 7 is neutral, pH < 7 is acidic and pH > 7 is basic. The scale is logarithmic, meaning that a difference in value of 1 is a ten-fold difference.

Values: All fish die at pH <3.5 or >9.5; larva of mayfly and caddisfly die at pH<5

pH scale:



Equipment: pH paper, or titration kit

SALINITY (*LA SALINITÉ)*

Background: Salinity is the total amount of dissolved salts in water, expressed as grams of salts per kilogram of water (g/kg) or as parts per thousand (ppt).

There are >100 different ions in ocean water. Most of the ocean's salinity is made up by ions of chloride (55%) and sodium (30.6%). Salinity influences dissolved oxygen and the density of the water.

Values: Average salinity of the world's oceans is 35 ppt (parts per thousand).

Freshwater has a salinity of <1 ppt.

Waters with salinity between 1 – 25 ppt are called brackish.

Equipment: hygrometer to measure relative density, thermometer for temperature and chart for corresponding salinity. (density = mass in a given volume)

DISSOLVED OXYGEN – (L'*OXYGÈNE DISSOUS)*

Background: Animal life in water requires dissolved oxygen, oxygen that is actually dissolved in the water and available for respiration. The amount of DO in water is affected by many things, including temperature, pressure, and activity levels of respiration and photosynthesis. DO levels are higher in cold water than warm.

Values: DO levels must be at least 5-6 ppm (parts per million)for a healthy ecosystem. DO levels <3 ppm are stressful to most aquatic organisms.

Protocol: DO water chemistry test kit.

Protocols for Water Quality Measurements

Field protocols follow GLOBE standards, www.globe.gov. (see For Teachers/Teacher's Guide/Protocols/Hydrology)

How to Measure Transparency

Make sure the Secchi disk and turbidity tube measurements are made in the shade with the sun to your back. This will allow for an accurate and reproducible reading. If there is no shade available, use an umbrella or a large piece of cardboard to provide shade. For the turbidity tube the shadow of the observer should be adequate.

Secchi Disk

1. Lower the disk slowly into the water until it just disappears. Mark this point on the rope at the water's surface (i.e. use a clothes pin). Record length on Data Sheet.

NOTE: if you are unable to mark at the water surface, then measure the distance from the observer to the water surface – and record this on the Data Sheet

2. Then raise the Secchi disk until it just reappears into view. Grab the line at the surface of the water when the Secchi disk reappears and mark this point. The rope should now be marked at two points, with only a few centimeters difference. Record this measurement on the Data Sheet.

3. If the 2 depths (disappear and reappear) differ by more than 10 cm, repeat the measurement.

4. Using a different observer, repeat steps 1 – 3.

5. Determine cloud cover. Record on Data Sheet.

NOTE: IF the Secchi Disk reaches the bottom of your study site and you can still see it, simply record the depth to the bottom.

Turbidity Tube

1. Pour sample water into the tube until the image at the bottom of the tube is no longer visible when looking directly through the water column at the image. Rotate the tube while looking down at the image to see if the black and white areas of the decal are distinguishable.

2. Record this depth of water on the Data Sheet to the nearest cm.

3. Repeat 2 more times, different observers.

NOTE: If you can see the image on the bottom of the tube when the tube is full, simple check the box on the Data Sheet indicating this.

How to Measure Water Temperature

1. Hold the end of the thermometer and shake it gently several times to remove any air in the enclosed liquid.
2. Immerse the thermometer to a depth of 10 cm in the sample water for 3 – 5 minutes.
3. Raise the thermometer only as much as is necessary to read the temperature. Quickly read the temperature and record on Data Sheet. If the water is too far too reach, take a water sample in a bucket.
4. Repeat 2 more times, different observers. Calculate average.

How to Measure pH

Using Ph paper:

1. Dip one strip of pH paper into sample water for at least a minute.
2. Remove the paper from the water and compare results with colour chart for pH. Record on Data Sheet.
3. Repeat 2 more times, different observers. Calculate average.

NOTE: pH paper readings may not be accurate if the water sample has an electrical conductivity below 300 microSiemens/cm.

