**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 to do this activity because a good “hook” for it is a conversation about the size of a water molecule. The discussion would center on how miniscule a water molecule is and would pose a question about how it is possible we know the chemical make-up of water.

We are currently in the midst of a unit about the size of the universe and I found an awesome online animation that allows for the comparison of the size of the universe and the size of a water molecule. <http://scaleofuniverse.com/>

This will allow students to be able to compare something they are familiar with (water molecules) to the mind-blowing vastness of the universe.

2. What are your classroom learning goals?

The learning goals that we are currently working on are:

I will be able to:

* Describe the size of the Universe.
* Define a galaxy.
* Describe the 3 types of galaxies.

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

This activity ties into the learning goals by allowing students to see the size of the universe in comparison to something as small as a water molecule.

4. What date do you plan to start this activity?

November 26-27

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

8.8.11 – Describe the major components of the universe.

**Ocean**

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

In the “lead-in” conversation, I will talk about how essential water is to this planet, how it makes the Earth habitable, how abundant it is on our surface (about 70%).

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.)

The review before this activity will be about the relative size of the universe and what the universe is composed of (galaxies, which in turn contain stars, some of which are orbited by planets).

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 students having difficulty grasping the size of water and the size of the universe. To help facilitate this understanding, I procured the scale of the universe animation (link pasted above).

**Questioning and Assessment Strategies**

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

Students will be asked questions to answer both in a full class and a small group setting. These questions will target prior knowledge and will lead students to connecting what they know to what they are learning through this activity.

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

At the end of the lesson, I plan to have student groups work together to synthesize a description of the activity that took place and what it verified for them. I will also ask them to describe the size of the universe in comparison to a water molecule.

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| **INTERPRETATION** | | **INITIATION** | |
| Mode(s) | Induction Replication | Mode(s) | Curiosity Authoritative Knowledge |
| Teacher | Will be asking questions about what happened in the experiment and leading students (through questions) to tie this to their prior knowledge to induce the chemical make-up of water. | Teacher | Describing the importance, abundance, and make-up of water with the help of an animation from “scale of the universe”. |
| Student | Engage in a discussion about what happened during the experiment as well as a thinking process that ties all of the information together. | Student | Students will be in their desks listening, answering questions, mentally engaging in the introduction to the lesson. |
| Assess (look for) | The assessment will be student answers to questions as well as a written explanation submitted by each lab group. | Assess (look for) | Scattered throughout this “hook” will be questions probing student prior knowledge as well as their engagement in the question asking that we are doing to initiate the activity. Participation will be the assessment for student initiation. |
| **INSTRUCTION** | | | |
| Mode(s) | Technology | | |
| Teacher | Description about how to set up the electrolysis system. Directions will be given step-by-step with students completing that instruction and waiting silently at their lab tables for the next directive. | | |
| Student | Students are listening and following teacher direction. They are also working collaboratively in groups of 4 to assemble the electrolysis apparatus. | | |
| Assess (look for) | I will know if students followed instruction by looking at both their finished electrolysis set-up as well as their progression towards the final product. | | |
| **INVESTIGATION** | | **INVENTION** | |
| Mode(s) | Experimentation | Mode(s) | Experimentation |
| Teacher | Circulating the room observing the students engaging in their experiment, asking questions to prompt thinking and induction. | Teacher | Providing instruction for the set-up of the apparatus, prompting students to generate guesses throughout the running of the experiment. |
| Student | Engaged in set-up and execution of the experiment collaboratively with lab group. Observation of the experiment will be a large part of this phase. | Student | Working to find the best way to set up the apparatus, generating ideas about where the gas is coming from and why/how it is forming the way it is. |
| Assess (look for) | Visual assessment based on level of engagement in the activity as well as success of experiment. | Assess (look for) | Look for students revising or tweaking their set-ups and trying to figure out what is going on during the experiment. |

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

**Initiation**

We will start with a full-class discussion about the importance and abundance of water on our home planet, Earth. Part of this discussion will be the size of the water molecule as well as the chemical make-up of water.

**Instruction**

Students will then transition to their assigned lab groups and will follow step-by-step instruction for the set-up of their apparatus.

**Invention**

The set-up of the apparatus will serve as part of the invention phase for students.

**Investigation**

Students will then run the experiment, the execution and observation of which is the investigation phase.

**Invention**

During the running of the experiment, students will return to the invention phase through mental exploration of why what is happening is taking place (a question to be posed by the teacher).

**Interpretation**

The activity will conclude with a synthesis of prior knowledge and knowledge gleaned from the experiment so that students induce the chemical make-up of water. To tie the water molecule to our current study of the universe, the parting thought for students will be the size of a water molecule compared to the size of the universe using an animation.

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

Overarching modes are induction, experimentation, and technology. Induction because the overall goal of the activity is for students to see what is happening and apply that newfound information to the what they already know about water. Experimentation is central to this activity as it gives students a key piece of information to answer the question, “How do we show what water is made of?”. Finally, without correct use and implementation of technology, the experiment would go awry.

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.