

**Lesson Title:** *Water Testing on the Susquehanna River*

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**Topic:** Water Quality

**Targeted Grade Level:** Grades 11 & 12 High

**Time Needed:** *One 85 minute lab period a month for ten months*

**Subject Integration:** *I will be using Chemistry and Earth Science along with Technology and then Geology and Literacy.*

**Justification:** The water testing kits use Chemicals to see how good or poor the water quality is and so the reactions occurring and the reasons why are discussed and explained through Chemistry. The water movement and runoff is discussed using some Earth Science terms and relates to the course my students took a few years ago. The kits we use are Technology: pH meters, timers, comparison charts, already filled ampoules and thermometers. The Geology piece comes along with the Earth Science piece in that the Chemicals found in rivers and streams is a direct correlation to the shape of the Earth and the population around it. And Literacy is needed to be able to read the program guide to use the materials and equipment and to also be able to explain the results of the data that is being gathered. My Maps, a Google program, is also used to show the terrain and path the river takes along with the ability to post results over time. And lastly, another Google program used is Google Sheets for the recording (or transferring to) of the data collected. After collection of the river water data, the students discuss their results and share their thoughts on poster board that will eventually have ten months worth of water testing data to look at and compare over the time of their school year. Combining these various topics shows the students how we really do not just study Chemistry or Geology. We study combinations of various topics since we are all interrelated and it is very difficult to separate them out and study just one thing into itself.

**Standards:** *NGSS, Common Core, or related State standards. Write out (or copy and paste) standards completely. Please identify the point when each standard is addressed in the 5E template below. Each standard should be explicitly addressed within the lesson if it is to be included. Example: Reading aloud a non-fiction text does not solely qualify for ELA integration. Making a graph does not solely qualify for math integration. What concept is explicitly being taught?*

**NGSS Performance Expectations** *If you state does not use NGSS, use your state standards. Identify the state and link to the standards page. You are encouraged to list both the NGSS and your state standards.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
<p><i>Asking questions (for science) and defining problems (for engineering)</i></p> <p><i>Planning and carrying out investigations</i></p> <p><i>Analyzing and interpreting data</i></p> <p><i>Constructing explanations</i></p> <p><i>Obtaining, evaluating and communicating information</i></p>	<p><i>PS:1 Matter and its interactions</i></p> <p><i>ESS:3 Earth and human activity</i></p>	<p><i>Cause and effect</i></p> <p><i>Scale, proportion and quantity</i></p> <p><i>Connections to NOS</i></p>

**Common Core State Standards:**

MATH: none

ELA: CCSS.ELA-LITERACY.WHST.11-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

CCSS.ELA-LITERACY.RST.11-12.4

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.

ITEEA Standards *none*

Other Standards (*as needed*)

**Measurable Student Learning Objectives:**

Students will be able to:

- Run and collect data for the six different testing kits.
- Write down the data succinctly and clearly for others to be able to read.
- Analyze the data by comparison to the given parameters.
- Compare the significance of data from the six tests—does it make sense.
- Compile the data for the ten months and see if there are trends or outliers.
- Draw conclusions from what they have seen each test date and then overall.
- Share out the information using MyMaps and Google Sheets.

**Nature of STEM:** *This lesson definitely addresses the NOS since it is hands on, in their backyards kind of research science. It utilizes more than just a text or workbook and is very opened. There is a 'best' answer, but no really right or wrong answer. And IF the 'best' answer is not one we wish to have, then there is so very much room for improvement and 'thinking out of the box' that we could go into almost any direction with asking how to fix/correct the tested problem.*

**Engaging Context/Phenomena:** *By showing my students some of the pictures of water from space, <https://earthdata.nasa.gov/learn/sensing-our-planet/cleaner-water-from-space> we can have a discussion of what they see, what is going on and what can be done about it. [https://cdn.earthdata.nasa.gov/conduit/upload/7710/cleaner\\_water\\_3.jpg](https://cdn.earthdata.nasa.gov/conduit/upload/7710/cleaner_water_3.jpg) shows an algae bloom. <https://www.cbf.org/about-the-bay/maps/geography/chesapeake-bay-watershed.html> This site uses the*

Chesapeake Bay Watershed and has maps to compare and show the effects of us New Yorkers on the Maryland crabbers. And lastly, <https://www.arcgis.com/index.html> using Arc-Gis, we can look at how things change with time and differences of conditions

**Data Integration:** The data being used for this lesson is student generated using water testing kits and then sharing out the information amongst the different groups. <https://earthdata.nasa.gov/learn/toolkits/freshwater-availability> used for data and further reading on water data. <https://terra.nasa.gov/citizen-science/water-quality> used for photos for discussion prior to going water testing.