How to Measure Dissolved Oxygen

(this test takes about 20 minutes to perform)

1. Use safety glasses and latex gloves to handle reagents.
2. Rinse sample bottle with sample water 3X.
3. Rinse vial with distilled water 3X.
4. To take sample, place bottle with cap on, into sample water, remove cap and fill bottle with sample water and replace cap while bottle completely submerged.
5. Check for air bubbles by tipping bottle upside down. If air bubbles present, repeat step 4.
6. Follow instruction in test kit. Record value on Data Sheet.

How to Measure Salinity

1. Rinse the 500 mL clear plastic graduated cylinder at least twice with sample water.

2. Fill the cylinder with sample water until the water level is 2-3 cm from the top of the cylinder.

3. Determine the temperature of your sample and record this value on the Data Sheet.

4. Very gently, place the hydrometer in the graduated cylinder and allow it to settle. The hydrometer should not touch the cylinder walls, and be sure to take the reading from the bottom of the meniscus.

5. Read the specific gravity from the hydrometer scale. (see image below). Reading to 3 decimal places is acceptable. Or read to 4 decimal places and interpolated between the values given in the Table HYD-P-3. Record this value on the Data Sheet.

6. Using the temperature and specific gravity, read the salinity of the sample from Table HYD-P-3. (For example, a water sample with temperature 22^0C and specific gravity of 1.0070 has a salinity of 10.6 ppt)

7. Repeat two more times, steps 2 – 6).

8. Take the average of the salinity values measured for the different samples. If the recorded values are all within 2 ppt of the average you are finished. Otherwise repeat the procedure again, steps 2 – 8.

Figure HYD-P-5: Reading Specific Gravity

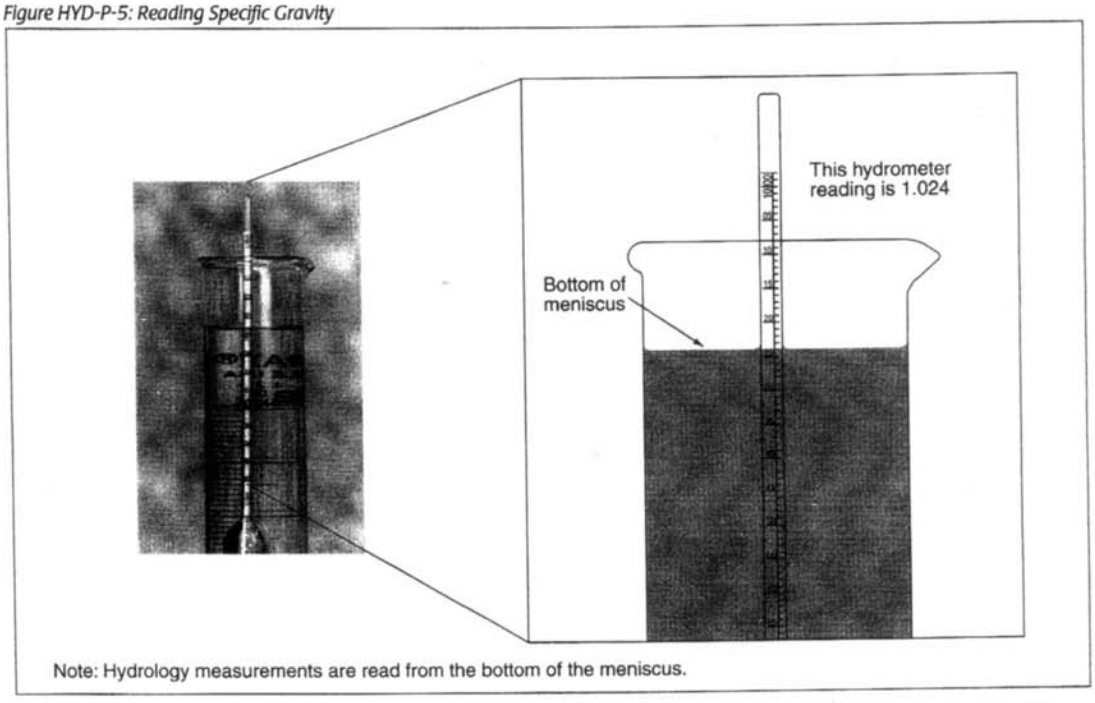


*Table HYD-P-3: Salinity (parts per thousand) as a function of density and temperature**

