**Teaching Science as Inquiry (TSI) Lesson Plan**

**Module 2: Chemical Aquatic Science**

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**Activity: Electrolysis**

**1. Why did you choose to do this activity?**

I chose this activity because students had previously been learning about atoms and elements. We had talked about compounds and I thought students would be excited to get to try and split water by using electricity. I also wanted to try it on a small scale, with only 1 class, in order to see if the setup was going to be workable for 6th graders. If it works well with my focus class, then I know I can use it in the future with all my 6th grade classes.

**2. What are your classroom learning goals?**

I would like for my students to continue to practice how to follow procedures to set up and experiment, how to hypothesize and analyze the data they get in order to come up with a reasonable conclusion.

I would also like students to see how the needs of our society have influenced the development and use of technologies and how our need for alternate fuels may create more and more need for electrolysis to create Hydrogen gas that can be used in fuel cell technology.

I would like students to have a more complete understanding of chemical changes by observing the formation of new substances during electrolysis.

I would like students to use their prior knowledge about physical and chemical properties of substances throughout the lab/lesson.

**3. How does this activity tie into your classroom learning goals?**

This activity will give my students practice following lab procedures and setting up their experimental equipment. They will also use their prior knowledge and data collected to make inferences and hypothesize about the makeup of the gases in the pipettes.

Students will get the opportunity to learn why the ocean is such a promising resource for future energy technology and will learn how science affects society and how the needs of society drive scientific discovery.

Students will get the opportunity to observe a chemical change and use their prior knowledge of the signs of a chemical reaction to infer that electrolysis did in fact decompose water.

Students will have an opportunity to use vocabulary and new learnings from their previous unit to build new learning.

**4. What date do you plan to start this activity?** Thursday 11/15/12

***5. If applicable:* HIDOE standards this lesson will address**

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| **◊** [*6.1.1*](http://165.248.30.40/hcpsv3/imr/report_by_code.jsp?code=SC.6.1.1&contentarea=SC&gradelevel=6)  | **Scientific Inquiry***Formulate a testable hypothesis that can be answered through a controlled experiment*  |
| **◊** [*6.1.2*](http://165.248.30.40/hcpsv3/imr/report_by_code.jsp?code=SC.6.1.2&contentarea=SC&gradelevel=6)  | **Scientific Inquiry***Use appropriate tools, equipment, and techniques safely to collect, display, and analyze data* |
| [*6.2.2*](http://165.248.30.40/hcpsv3/imr/report_by_code.jsp?code=SC.6.2.2&contentarea=SC&gradelevel=6)  | **Science, Technology, and Society***Explain how the needs of society have influenced the development and use of technologies* |
| [6.6.6](http://165.248.30.40/hcpsv3/imr/report_by_code.jsp?code=SC.6.6.6&contentarea=SC&gradelevel=6)  | **Nature of Matter**Describe and compare the physical and chemical properties of different substances |
| [6.6.8](http://165.248.30.40/hcpsv3/imr/report_by_code.jsp?code=SC.6.6.8&contentarea=SC&gradelevel=6)  | **Nature of Matter**Recognize changes that indicate that a chemical reaction has taken place |

**Ocean**

**6. Describe how you will connect this activity to the ocean:**

The ocean is a source of water that has higher electrical conductivity than fresh water and would be a large source of water to be used in electrolysis to create Hydrogen gas. This fuel can then be used in fuel cells as an alternate to fossil fuels.

**7. Select the Ocean Literacy Principle(s) that you anticipate this activity will address.** (check all that apply)

√ 1. The Earth has one big ocean with many features.

□ 2. The ocean and life in the ocean shape the features of the Earth.

□ 3. The ocean is a major influence on weather and climate.

□ 4. The ocean makes earth habitable

□ 5. The ocean supports a great diversity of life and ecosystems.

√ 6. The ocean and humans are inextricably interconnected

□ 7. The ocean is largely unexplored

**Preparation**

**8. How will you prepare your students for this activity? (For example, review of prior knowledge.)**

I will do a lesson prior to the electrolysis in order to review learning and introduce molecules, compounds and bonding.

I will review their prior learning about physical and chemical changes and ask what kind of change occurs when water changes state.

I will also review the chemical composition of water and of other compounds like NaCl.

I will talk to the class about how water is a very stable molecule because it is difficult to break it apart into the elements that make water.

Then I will ask the class if anyone can think of a way we can chemically change water. I will show a picture of boiling water, a volcano, a nuclear reactor and ask if we put water in these places, would it chemically change?

Then I will tell the class about Electrolysis and tell them that it was used to break apart substances to discover new elements. I will ask if anyone thinks perhaps electricity could break apart water…

Connect to Ocean!!! How?

