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GK-12: Improvement of Science Education in Vocational Technical High Schools  
University of Delaware  
Newark, DE  
www.udel.edu/GK-12



Understanding Hydrothermal Vents

Ions, Energy Transfer and Graduate Research

Overview

University research, centered on hydrothermal vents, has been integrated into the 9<sup>th</sup> grade physical science curriculum.  
PBL activities have been designed to highlight the significance of the material covered in the Delaware State Standards.  
Technology is central to the project allowing students to gain valuable web-based experience.  
Qualitative analysis experiment relates oxidation numbers and chemical bonding to unique natural environments.

Abstract



Presented here is a project developed for 9th grade Physical Science students aimed at introducing them to a collaborative research effort between the Department 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 hydrogen sulfide we can better describe the chemistry taking place near hydrothermal vents and the bioavailability of metals in aqueous environments. PBL activities have been designed for two different class settings. In the first case, the project was designed to bridge the entire semester in which students used wiki pages to post their work. The newest adaptation is an abbreviated version which can be completed in two class periods. In both cases, the final aspect of the activity is a presentation of my graduate research and how it relates to what the students are learning in Physical Science

Learning Goals

Graduate Fellow

- Develop classroom management/communication skills
- Technological experience
- Familiarization with PBL activities

Student

- Exposure to cutting edge research
- Technological experience
- Meet specific Delaware State Standards

Teacher

- Exposure to university research
- Technological experience
- Familiarization with PBL activities

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

Acknowledgements

A special thanks goes to Terry Blanch (St. Georges) and Kevin Madigan (Delcastle), the GK-12 teachers that have helped with the project.  
Online Expeditions: A website designed for high school education by the University of Delaware College of Marine & Earth Studies and the Sea Grant College Program.  
www.ocean.udel.edu/expeditions

Black Smokers Webquest: An internet based webquest on hydrothermal Vents by UniServe Science. science.uniserve.edu.au

Abbreviated Version

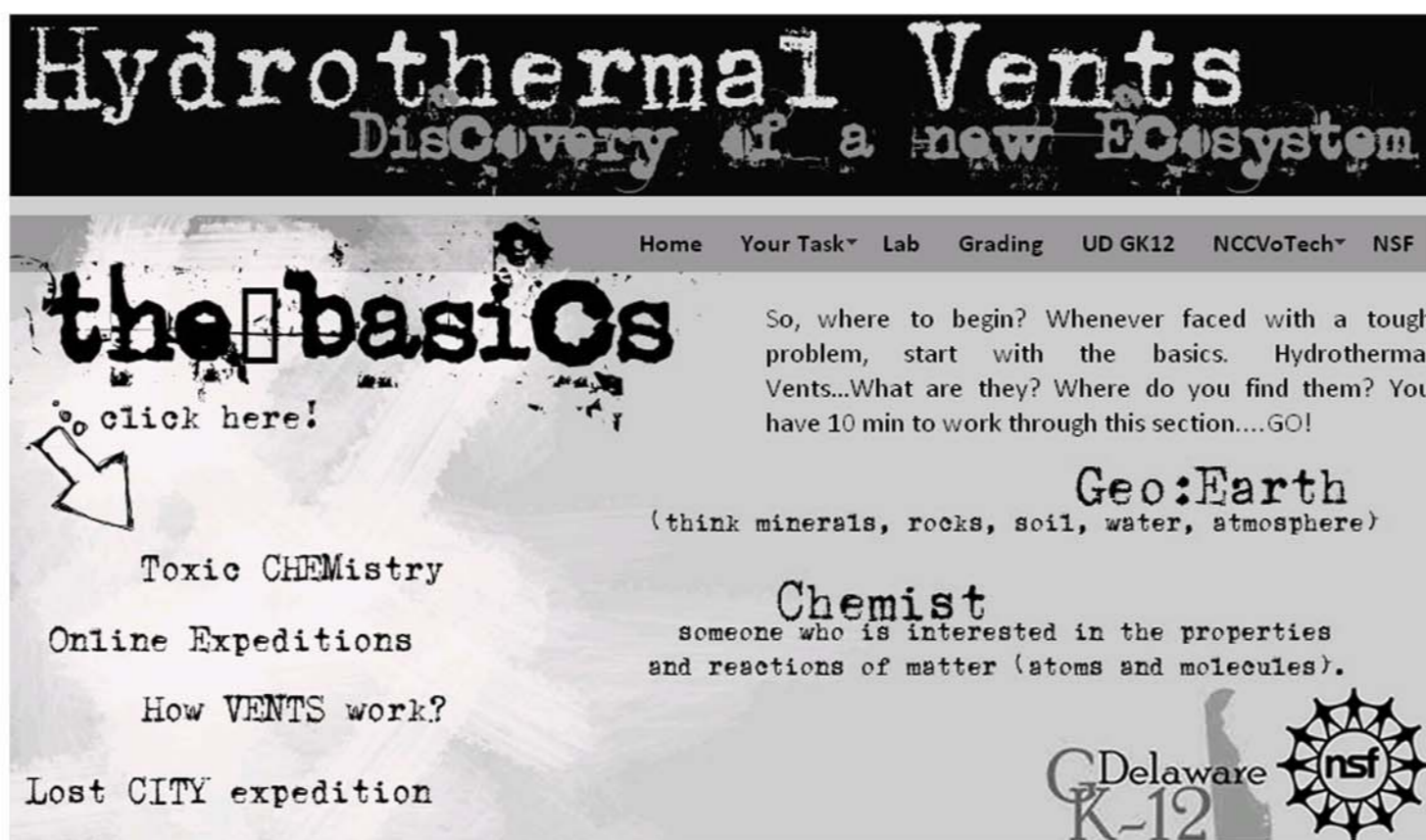
- Problem Based Learning activity focused on hydrothermal vents from a geochemical perspective.
- Project is introduced by showing images of hydrothermal vents and the creatures that inhabit this unique ecosystem.
- Students work in groups (2-3 students) to scientifically address the question: "What is the smoke?"
- This is a web-based project which takes advantage of the Online Expeditions site set up by the University of Delaware College of Marine & Earth Studies.