	Temperature of Water in Graduated Cylinder (° C)																
Observed Reading	-2.0	-1.0	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
0.9980																	
0.9990																	
1.0000																	
1.0010	0.7	0.6	0.6	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.6	0.6	0.7	0.8
1.0020	2.0	1.9	1.9	1.8	1.6	1.6	1.6	1.5	1.5	1.6	1.6	1.6	1.8	1.9	2.0	2.1	2.3
1.0030	3.3	3.2	3.1	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.9	2.9	3.1	3.2	3.3	3.4	3.6
1.0040	4.5	4.4	4.2	4.2	4.1	4.1	4.1	4.1	4.1	4.1	4.2	4.2	4.4	4.5	4.6	4.8	4.9
1.0050	5.8	5.7	5.5	5.4	5.4	5.4	5.3	5.3	5.4	5.4	5.4	5.5	5.5	5.7	5.8	5.9	6.2
1.0060	7.0	6.8	6.8	6.7	6.6	6.6	6.6	6.6	6.6	6.7	6.7	6.8	6.8	7.0	7.1	7.2	7.5
1.0070	8.1	8.1	8.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.1	8.1	8.3	8.4	8.5	8.8
1.0080	9.4	9.3	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.3	9.3	9.4	9.6	9.7	9.8	10.0
1.0090	10.6	10.5	10.5	10.4	10.4	10.4	10.4	10.4	10.5	10.5	10.6	10.6	10.7	10.9	11.0	11.1	11.3
1.0100	11.9	11.8	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.8	11.8	11.9	12.0	12.2	12.3	12.4	12.6
1.0110	13.1	13.0	13.0	12.8	12.8	12.8	12.8	13.0	13.0	13.1	13.1	13.2	13.4	13.5	13.6	13.7	13.9
1.0120	14.3	14.3	14.1	14.1	14.1	14.1	14.1	14.1	14.3	14.3	14.4	14.5	14.7	14.8	14.9	15.0	15.2
1.0130	15.6	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.6	15.7	15.8	15.8	16.0	16.2	16.3	16.5
1.0140	16.7	16.7	16.6	16.6	16.6	16.6	16.6	16.7	16.7	16.9	17.0	17.0	17.1	17.3	17.5	17.7	17.8
1.0150	18.0	17.9	17.9	17.9	17.9	17.9	17.9	17.9	18.0	18.0	18.2	18.3	18.4	18.6	18.8	19.0	19.1
1.0160	19.2	19.2	19.1	19.1	19.1	19.1	19.2	19.2	19.3	19.3	19.5	19.6	19.7	19.9	20.1	20.3	20.4
1.0170	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.5	20.5	20.6	20.8	20.9	21.0	21.2	21.3	21.6	21.7
1.0180	21.7	21.7	21.7	21.6	21.6	21.7	21.7	21.7	21.8	22.0	22.1	22.2	22.3	22.5	22.6	22.9	23.0
1.0190	22.9	22.9	22.9	22.9	22.9	22.9	23.0	23.0	23.1	23.3	23.4	23.5	23.6	23.8	23.9	24.2	24.3
1.0200	24.2	24.2	24.2	24.0	24.2	24.2	24.2	24.3	24.3	24.4	24.6	24.7	24.8	25.1	25.2	25.5	25.6
1.0210	25.3	25.3	25.3	25.3	25.3	25.5	25.5	25.6	25.6	25.7	25.9	26.0	26.1	26.4	26.5	26.8	26.9
1.0220	26.6	26.6	26.6	26.6	26.6	26.6	26.8	26.8	26.9	27.0	27.2	27.3	27.4	27.7	27.8	28.1	28.2
1.0230	27.8	27.8	27.8	27.8	27.8	27.9	27.9	28.1	28.2	28.3	28.5	28.6	28.7	28.9	29.1	29.4	29.5
1.0240	29.1	29.1	29.1	29.1	29.1	29.1	29.2	29.4	29.5	29.5	29.8	29.9	30.0	30.2	30.4	30.6	30.8
1.0250	30.3	30.3	30.3	30.3	30.4	30.4	30.6	30.6	30.7	30.8	30.9	31.1	31.3	31.5	31.7	31.9	32.1
1.0260	31.6	31.6	31.6	31.6	31.6	31.7	31.7	31.9	32.0	32.1	32.2	32.4	32.6	32.8	33.0	33.2	33.4
1.0270	32.8	32.8	32.8	32.9	32.9	32.9	33.0	33.2	33.3	33.4	33.5	33.7	33.9	34.1	34.3	34.5	34.7
1.0280	33.9	34.1	34.1	34.1	34.1	34.2	34.3	34.5	34.5	34.7	34.8	35.0	35.1	35.4	35.6	35.8	36.0
1.0290	35.2	35.2	35.2	35.4	35.4	35.5	35.5	35.6	35.8	35.9	36.2	36.3	36.4	36.7	36.8	37.1	37.3
1.0300	36.4	36.5	36.5	36.5	36.7	36.7	36.8	36.9	37.1	37.2	37.3	37.6	37.7	38.0	38.1	38.4	38.6
1.0310	37.7	37.7	37.7	37.8	37.8	38.0	38.1	38.2	38.4	38.5	38.6	38.9	39.0	39.3	39.4	39.7	39.9