**9. Explain any instructional struggles that you foresee and how you will address these issues. (For example, student misconceptions, classroom discussion, aspects most difficult for students to grasp, etc.)**

I foresee some students who still will forget that phase changes are just physical changes even though we went over that in the previous lesson. One way I can address this issue if it arises is to capture the gas that rises over boiling water and show students that it is not the same as the Hydrogen and Oxygen gases that form during electrolysis of water. They will also be able to see that it condenses on the glass once it gets enough steam in the tube.

I also foresee that students might have a difficult time understanding what “bonds” are. I will try to explain it like the game Red Rover and how bonds connect things together and how some “bonds” are easier to break than others.

I also foresee some difficulty with the vocabulary, such as electrode and pipette. I will introduce them prior to the lesson so that they are more familiar before we start.

Students might also have some difficulty understanding that water can actually be used to complete the circuit. If this becomes a problem, I can always show them how we can get a light to light using water to complete the circuit so that they understand more that electricity is flowing throughout the circuit.

**Questioning and Assessment Strategies**

**10. What *questioning strategies* will you use to help your students meet your learning goals?**

* Probing questions – prior knowledge/experience with last lab and unit information
* Predictions – for lab
* Oral Questioning of Whole Group, Lab groups, and Individuals
* Follow up Questions – discuss in groups and review orally

**11. What *assessment strategies* will you use to help your students meet your learning goals and monitor their progress?**

* Formative assessment using oral questioning of individuals and groups
* Follow up questions – orally reviewed.
* Written Activity Questions
* Group and Class Discusisons

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| Use the following table to plan your lesson using TSI. For each phase:* **Mode(s):** List the Mode(s) of Inquiry you will incorporate
* **Teacher:** Describe what you will be doing
* **Student:** Describe what your students will be doing
* **Assess:** Describe how you will assess your students in this phase so you can monitor their progress through the activity

\*Modes: Curiosity, Description, Authoritative knowledge, Experimentation, Product evaluation, Technology, Replication, Induction, Deduction, Transitive knowledge |

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| **INTERPRETATION** | **INITIATION** |
| Mode(s) | Inferring (is deduction or induction?) | Mode(s) | CuriosityAuthoritative Knowledge |
| Teacher | Group discussion about results.Ask and Review questions | Teacher | How can water be chemically changed?Show pics of volcano, nuclear reactorAsk who would like to try splitting water with electricity…. |
| Student | Discuss and Answer questions.Determine the chemical composition of water and what is in the pipettes.Compare physical and chemical change. | Student | Brainstorm with groups and share out |
| Assess (look for) | Understanding that a chemical change occurred and that the pipette with 2x as much gas is hydrogen and the lesser one is oxygen. | Assess (look for) | EngagementUnderstanding that they are trying to break apart H2O – which is different from physical changes |
| **INSTRUCTION** |
| Mode(s) | Authoritative KnowledgeDescription, Replication, Product Evaluation |
| Teacher | First, Describe ElectrolysisAsk students to share our their resultsShow electrolysis/flame test videoRelate to ocean as a source of water to create H2 – an alternate fuel source. |
| Student |  Students share results and experiences, set-up problems, discuss inconsistenciesDiscuss significance of the ocean as a resource for electrolysis and future fuel source |
| Assess (look for) | Understanding that electricity split H2O into H2 and O2 and why this is important scientific technology. How is this relevant here in Hawaii? |
| **INVESTIGATION** | **INVENTION** |
| Mode(s) | Experimentation, CuriosityTechnology | Mode(s) | ExperimentationCuriosity, Technology, Product Eval. |
| Teacher | Checks groups and asks activity inquiry prompts | Teacher | Review procedure with students and allow them to set up apparatus.Check off for correct set-up. |
| Student | Connect to battery, test for complete circuit and bubbles.Observing, discussing with group members. Record data. | Student | Review procedure and follow to set up their apparatus.Create hypothesis |
| Assess (look for) | Is electrolysis occurring? Look for bubbles on electrodes. | Assess (look for) | Correct set-up, measuring (esp. prior to cutting the pipettes) |

**12. Briefly describe how you will direct your students through the Phases of Inquiry.**

**13. What will be the *overarching* mode(s) of this activity? Why?**

The overarching modes will be experimentation and making inferences (induction or deduction??). Experimentation will be covered in different phases – first setting up the apparatus, checking it for accuracy, doing the experiment and examining setup to see what happens under different circumstances. Students will continually be analyzing information and making inferences about their data. I’m not sure if this is induction or deduction.

**Please provide any additional comments that will help you prepare to teach this activity or help the TSI facilitators understand how you plan to teach this activity.**