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| **Water Dawgs Lesson Plan**  **Topic: Chemical Monitoring, Part B**  **Learning Module #6** | | | |
| **Lesson Objectives(s):** | | * SWBAT conduct chemical monitoring in a campus stream using Adopt-A-Stream protocols. * SWBAT compare and contrast Adopt-A-Stream protocols with YSI protocols. | |
| **Associated NGSS Standard(s):** | | N/A | |
| **Associated A.P. Environmental Science Standard(s):** | | * STB-3-B-Describe the impacts of human activities on aquatic ecosystems | |
| **Materials:** | | * PowerPoint * Printed materials:   + Lesson worksheets (WS) – 1 copy per student   + Field Directions for Chemical Monitoring (Handout 1 [H1]) – 2 copies per student, one for notebook and one for the field   + Adopt-A-Stream Chemical Form (Handout 2 [H2]) – 2 copies per student * Poster paper * Water quality testing supplies:   + LaMotte pH Environmental Test Kit – ~1 kit for each pair of students)   + LaMotte Dissolved Oxygen Test Kid – ~1 kit for each pair of students)   + Conductivity Probe/Thermometer – ~1 kit for each pair of students)   + 3 containers for stream/lake sample water (i.e., SOLO cups for beakers for EXPLORE activity)   + Waste jug   + DI water   + Rubber gloves   + Pencil and clipboard – for each student   + Safety glasses – for each student   + Water boots – for each student   + Backpack – for each student | |
| **Instructor to do before lesson:** | | * Print:   + Lesson worksheets (WS) – 1 copy per student   + Field Directions for Chemical Monitoring (Handout 1 [H1]) – 2 copies per student, one for notebook and one for the field   + Adopt-A-Stream Chemical Form (Handout 2 [H2]) – 2 copies per student * Look over PPT/Lesson plan * Collect stream or lake water to use for EXPLORE activity. * Set up water quality testing supplies. * Run through all of the protocols at least once before completing this lesson with students (especially the dissolved oxygen protocols, as they are complicated!!!)   + If for some reason you believe that the dissolved oxygen protocols are too advanced for the students, you could run through the protocols as an example and have the students observe both during the EXPLORE activity and at the campus stream. | |
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| **Part of Lesson** | **Time** | **Duration** | **Lesson** |
| **ENGAGE** | 1:00 | 10 min | Opening Activity  \*\*Pass out the lesson worksheet (WS).   1. Have you ever measured water temperature or pH before? If so, how did you do each?   ^Allow 3 min for writing, 2 min for pair and sharing with a partner.  \*\*During the class discussion, you should highlight if students report different methods for measuring temperature or pH…. note that there are multiple methods to achieve a result.  ^^Allow 5 min for class discussion |
| **EXPLORE** | 1:15 | 1 hour | Adopt-A-Stream protocols for Chemical Monitoring  \*\*Pass out 1 copy of field directions for chemical monitoring (H1). This should go in their notebooks.  \*\*Pass out 1 copy of the Chemical Form (H2). They will use this form for measuring chemical parameters in the activity.  \*\*Split students into pairs for this activity (or let them choose). You will want to have them work in the same pairs for the campus stream (ELABORATE) activity.  \*\*You will lead students through Adopt-A-Stream protocols for measuring temperature/conductivity (probe), pH (LaMotte testing kit), Dissolved Oxygen (LaMotte testing kit).  *🡪 See H1 and the PPT for step-by-step instructions.*  \*As students work through protocols, they will work in apirs. To practice protocols using a sample water from a stream or lake. They will also answer a series of questions “why” questions as they go through protocols.  Examples:  -Why measure air temperature before water temperature?  -Why take DO and pH measurements twice?  -Why ensure no air is in DO sample bottle?  -Why do we need to calibrate conductivity probe?  ^^Allow 55 minutes for activity |
| **EXPLAIN** | 2:10 | 20 min | Compare and Contrast Adopt-A-Stream Protocols with YSI Probe  \*\*Show students the YSI probe and explain how it works.  ^^Allow 10 min  \*Students will work together as a class to compare contrast Adopt-A-Stream protocols with YSI protocols by coming up with “Pros” and “Cons” for each.  *🡪 You could achieve this in multiple ways (i.e., think, pair, share; write on sticky notes individually and share out with class; work together as a class).*  \*\*We suggest you draw this table on a piece of poster paper and list pros and cons as they are discussed:   |  |  |  | | --- | --- | --- | |  | Adopt-A-Stream Protocols | YSI Probe | | Pros |  |  | | Cons |  |  |   ^^Allow 10 min. Afterwards, hang up poster in classroom. |
| BREAK | 2:30 | 15 min | BREAK  Instructor should encourage students to use the restroom, get water, etc. before field trip |
| **ELABORATE** | 2:45 | 20 min | Chemical Monitoring in our Campus Stream  \*\*Pass out 1 copy of field directions for chemical monitoring (H1). They will take this copy with them to the field.  \*\*Pass out 1 copy of the Chemical Form (H2). They will use this form for measuring chemical parameters in the campus stream.  \*\*Make sure everyone has the required supplies for the field trip:  You will need:   1. Field directions for Chemical Monitoring 2. Chemical Monitoring Form 3. Pencil/Clipboard 4. Gloves 5. Safety Glasses 6. Waste Jug (one per class) 7. Conductivity/Temperature Probe (one per group) 8. pH sampling Kit (one per group) 9. Dissolved Oxygen Sampling Kit (one per group) 10. Water boots 11. Backpack   \*\*Walk to campus stream from classroom |
| 3:05 | 45 min | \*\*Instructor will go over instructions and safety considerations.  ^^Allow 5 minutes  \*\*Students will work in pairs/small groups to test temperature, conductivity, DO, and pH at campus stream using Adopt-A-Stream protocols.  ^^Allow 40 min |
|  | 3:50 | 20 min | BREAK  \*\*Walk back to classroom from campus stream  \*\*Give students time to use the restroom, get water, etc. |
| **EVALUATE** | 4:10 | 15 min | Closing Activity  \*\*Have students answer questions on their lesson worksheets (WS).  Question 1: You are a water researcher for Athens Clarke County. You are going to be in charge of an upcoming water quality sampling event of the North Oconee River, and will take place four times per year. The sampling event will including measuring temperature, conductivity, dissolved oxygen, and pH. You are sponsored by a large corporation that has given you a $10,000 budget for the sampling. Would you choose to use Georgia Adopt-a-Stream protocols for chemical monitoring, or a YSI probe? Explain your answer.  Question 2: Why do we measure pH twice using Georgia Adopt-A-Stream protocols?  ^^Allow 10 min. Collect responses and review after the lesson. |