**Teaching Science as Inquiry (TSI) Lesson Plan #2**

**Module 2: Chemical Aquatic Science**

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Activity: Properties of Water

1. Why did you choose to do this activity?

We are studying the ocean in great detail in Marine Science so it is vital for the students to understand the unique properties that water possesses and how they give water the ability to form waves, allow boats to float, and provide a medium in which marine organisms can live.

2. What are your classroom learning goals?

I would like my students to be able to make connections between various topics that may seem to be isolated and also to understand the way that scientists conduct research in their laboratories and out in the field.

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

Our entire Marine Science course centers around the ocean, so it is important for students to understand how water behaves and how its properties affect everything that occurs in the ocean. It will allow the students to make connections between the different modules that we study during the year, rather than thinking of them as distinct units, as well as provide a foundation for studying the chemistry and biology of the ocean.

4. What date do you plan to start this activity? November 26, 2012

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

* **Benchmark SC.MS.1.2** Design and safely implement an experiment, including the appropriate use of tools and techniques to organize, analyze, and validate data
* **Benchmark SC.MS.1.3** Defend and support conclusions, explanations, and arguments based on logic, scientific knowledge, and evidence from data
* **Benchmark SC.MS.1.4** Determine the connection(s) among hypotheses, scientific evidence, and conclusions
* **Benchmark SC.MS.1.7** Revise, as needed, conclusions and explanations based on new evidence

**Ocean**

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

Our entire Marine Science course centers around the ocean, so it is important for students to understand how water behaves and how its unique properties contribute to physical, chemical, and biological oceanography. We will try to examine why things occur in the ocean in connection to the properties of water.

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

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

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

X 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.)

On the first day of the activity, I will do a Powerpoint introduction to the properties of water including cohesion, adhesion, and the molecular forces responsible for these properties.

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.)

Students may have had some prior knowledge of cohesion and adhesion, so I will first ask them to write what they think each of these words mean in their notebooks, then do a class share to see what our ideas about them are. Once we have defined them, we will try to apply them to the penny and water drop activity (A) and use these new vocabulary words to describe our observations.

**Questioning and Assessment Strategies**

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

* Pre-assessment: Ask students to write their definitions of adhesion and cohesion and give real-life examples.
* During the activity:
* Post-assessment: Ask students to explain the difference between adhesion and cohesion by explaining where each occurs in the penny and water drop system and in real-life examples.

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

* Formative assessment
  + See #10
  + prior knowledge (terms: adhesion, cohesion)
  + notes in science lab notebook
  + post-activity questions

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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) | Description | Mode(s) | Description, Authoritative knowledge, Transitive knowledge |
| Teacher | * Facilitate discussion about activity * Use questioning strategies as needed to guide the discussion. | Teacher | Intro: Powerpoint about adhesion, cohesion, and molecular bonding. |
| Student | * Answer Activity Questions for homework. * Discuss experiments and observations with group members and class. * Contribute to class discussion and take notes. | Student | Take notes in science notebook (SNB). |
| Assess (look for) | * Students are using the new vocabulary words (adhesion, cohesion) when discussing their observations. | Assess (look for) | * Prior understanding of “adhesion” and “cohesion” terms. * Ability to give examples of adhesion and cohesion. |
| **INSTRUCTION** | | | |
| Mode(s) | Description, Experimentation | | |
| Teacher | * Give students materials and demonstrate each activity. * Remind students to watch and budget their time. | | |
| Student | * Listen to instructions and budget time. * Discuss observations with partners and group members. * Share during class discussion. | | |
| Assess (look for) | Make sure that students are doing the activities as described but allow for experimentation and improvisation. | | |

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| **INVESTIGATION** | | **INVENTION** | |
| Mode(s) | Description, Experimentation, Replication | Mode(s) | Curiosity, Transitive knowledge |
| Teacher | * Give suggestions as needed. * Ask students questions about what they see and how it demonstrates the properties of water. | Teacher | * Support students’ ideas of how to test their hypotheses. * Give suggestions as needed. |
| Student | * Carry out experiments to test predictions. * Record observations. | Student | * Make predictions about each activity. * Devise ways to test the properties of water described. |
| Assess  (look for) | * Students use materials properly. * Novel ideas of ways to test hypotheses. * Students recording data accurately and thoroughly. | Assess (look for) | * Give suggestions as needed. |

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

* Initiation: Check students’ understanding of adhesion and cohesion, introduce molecular bonding (PowerPoint)
* Instruction: Minimal instruction except to introduce new terms and materials and show students how to use them
* Invention: Support students ideas on how to test their hypotheses and give suggestions as needed
* Investigation: Ask students about what they are doing, how their observations support their hypotheses about water properties, and give support and suggestions as needed.
* Interpretation: Help students to connect their observations with real-life examples of cohesion, adhesion, capillary action, and surface tension, especially in relation to the ocean.

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

* Description – students will be predicting what they think will happen and writing detailed observations of the results, which both require thinking and describing qualitatively and quantitatively
* Experimentation – students will spend the majority of their time manipulating materials to explore the properties of water, and practicing their investigative skills

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.

This is the first time I will be teaching this activity. Due to time constraints, I will adjust the time as needed but would like to finish the activity within two class periods, including time to work on and discuss the Activity Questions. I think that the information students gain from this activity will make studying Chemistry of the ocean easier later in the semester.