Water Quality Testing

Course: 9th Grade Chemistry/Environmental Science
Adapted from Jodie Prohaska, Saint Paul Public Schools

Learning Goal:
This field investigation is designed for students to understand chemistry and land use through the environment. We will look at the water quality through chemical tests (the what) and then evaluate the land use around our watershed (the how).

Goals
Students will be able to use chemical testing kits.
SWBAT define key vocabulary: lithosphere, hydrosphere, atmosphere, biosphere.
SWBAT read a chemical reaction and recognize chemical symbols.
SWBAT identify causes of pollution to their watershed.
SWBAT analyze costs, benefits and risks with using land in a floodplain.

Standards
9.3.4.1.1 Analyze the benefits, costs, risks and tradeoffs associated with natural hazards, including the selection of land use and engineering mitigation.
For example: Determining land use in floodplains and areas prone to landslides.
9.2.1.2.3 Describe a chemical reaction using words and symbolic equations.
For example: The reaction of hydrogen gas with oxygen gas can be written: $2H_2 + O_2 \rightarrow 2H_2O$.
9.3.4.1.2 Explain how human activity and natural processes are altering the hydrosphere, biosphere, lithosphere and atmosphere, including pollution, topography and climate.
For example: Active volcanoes and the burning of fossil fuels contribute to the greenhouse effect.
9.3.2.3.1 Trace the cyclical movement of carbon, oxygen and nitrogen through the lithosphere, hydrosphere, atmosphere and biosphere.
For example: The burning of fossil fuels contributes to the greenhouse effect.

Materials
Water Quality Kits (P, N, Cl, dissolved O)
Thermometers
Stream Table
Science Notebooks

Other Prep
Ensure all students are granted permission to go to the site
Reserve transportation
Reserve a substitute

Procedure
DAY 1:
Students will learn to identify and write a testable question. This will be the focus of their investigation.

DAY 2:
Students will receive a brief introduction to the pollution indicators we will be testing through an article they will put in their notebook. Students will complete a reading strategy with the reading and then will be put into groups of 2-3. Each group will write a testable question related to their indicator.

DAY 3:
Students will complete an investigation at Thompson Lake in Thompson Park. Before they begin the water sampling, they will write down general observations of the lake. They will complete all tests.

DAY 4 and 5
Once we've looked at all the data, the students will answer a few questions about their results. I will guide them to the question asking: How does pollution get into our waterways? Students usually say trash/litter. We will start learning about land use. Use stream tables for students to create a model stream. Add concrete (plastic), plants (a sponge) and pollution (food coloring) so the students can see what happens. Students will draw their observations in there notebooks, and will answer the analysis questions at the end. After the students have experimented, we'll discuss what the pollution is (from the lab) and look at how we use the land.

Evaluation
Students will complete a Claims, Evidence, and Reasoning Lab report describing the findings of their investigation.

How does this relate to place-based education?
We are monitoring the water quality of a neighboring lake. Most students live very close to the park and it is part of the Mississippi River watershed. Since all of the students use tap water from the Mississippi River, it is very easy to make a connection to place. This park is in their neighborhood and they will be discovering it on a level they haven't experienced before.

After lesson implementation
I took 4 classes of Environmental Physical Science students for an approximate total of 120 students. We went over the span of 2 days so we had smaller groups. The lesson from beginning to end took about 3 weeks.

Base Scientific Explanation Rubric

A scientific explanation is a written response to a question that requires you to analyze and interpret data with regard to scientific knowledge. Quality explanations contain three components: Claim, Evidence, and Reasoning. As this can be a difficult practice to learn quickly, scientific explanations for all labs will be rated using the rubric below along with peer and teacher critiques and thorough feedback.

