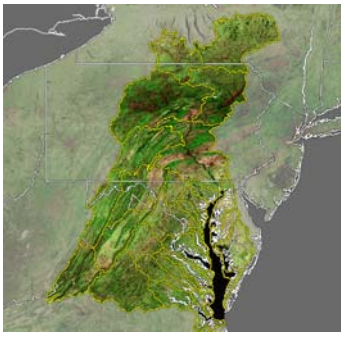
Name _____ Date _____

HOW DOES YOUR WATER COMPARE?

Introduction:
All living things need certain elements to survive. We all need oxygen, food, water, shelter, etc. If you were a plant or animal that lived in the water you would need certain water quality conditions in order to survive. Poor water quality can be caused by high temperatures, sediment, acidity (pH), toxics, or low dissolved oxygen. The following activity will allow you to compare the water in your local stream to water in the Patapsco River, one of the Bay's tributaries!

Materials:

DO Kit
pH Kit
Thermometer
Tape Measure
Access to Data on Internet
Post-it Notes
Maryland Map
Clipboard



PART I- HELLO STREAM! WHAT'S YOUR NAME?

Directions: Answer the questions below by introducing yourself to your stream and making observations.

1. Walk around your stream and look at it. Just by looking at your stream, do you think it is healthy? Explain why.

_____

_____

_____

_____

_____

Now that you have had a chance to look at your stream you are going to make some specific observations to assess the health of this waterway. You will make an observation for each question and rate what this means in relation to the health of your stream. Your rating is based on the scale below:

Very Healthy ⟷ Not Healthy

Great! *Good* *Okay* *Not Good* *Bad*

2. Vegetation should separate a stream from human activities in order to help filter out pollutants that might runoff into the water. This area of vegetation is known as a "**Buffer Zone**" Use a tape measure to measure how wide your stream's buffer zone is at three different places at 10 meter intervals along the stream. Take the average of the three measurements. Based on your average number determine whether this is a good number for your stream. Circle the answer that corresponds with your stream's average width.

   Measurement 1 _____
   Measurement 2 _____ Average _____
   Measurement 3 _____

   a) At least 18 meters wide *Great!*
   b) Between 12-18 meters wide *Good*
   c) Between 6-12 meters wide *Okay*
   d) Less than 6 meters wide *Bad*

3. It has been estimated that at least 18 meters of vegetation are necessary to protect a stream. What ground surfaces make up most of the 18 meters surrounding your stream? Circle the answer that corresponds with your stream's surrounding ground surfaces.

   a) Mainly trees or wetlands *Great!*
   b) Mainly shrubs, unmowed grass, or pastureland *Good*
   c) Mainly mowed lawns or agricultural crops *Okay*
   d) Mainly pavement *Bad*

4. Observe the banks of your stream. Are they heavily eroded? Heavy erosion on the banks of the stream usually means that development surrounding your stream or upstream is causing too much runoff to go directly into your stream every time it rains. Circle the answer that corresponds to your stream.

a) Little to no erosion: boulders, shrubs, trees, and vegetation present	*Great!*
b) Small areas of erosion: 10-30% of the bank shows erosion	*Good*
c) Streambanks are quite steep and 30-60% show bare soil	*Okay*
d) 61-100% of the banks have bare, eroded soil; banks look "raw" and have no vegetation. Banks are very steep.	*Bad*

5. Streams need to have ways to maintain stable water temperatures as the temperature of the air changes from day to day. Trees and shrubs covering the stream provide shade, which helps to keep the stream cool in the summer. Within your study site, how much of the stream is shaded? Circle the corresponding answer.`

a) Greater than 80%	*Great!*
b) Between 50-80%	*Good*
c) Between 30 and 49%	*Okay*
d) Less than 30%; most of the stream is in direct sunlight.	*Bad*

6. Based on your answers above, do you think your stream is healthy? Explain.

_____

_____

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_____

Let's Find Out!