* Adapted from LaMotte hydrometer instructions.

Table HYD-P-3: Salinity (parts per thousand) as a function of density and temperature - continued

	Temperature of Water in Graduated Cylinder (° C)																
Observed Reading	15.0	16.0	17.0	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5
0.9980																	
0.9990										0.0	0.1	0.2	0.3	0.5	0.6	0.7	
1.0000		0.0	0.2	0.3	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.6	1.8	1.9	2.0
1.0010	1.0	1.2	1.5	1.6	1.8	1.9	2.0	2.1	2.3	2.4	2.5	2.5	2.7	2.8	2.9	3.1	3.2
1.0020	2.4	2.5	2.8	2.9	3.1	3.2	3.3	3.4	3.6	3.7	3.8	4.0	4.1	4.2	4.4	4.6	4.8
1.0030	3.7	3.8	4.1	4.2	4.4	4.5	4.6	4.8	4.9	5.0	5.1	5.3	5.4	5.5	5.8	5.9	6.1
1.0040	5.0	5.1	5.4	5.5	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.6	6.7	7.0	7.1	7.2	7.4
1.0050	6.3	6.6	6.7	7.0	7.1	7.1	7.2	7.4	7.5	7.6	7.7	7.9	8.1	8.3	8.4	8.5	8.7
1.0060	7.6	7.9	8.0	8.3	8.4	8.5	8.7	8.8	8.9	9.1	9.2	9.3	9.4	9.6	9.7	9.8	10.1
1.0070	8.9	9.2	9.3	9.6	9.7	9.8	10.0	10.1	10.2	10.4	10.5	10.6	10.7	10.9	11.0	11.3	11.4
1.0080	10.2	10.5	10.6	10.9	11.0	11.1	11.3	11.4	11.5	11.7	11.8	11.9	12.0	12.2	12.4	12.6	12.7
1.0090	11.5	11.8	11.9	12.2	12.3	12.4	12.6	12.7	12.8	13.0	13.1	13.2	13.4	13.6	13.7	13.9	14.0
1.0100	12.8	13.1	13.2	13.5	13.6	13.7	13.9	14.0	14.1	14.3	14.4	14.5	14.8	14.9	15.0	15.2	15.3
1.0110	14.1	14.4	14.5	14.8	14.9	15.0	15.2	15.3	15.4	15.6	15.7	16.0	16.1	16.2	16.3	16.5	16.7
1.0120	15.4	15.7	15.8	16.1	16.2	16.3	16.5	16.6	16.7	17.0	17.1	17.3	17.4	17.5	17.7	17.9	18.0
1.0130	16.7	17.0	17.1	17.4	17.5	17.7	17.8	17.9	18.0	18.3	18.4	18.6	18.7	18.8	19.1	19.2	19.3
1.0140	18.0	18.3	18.6	18.7	18.8	19.0	19.1	19.3	19.5	19.6	19.7	19.9	20.0	20.1	20.4	20.5	20.6
1.0150	19.3	19.6	19.9	20.0	20.1	20.4	20.5	20.6	20.8	20.9	21.0	21.2	21.3	21.6	21.7	21.8	22.0
1.0160	20.6	20.9	21.2	21.3	21.4	21.7	21.8	22.0	22.1	22.2	22.3	22.5	22.7	22.9	23.0	23.3	23.4
1.0170	22.0	22.2	22.5	22.7	22.9	23.0	23.1	23.3	23.4	23.5	23.6	23.8	24.0	24.2	24.3	24.6	24.7
1.0180	23.3	23.5	23.8	24.0	24.2	24.3	24.4	24.6	24.7	24.8	24.9	25.2	25.3	25.5	25.6	25.9	26.0
1.0190	24.6	24.8	25.1	25.3	25.5	25.6	25.7	25.9	26.0	26.1	26.4	26.5	26.6	26.8	27.0	27.2	27.3
1.0200	25.9	26.1	26.4	26.6	26.8	26.9	27.0	27.2	27.3	27.4	27.7	27.8	27.9	28.2	28.3	28.5	28.6
1.0210	27.2	27.4	27.7	27.9	28.1	28.2	28.3	28.5	28.6	28.9	29.0	29.1	29.2	29.5	29.6	29.8	30.0
1.0220	28.5	28.7	29.0	29.2	29.4	29.5	29.6	29.8	30.0	30.2	30.3	30.4	30.7	30.8	30.9	31.2	31.3
1.0230	29.8	30.0	30.3	30.6	30.7	30.8	30.9	31.2	31.3	31.5	31.6	31.7	32.0	32.1	32.2	32.5	32.6
1.0240	31.1	31.3	31.6	31.9	32.0	32.1	32.2	32.5	32.6	32.8	32.9	33.2	33.3	33.4	33.7	33.8	33.9
1.0250	32.4	32.6	32.9	33.2	33.3	33.4	33.7	33.8	33.9	34.1	34.2	34.5	34.6	34.7	35.0	35.1	35.2
1.0260	33.7	33.9	34.2	34.5	34.6	34.7	35.0	35.1	35.2	35.4	35.6	35.8	35.9	36.0	36.3	36.4	36.7
1.0270	35.0	35.2	35.5	35.8	35.9	36.2	36.3	36.4	36.5	36.7	36.9	37.1	37.2	37.5	37.6	37.8	38.0
1.0280	36.3	36.5	36.8	37.1	37.2	37.5	37.6	37.7	37.8	38.1	38.2	38.4	38.5	38.8	38.9	39.1	39.3
1.0290	37.6	37.8	38.1	38.4	38.6	38.8	38.9	39.0	39.1	39.4	39.5	39.7	39.9	40.1	40.2	40.5	40.6
1.0300	38.9	39.1	39.4	39.7	39.9	40.1	40.2	40.3	40.6	40.7	40.8	41.0	41.2	41.4	41.6	41.8	41.9
1.0310	40.2	40.5	40.7	41.0	41.2	41.4	41.5	41.8	41.9	42.0	42.1	42.3	42.5				