Component	0-Not There	1-Not Proficient	2-Partially Proficient	3-Proficient	4-Excellent
CLAIM- A conclusion that answers the original question.	Missing	Does not make a claim or does not make an accurate claim.	Makes an accurate but incomplete claim.	Makes an accurate and complete claim.	Makes an accurate and complete claim that exceeds expectations.
EVIDENCE- Scientific data that supports the claim. The data needs to be appropriate and sufficient to support the claim.	Missing	Does not provide evidence, or only provides inappropriate evidence (evidence that does not support the claim), no numerical data with appropriate labels.	Provides appropriate, but insufficient evidence to support claim. May include some inappropriate evidence or missing numerical data or appropriate labels.	Provides appropriate and sufficient evidence to support claim. All numerical evidence contains appropriate labels.	Provides appropriate and sufficient evidence to support claim. All numerical evidence contains appropriate labels. Data is especially clear.
REASONING-A justification that links the claim and evidence. It shows why the data counts as evidence by using appropriate and sufficient scientific principles.	Missing	Does not provide reasoning, or only provides reasoning that does not link the evidence to the claim.	Provides reasoning that links the claim and evidence. Repeats the evidence and/or includes some scientific principles, but not sufficient.	Provides reasoning that links evidence to claim. Includes appropriate and sufficient scientific principles.	Provides reasoning that links evidence to claim. Includes scientific principles that go beyond what we have learned thus far.

Water Quality Test Directions

Chlorine Test:
1. Fill the water tube (green top) to the 5 mL line with fresh water.
2. Add one chlorine (DPD) test tablet.
3. Put the cap on the tube and mix the solution until the tablet has dissolved.
4. Compare the color of the sample to the chlorine color comparison chart.
5. Record your findings in the data table.
6. Pour the liquid in the waste bucket.
7. Rinse the tube twice for the next sample.

Dissolved Oxygen Test:
1. Fill a small test tube (black top) to the very top with water
2. Add TWO dissolved oxygen test tablets
3. Put the cap on the tube and make sure there are no air bubbles in the sample.
4. Mix the solution until the tablets have dissolved.
5. Wait for FIVE minutes.
6. Compare the color of the sample to the dissolved oxygen color chart.
7. Record your findings in the data table.
8. Pour the liquid in the waste bucket.

Nitrate Test:
1. Fill the water tube (green top) to the 5 mL line with fresh water.
2. Add one nitrate test tablet.
3. Put the cap on the tube and mix the solution until the tablet has dissolved.
4. Wait for FIVE minutes.
5. Compare the color of the sample to the nitrate color comparison chart.
6. Record your findings in the data table.
7. Pour the liquid in the waste bucket.
8. Rinse the tube twice for the next sample.

Phosphate Test:
1. Fill the water tube (green top) to the 5 mL line with fresh water.
2. Add one phosphorus test tablet.
3. Put the cap on the tube and mix the solution until the tablet has dissolved.
4. Wait for FIVE minutes.
5. Compare the color of the sample to the phosphate color comparison chart.
6. Record your findings in the data table.
7. Pour the liquid in the waste bucket.
8. Rinse the tube twice for the next sample.

pH Test:
1. Fill the water tube (green top) to the 10 mL line with fresh water.
2. Add one pH test tablet.
3. Put the cap on the tube and mix the solution until the tablet has dissolved.
4. Compare the color of the sample to the pH color comparison chart.
5. Record your findings in the data table.
6. Pour the liquid in the waste bucket.
7. Rinse the tube twice.

WATER QUALITY DATA TABLE

Name _____ Class Period _____

Sampling Site _____

Water Temperature (°C): _____

Now that you're here, take a minute and look around. Write a paragraph (at least) describing your observations. What do you see, smell, and hear.

_____
_____
_____
_____
_____
_____

Pollution Indicator	Test Result	Healthy Level? (yes or no)
CHLORINE		
DISSOLVED OXYGEN		
NITRATE		
PHOSPHATE		
pH		

Questions:

1. What are some types of water pollution?

_____
_____
_____

2. How does the water get polluted?

_____
_____
_____

3. What can we do to decrease (get rid of) water pollution?

_____
_____
_____

WATER QUALITY DATA TABLE

Name _____ Class Period _____

Sampling Site _____

Water Temperature (°C): _____

Now that you're here, take a minute and look around. What do you see, smell, and hear.

I see _____

I smell _____

I hear _____

Pollution Indicator	Test Result	Healthy Level? (yes or no)
CHLORINE in lake		
CHLORINE in drinking water		
CHLORINE in pool		

Questions:

1. What had the most chlorine? The lake, drinking water or pool?

_____
_____
_____

2. How does chlorine get into the water?

_____
_____
_____

3. What can we do to get rid of chlorine?

_____
_____
_____