PART II- INVESTIGATING THE HEALTH OF YOUR STREAM

Directions: Answer the questions below using the thermometer, pH Kit and DO Kit. Circle the response (*Great, Good, Okay and Bad*) that best fits. It is very important to remember safety when you are performing chemical tests. Make sure that you are wearing your goggles and gloves if necessary.

1. Record today's date (the date you are performing the tests below) and the time of day you are beginning to perform the tests.

   Date: _____ Time: _____

2. Measure the temperature of your stream at the surface and at the bottom at **three** 10 meter intervals along the stream. Even though different species of fish require different temperatures of water, all fish are stressed by rapid changes in temperature and temperatures above 32 degrees Celsius (90 degrees Fahrenheit). Keep in mind though that temperatures change between morning and night and often rise quickly in the summer.

   Temperature #1 _____
   Temperature #2 _____ Average temperature _____
   Temperature #3 _____

   a) Average temperature is fine today- under 32 degrees Celsius. *Good*
   b) Too hot for most organisms- at or over 32 degrees Celsius. *Bad*

3. Just like you, fish and aquatic species need to breathe! The amount of dissolved oxygen in the waters of your stream will be an important indication of what can live there. Using the Dissolved Oxygen kit measure the amount of dissolved oxygen in your water in ppm (parts per million). The measured dissolved oxygen of your stream is: _____ ppm

   a) Good for growth and activity: more than 5 ppm *Great*
   b) Stressful for many aquatic organisms: 3-5 ppm *Okay*
   c) Stressful for most aquatic organisms: 2-2.99 ppm *Not Good*
   d) Less than 2 ppm will not support most fish. *Bad*

4. Now you will figure out the "percent saturation" of your stream to see how much oxygen it has compared to how much oxygen it should have. The chart below tells you how much oxygen your stream could have at different temperatures. As you can see, the hotter the water, the less oxygen it can hold- this means that in hot weather, it is more likely that fish will become stressed. Refer back to your answer to question #2 where you determined your stream's average temperature. In the temperature column below circle the temperature that is closest to your stream's average temperature and the corresponding potential dissolved oxygen.

Temperature (in degrees Celsius)	**Potential dissolved oxygen** (ppm)
0	14.6
5	12.8
10	11.3
15	10.1
20	9.1
25	8.2
30	7.5
35	6.9

Use the following formula to figure out your stream's % saturation:

measured dissolved oxygen (stream's DO level) **x 100 = % saturation**
potential dissolved oxygen (circled above)

Show your work here: ↓

The % saturation for your stream is: _____ percent

a) 80% to 100% of the potential dissolved oxygen — *Great!*
b) 60% to 79% of the potential dissolved oxygen — *Good*
c) 40% to 59% of the potential dissolved oxygen — *Okay*
d) Below 40% of the potential dissolved oxygen — *Bad*

5. Using the pH kit determine the pH level of your stream. If a stream is very clean but you see very little life in it and there seems to be no other significant problems, it could mean your stream is too acidic. Old mines, certain chemicals draining into streams, or acid rain from car exhaust and factories can make streams too acidic. Since pH can change, your stream might have a pH problem that you can't detect at this time. What was the pH of your stream today?

   a) 6.5 – 8.2: Perfect for most organisms *Great*
   b) 5.0 – 6.5 or 8.2 – 9.0: Not directly harmful to fish, but may harm delicate species. *Okay*
   c) 4.5 – 5.0 or 9.0 – 10.5: Harmful to some fish; most eggs won't hatch; most insects absent. *Not Good*
   d) Below 4.5 or above 10.5: Lethal to most fish. *Bad*

PART III- IS YOUR STREAM HEALTHY?

Directions: Based on your answers in Part 1 and 2 complete the questions below. Please write in COMPLETE SENTENCES!

1. Now that you have investigated your stream in depth, taking measurements and performing chemical tests, **do you think your stream is healthy**? Support your answer with data that you have collected.

2. Look back to your answers for questions 1 and 6 in Part I. Has your opinion on the health of your stream changed? Explain.