Hydrology Investigation

Data Sheet

School name: _____

Class or group name: _____

Name(s) of Student(s) collecting data: _____

_____

Measurement Time:

Year: ____ Month: ____ Day: ____ Time: __:__ (UT) Time: __:__ (Local)

Name of Site :_____

Water State: (check one)

❒ Normal ❒ Flooded ❒ Dry ❒ Frozen ❒ Unreachable

Transparency

Cloud Cover (check one):

❒ no clouds
❒ clear (<10%)
❒ isolated clouds (10%-24%)
❒ scattered (25%-49%)
❒ broken (50%-90%)
❒ overcast (>90%)
❒ obscured

Enter data below, depending on whether you are using the Secchi Disk or the Transparency Tube method.

Secchi Disk

First Secchi Disk Test:

Distance from observer to where disk disappears ____ (m)

Distance from observer to where disk reappears ____ (m)

Distance from observer to water surface ____(m)

❒ Secchi Disk reaches the bottom and does not disappear.
If checked enter depth to the bottom of the water site ____ (m)

Second Secchi Disk Test:

Distance from observer to where disk disappears ____ (m)

Distance from observer to where disk reappears ____ (m)

Distance from observer to water surface ____(m)

❒ Secchi Disk reaches the bottom and does not disappear.
If checked enter depth to the bottom of the water site ____ (m)

Third Secchi Disk Test:

Distance from observer to where disk disappears ____ (m)

Distance from observer to where disk reappears ____ (m)

Distance from observer to water surface ____(m)

❒ Secchi Disk reaches the bottom and does not disappear.
If checked enter depth to the bottom of the water site ____ (m)

(m)
average

Transparency Tube

Note: If the image is still visible when the tube is full, input the length of the tube and check the "Greater than the depth of the turbidity tube".