**Differentiation of Instruction:** *there are not many modifications necessary for this lab/lesson. We walk to the river, so IF a student needed a ride that is possible. No hearing problems, since directions are written down. Writing difficulties could be handled by recording them on their phones or iPads. Most of the tests are visual ones, so this would need to have someone describing what is seen a*<https://www.cbf.org/about-the-bay/maps/geography/chesapeake-bay-watershed.html>*nd saying it out loud. But the visually impaired student could still participate with the hands on testing, just needing someone to ‘see’ for them. Those afraid of the water or being close to it would be able to stay farther up on the back and approach as they felt comfortable to do so.*

**Real-life Connection:** *The real life connection to this lesson is in the thought about having safe drinking water and what we put into the water system and why. We can drink river water, but should we? Not sure how culturally responsive teaching practices would fit into this. And students see water all around them everywhere and should be thinking about the possibilities of not having safe drinking water.*

**Possible Misconceptions:** *None I can think of.*

**Lesson Procedure:** *This is where you include each phase of the 5E. They should be extremely clear, well organized, and ready to be used by another educator. Be sure that each learning experience meets the guidelines for each “E”. The template below will help you.*

5E Model	5E Objectives
Engage	Procedure: Show the students one of the views of water from a NASA or Arc-Gis website

<p><i>Introduce the lesson with an anchoring phenomenon. Facilitate student questions, discussion, etc. as appropriate. Learn about what students already know and want to know.</i></p>	<p>and ask about it? Teacher is leading discussion and students are asking/answering generated questions. Sharing how to use MyMaps and logging all students in for access for later usage.</p> <p><b>Modifications</b> <i>cannot think of any</i></p> <p><b>Standards Addressed</b> <i>Asking questions (for science) and defining problems (for engineering)</i></p> <p><b>Formative/Summative Assessments</b> <i>making sure each student asks/answers a question</i></p> <p><b>Resources:</b> <i>chrome books, MyMaps, websites previously listed</i></p>
<p><b>Explore</b></p> <p><i>Plan for students to engage in hands-on activities that are designed to facilitate conceptual change.</i></p>	<p><b>Procedure:</b> <i>All students will run all of the water tests and record the information during a lab period. Then when we go on the trip to the river, each pairs of students will do one test and record the results to be shared back in the classroom. Each pair selects a testing kit and carries it to the river, runs the test and brings it back.</i></p> <p><b>Modifications</b> <i>Those with mobility issues or sight issues will be assisted by their buddy.</i></p> <p><b>Standards Addressed</b> <i>Planning and carrying out investigations.</i></p> <p><b>Formative/Summative Assessments</b> <i>By the reading of the collected data and the actual completion of the data collection at hand.</i></p> <p><b>Resources</b> <i>Test kits (phosphate, nitrate, dissolved oxygen, acidity &amp; harness, temperature, turbidity, dissolved solids), life saver, turbidity tube and rope, 5 x 8 cards to record on and pens, phones for pics. Sample water <a href="#">card</a> and sample water <a href="#">chart</a></i></p>

<p><b><u>Explain</u></b></p> <p><i>Facilitate opportunities for students to explain their understanding of concepts and processes and make sense of new concepts.</i></p>	<p><b>Procedure:</b> <i>Once data is collected, students will share their data and explain why it is what it is and whether it is good/not good and why. Posting data collected on the Google Sheets. Teacher is facilitating as student pairs share.</i></p> <p><b>Modifications</b> <i>none I can think of</i></p> <p><b>Standards Addressed</b> <i>Analyzing and interpreting data</i></p> <p><b>Formative/Summative Assessments</b> <i>By taking notes on how well the students explain what they have discovered.</i></p> <p><b>Resources</b> <i>paper charts created from the 5 x 8 cards used at the river; MyMaps; Google Sheets</i></p>
<p><b><u>Elaborate</u></b></p> <p><i>Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend understanding and skills.</i></p>	<p><b>Procedure:</b> <i>Discuss what is happening over the time of a year: seasons, different materials put into the river, how it might affect the results of our tests. Students asking/answering questions as teacher leads discussion.</i></p> <p><b>Modifications</b> <i>none I can think of.</i></p> <p><b>Standards Addressed</b> <i>Constructing explanations</i></p> <p><b>Formative/Summative Assessments</b> <i>How will you assess in each phase?)collecting subjective data as to which students understand and which are still in need of further explanations.</i></p> <p><b>Resources</b> <i>none</i></p>
<p><b><u>Evaluate</u></b></p> <p><i>Assess students knowledge, skills and</i></p>	<p><b>Procedure:</b> <i>Explanation of what the lab report will need to have in it and what the questions are that the students will be answering.</i></p> <p><b>Modifications</b> <i>none</i></p> <p><b>Standards Addressed</b> <i>Obtaining, evaluating and communicating information</i></p>

<i>abilities.</i>	<b>Formative/Summative Assessments</b> <i>A final written lab report using all of the data collected over the year.</i> <b>Resources</b> <i>none</i>
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**Teacher Background:** The teacher needs to have knowledge of how to use each of the water testing kits. (Learned and received through NYGA <https://www.nygeographicalliance.org/>). Also an understanding of how to use the My Maps feature from Google and be able to show and explain it to others. And the Google Sheets program for recording of data once back in the classroom. (Learned through courses at Teacher Center of Broome County and Google PD).