Understanding Hydrothermal Vents

Ions, Energy Transfer and Graduate Research

Overview

1. University reform focused on hydrothermal vents has been integrated into the K-12, grade physical science curricula.

2. PBL activity for high schools to highlight the significance of the material covered in the Delaware State Standards.

3. A project allowing students to gain valuable hand-on experience.

4. Graduate study experiment results oxidation numbers and chemical bonding to unique natural environments.

Abstract

Presented here is a project developed for 7th grade Physical Science students aimed at introducing them to collaborative research efforts between the Departments of Chemistry & Biochemistry and the College of Marine Studies at the University of Delaware. The focus of our research is understanding metal sulfide cluster formation using mass spectrometry by characterizing the environmentally significant reactions between metal clusters and hydrothermal vents. We can better allocate the chemistry using mass spectrometry for the formation of metal clusters in aqueous environments. PBL activities have been designed for two different grade settings. In the first case, the project was designed to bring the entire universe in which students used web pages to gain their work. The second adoption is an abbreviated version which can be completed in two days periods. In both cases, the final aspect of the activity is a presentation of your graduate research and how it relates to what the students are learning in Physical Science.

Learning Goals

Graduate Fellow

- Develop classroom management/communication skills
- Biotechnology innovation
- Familiarization with PBL activities

Student

- Expectant in cutting-edge research
- Biotechnology experience
- Most specific Delaware State Standards

Teacher

- Exposure to university research
- Biotechnology innovation
- Familiarization with PBL activities

In the spirit of the GK-12 fellowship program, this activity is designed to not only enhance students understanding, but also provide valuable educational experiences for both the teacher and graduate fellow. Broadly, the goals set out for this activity.

Abbreviated Version

- Problem-Based Learning activity focused on hydrothermal vents from a geological perspective.

- Project (introduced to class) showing images of hydrothermal vents and the condition that initiates the unique encounter.

- Students work in groups (2-3 students) to sufficiently address the question “What is the smoke?”

- This is a web-based project which takes advantage of the online exposure site set up by the University of Delaware College of Marine & Earth Studies.

- PBL Design for 4th Grade Science

- Setting up the Problem

- Because this activity is designed for 3rd grade students, we help them describe the question by breaking it into three separate tasks. These tasks are designed to help direct their research and keep the students focused.

“l loved the experiment we should do more of this in Science 1, I like going on the computer and learning about Science in our world.”

- Student Comment

Extended Project

- Problem-Based Learning activity covering hydrothermal vents with an emphasis on multidisciplinary research.

- Groups of 3-5 students write “alkali miners” from different scientific perspectives.

- Students develop group wiki pages to organize their findings and record their experimental data.

- A qualitative analysis lab was developed which has students identify an unknown metal salt solution based on the color of the sulfide reaction product.

Addressing Delaware State Standards

- Physical and Chemical Properties
- Oxidation Numbers
- Chemical Bonding
- Energy Transfer

Project Wiki

- Students record their research in group wiki pages.

- Allows students to work on group project independently from home.

- Development of web-based communication skills

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- Development of web-based communication skills