Test 1(cm): Greater than depth of transparency tube? ❒ _____

Test 2(cm): Greater than depth of transparency tube? ❒ _____

Test 3(cm): Greater than depth of transparency tube? ❒ _____

} _____ (cm) average

Water Temperature: Measured with (check one) __ alcohol-filled thermometer __ probe

Average:	Observer Name	Temperature °C
	1.	
	2.	
____ °C	3.	

Dissolved Oxygen Kits:

Average:	Observer Name	Dissolved Oxygen (mg/L)
	1.	
	2.	
____ mg/L	3.	

Salinity: _____ppt

Salinity

Tide Information

Time of tide before measurement: _____ hours and minutes

Check one: ❒ High Tide: ❒ Low Tide Check one: ❒ UT ❒ Local time

Time of tide after measurement: _____ hours and minutes

Check one: ❒ High Tide: ❒ Low Tide Check one: ❒ UT ❒ Local time

Place where these tides occur: _____

Salinity (Hydrometer Method)

	Test 1	Test 2	Test 3
Temperature of water in 500 mL cylinder	_____ °C	_____ °C	_____ °C
Specific Gravity:	_____	_____	_____
Salinity of Sample:	_____ ppt	_____ ppt	_____ppt

Average Salinity: _____ppt

Water pH: Measured with: (check one) ❒ paper ❒ meter

Average:	Observer Name	If salt added, conductivity (µS/cm)	pH
	1.		
	2.		
____	3.		

Value of buffers used: ❒ pH 4 ❒ pH 7 ❒ pH 10 (Check all used.)

Étude de l'hydrologie

Fiche de relevé des données

Nom de l'école : _____

Groupe d'élèves : _____

Nom du site : _____

Prélèvement de l'échantillon. Date : ____ Heure : ____ (heures et minutes)

Transparence

Couverture nuageuse (cocher un) : ___ Ciel clair ___ Nuages épars ___ Nuages fragmentés ___ Ciel couvert

Disque de Secchi :

Observateur 1 : Longueur de corde lorsque le disque devient invisible : _____ m lorsqu'il redevient visible : _____ m ∠10 cm

Distance au-dessus de l'eau à laquelle l'observateur 1 a marqué la corde : _____ m

Observateur 2 : Longueur de corde lorsque le disque devient invisible : _____ m lorsqu'il redevient visible : _____ m

Distance au-dessus de l'eau à laquelle l'observateur 2 a marqué la corde : _____ m

Observateur 3 : Longueur de corde lorsque le disque devient invisible : _____ m lorsqu'il redevient visible : _____ m

Distance au-dessus de l'eau à laquelle l'observateur 3 a marqué la corde : _____ m

Tube de turbidité :

Hauteur de l'eau lorsque l'image devient invisible :

Observateur 1 : _____ cm Observateur 2 : _____ cm Observateur 3 : _____ cm

Température de l'eau

Observateur 1 : _____ °C Observateur 2 : _____ °C Observateur 3 : _____ °C Moyenne : _____ °C

Teneur en oxygène dissous

Observateur 1 : _____ mg/l Observateur 2 : _____ mg/l Observateur 3 : _____ mg/l
Moyenne : _____ mg/l

Marque et modèle du kit : _____

pH

Méthode de mesure : _____Papier _____Stylo _____ pHmètre

Observateur 1 : _____ Observateur 2 : _____ Observateur 3 : _____ Moyenne : _____

Salinité (méthode hydrométrique)

	Observateur 1	Observateur 2	Observateur 3
Température de l'eau dans l'éprouvette :	_____ °C	_____ °C	_____ °C
Densité :	_____	_____	_____
Salinité de l'échantillon :	_____ g/kg	_____ g/kg	_____ g/kg

Salinité moyenne : _____ g/kg