

Modeling Instruction in High School Chemistry

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Instructors:

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Description:

The workshop focuses on the core concepts in high school chemistry from a model-centered perspective. A second workshop will address more advanced concepts at a later date.

Prerequisites:

In-service or pre-service teacher of chemistry or physics or instructor approval

Course Objectives:

The emphasis is on plans and techniques for helping students to learn concepts in chemistry from the perspective of systematically developed particle models for matter. Instructional strategies include a coherent approach to the role of energy in physical and chemical change.

Grading:

A-B-C grades:

B means average; incomplete: only for special circumstances

Attendance:

Grade is based on attendance, lab reports, reflections and participation

Journal:

a daily log book or notebook of problems solved, labs done, reflections on classroom activities and assigned readings

Course Content:

1. **Particulate structure of matter**
 - a. Macroscopic vs. microscopic descriptions
 - b. Compounds, elements and mixtures
 - c. Explanation of observed (macroscopic) properties using microscopic models
 - d. Systematic explanation of details with models of increasing complexity
 - e. Macroscopic evidence for microscopic structure (ionic vs. molecular substances)
2. **Energy and Kinetic Molecular Theory**
 - a. Visualizable models (macroscopic analogs) for solids, liquids and gases.
 - b. Energy storage modes and transfer mechanisms

- c. Role of energy in phase changes
- d. Distinction between heat and temperature
- 3. Stoichiometry**
 - a. The mole concept – relating how much to how many
 - b. Using equations to represent chemical change
 - c. Non-algorithmic approaches to chemical calculations
- 4. Energy and chemical changes**
 - a. Attractions vs. chemical bonds
 - b. Chemical energy, thermal energy and ΔH
- 5. Naïve conceptions about matter and interactions**

Workshop readings:

Great Ideas of Chemistry. Ronald Gillespie *JChemEd*, Vol 74 No 7 July 1997

Testing for Conceptual Understanding in General Chemistry. Craig W. Bowen and Diane M. Bunce. *The Chemical Educator*, Volume 2 Issue 2 (1997), S1430-4171(97)02118-3 <http://chemeducator.org/bibs/000200200020118.htm> (abstract only)

Improving Teaching and Learning through Chemistry Education Research: A Look to the Future. Dorothy Gabel. *JChemEd*, Vol 76 No 4 April 1999

Secondary Students' Mental Models of Atoms and Molecules: Implications for Teaching Chemistry. Allan G Harrison and David F Treagust, *Science Education* 80(5) (1996)

Beyond Appearances: Students' misconceptions about basic chemical ideas. A report prepared for the Royal Society of Chemistry, by Vanessa Barker. Online in pdf format at <http://www.chemsoc.org/pdf/LearnNet/rsc/miscon.pdf>

Exothermic Bond Breaking: A Persistent Misconception, W Galley, *JChemEd*, Vol 81 No 4 April 2004