PBL Design for 9<sup>th</sup> Grade Science

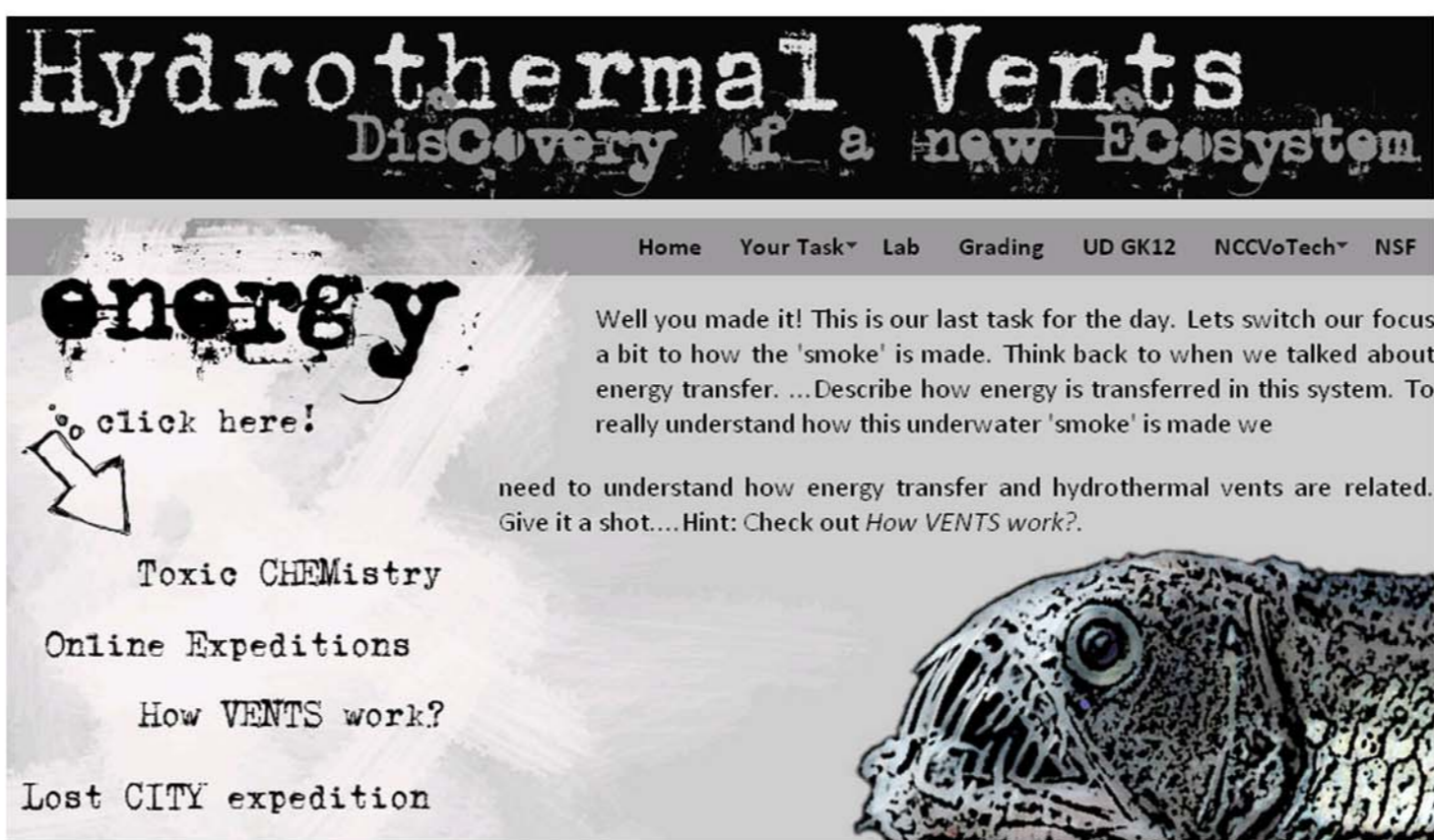
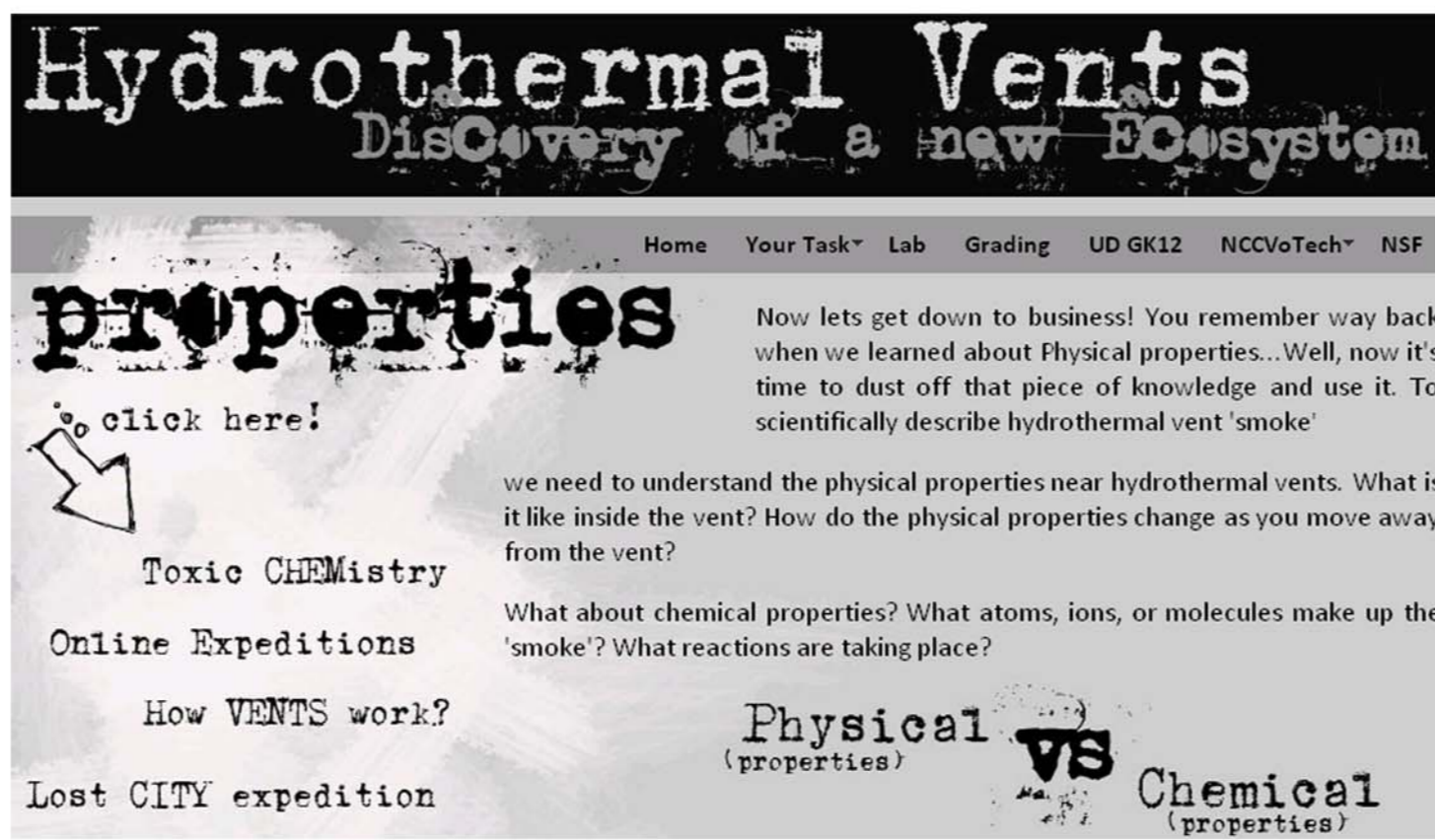
Setting up the Problem

Because this activity is designed for 9<sup>th</sup> grade students, we help them address the question by breaking it into three separate tasks. These tasks are designed to help direct their research and keep the students focused.



"I loved the experiment we should do more of this in Science. I liked 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 2-3 students study 'black smokers' from different scientific perspectives.
- Students develop group wiki pages to organize their finding 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 recorded their research in group wiki pages.
- Allows students to work on group projects individually from home.
- Development of web-based communication skills