PART IV- COMPARING YOUR RESULTS

The National Aquarium in Baltimore is concerned about the health of the Chesapeake Bay and does chemical testing like you just did! They monitor a wetland at Ft McHenry, which is a man-made marsh located on the "middle branch" of the Patapsco River. This water quality data can be found at the following web address: http://www.aqua.org

You will be looking at data that was collected every fifteen minutes during the course of the day. All of the data you will see on the website is collected 1 meter below the surface of the water.

When you are recording information from this site it is important that you use data that was collected from the same time of day that you performed your chemical tests. For example, if you did your dissolved oxygen test around 1 o'clock in the afternoon record the dissolved oxygen information that was collected at 1 o'clock at the Ft. McHenry site.

In this section you will compare your water quality data to that of the water quality data obtained from the Ft. McHenry site. You will answer the question: **Is your stream more or less healthy then another Bay tributary?**

Ft. McHenry Field Station
Baltimore, MD

STEP 1:

Using a Maryland state map find where Ft. McHenry is located on the Patapsco River. Place a small post-it-note or sticker on this spot. Now find your town on the same map and place a sticker as close to your stream's location as possible. You might need to "guesstimate" this spot but try your best!

STEP 2:

1. Log onto the Internet and go to the following web address: http://www.aqua.org

2. Once you are on the site, go to Conservation and "Water Quality Information in the Chesapeake Bay."

3. Choose a "Select Date" at least two weeks ago (current data hasn't been sent to the website yet). Once you have chosen your select date, scroll down to the bottom of the page and click on "Data Table."

4. On this page you will choose your "Starting Day" and "Finish Day". You want to choose the same date you chose as your "Select Date" for both your starting and finish day. You want to choose the same day for start and finish so that you are only looking at a 24 hour time period. After you have put the date in click on "View Data."

5. Look at the **Temperature** column first. You'll notice that the water is warmer later in the day then in the morning. Why do you think this occurs?

If you thought the water was warmer later in the day because the sun slowly heats up the water throughout the day, you were right! Use the table to find out what the water temperature at Ft. McHenry was around the same time of day you collected your stream's temperature. Record the temperature in the table below.

6. Look at the **Dissolved Oxygen (DO)** column next. You'll notice that the DO level changes throughout the day, sometimes it is very high and other times it is very low. This is because of photosynthesis. Plants are able to photosynthesize (make food) during the day because the sun is out. Therefore, the DO level is higher during the day then at night. If you look a little closer you'll notice the DO level is higher later in the day then in the morning. Record what the DO level was around the same time of day you collected your stream's dissolved oxygen level. Record this information in the table below.

7. Now look at the **pH** column. You should see that pH doesn't change dramatically during the day. Record what the pH was at the same time of day you performed your stream's pH test on the table below.

Chemical Test	Your Stream Data	Ft. McHenry Data	Healthy Range
Water Temperature			Under 32 degrees Celcius
Dissolved Oxygen Concentration			Around 5 ppm (mg/L)
pH			6.5-8.2

STEP 3:

1. Look at the data collected from the Ft. McHenry site. Would you say the water there is healthy? Support this statement with data.

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_____

2. Compare your stream's data to the Ft. McHenry's (Patapsco River) data. Would you say that one location is more healthy then the other? Support this statement with data.

_____

_____

_____

3. Refer back to the MD map where you placed your post-it-notes. Which waterway (your stream or the Patapsco River) is closer to the Bay?

4. Do you think that a tributary located far away from the Chesapeake Bay could still affect the Bay's health? Explain.

5. We know that everyone can help the Bay, no matter how close or far away they are. What is one thing you could do in your own backyard to help improve the health of the Bay?

_____

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_____

You have now spent a lot of time analyzing the health of two different Chesapeake Bay tributaries. It is everyone's responsibility to do their part to improve the health of the Bay. I challenge you to start this process by working on what you suggested in question #5 above. The Bay needs your help!

Parts I & II Modified From: Chesapeake Bay Foundation, "Chesapeake Choices and Challenges: The Catch of the Bay," Section 3, Activity 2.