Breaking Up is Hard to Do
Module 1

Module 1 Description:

Participants will be introduced to the philosophy, the website and resources of National Math and Science Initiative. The teachers will explore physical interactions and systems of particles by performing lessons that will solidify a fundamental understanding of the relationship between the states of matter, intermolecular forces and energy.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- explore deeper content-based knowledge regarding the concepts of intermolecular attractions and the significance of these forces.
- model a teaching strategy to distinguish between atoms, compounds, molecules, elements and ions.
- engage in dialogue about intermolecular forces using a set of data collected in the laboratory vs. a traditional lecture.
- utilize technology to collect data to develop a better understanding between intermolecular forces in hydrocarbons.
- actively compare similarities and differences between water ice and dry ice in a laboratory experience.
- demonstrate an understanding of heating curves by participating in an engaging lab experience.

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Heat 'em Up, Speed 'em Up
Module 2

Module 2 Description:

Participants will explore the role of energy in chemical reactions through thermodynamics and kinetics. In addition to quantifying heat transfers, teachers will discuss the benefits of laying a strong conceptual foundation for topics that are often considered more computational than is appropriate for a first year chemistry student.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- engage in a guided-inquiry approach for establishing the relationship between mass, heat, and temperature as applied within the Law of Conservation of Energy.
- utilize technology to collect calorimetric data with soda-can and coffee-cup calorimeters such that analysis of process enthalpies can be conducted.
- utilize literacy skills to understand and discuss entropy and free energy at an appropriate level of conceptual rigor for a first year chemistry student.
- participate in a modeled guided-inquiry demonstration to establish the basics of reaction kinetics and catalysts.
- extend their knowledge of reaction kinetics with a lesson on rate law considerations and calculations.

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Hanging In the Balance
Module 3

Module 3 Description:

Participants will explore the significance of coefficients in balanced equations for chemical and physical processes, including those that do not go to completion. Concepts traditionally developed in stoichiometry will help teachers to formulate a conceptual approach to introducing general equilibrium in a way appropriate for first year chemistry students.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- establish scaffolded background knowledge for quantifying chemical amounts in the context of balanced chemical reactions.
- explore stoichiometric relationships in a physical investigation involving limiting and excess reactants.
- investigate science practices in an inquiry experiment involving a chemical reaction that produces a gas.
- discuss how the use of a discrepant event in a lab setting can create an authentic opportunity for introducing students to the concept of equilibrium.
- develop the concept of the Law of Mass Action using lab equipment to simulate a system of physical equilibrium that allows for safe collection of quantitative data and manipulation of variables.
- extend their understanding of equilibrium by manipulating physical and chemical systems and observing the effects in the lab.

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Lures for Learning
Module 4

Module 4 Description:

This is the fourth module of any science training series. Unlike the other training modules, it is presented to a mixed audience of middle school and high school teachers. Participants will explore various types and levels of inquiry through hands-on, minds-on activities. The importance of carefully and strategically aligning both content and science process skills and practices is stressed by highlighting the connections in each of the activities. Building successful students starts in the middle grades and progresses throughout the high school years. This vertical emphasis is accomplished by allowing the participants to have the opportunity to explore the process of inquiry, together, through selected activities from middle grades through physics. This also allows participants to examine their own curriculum and determine the best way to integrate lessons obtained at training within their various grade levels or subjects.

Learner Outcomes:

Participants will

- describe what the Science and Engineering Practices look like within the context of a lesson.
- identify and relate each lesson to Common Core State Standards and Next Generation Science Standards.
- review and make connections to the Big Ideas of AP when applicable.
- explain how rates describe mathematical patterns.
- calculate and use slope to describe physical slopes.
- manipulate objects to illustrate different types of motion.
- create multiple representations to describe the motion of a beetle.
- model linearization as an analytical tool.
- demonstrate that acceleration is a rate of a rate of change.
- develop a rich understanding of the philosophy of rigorous instruction in the classroom.

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Mathematics and the Periodic Table
Module 5

Module 5 Description:

Participants will discuss mathematical problem solving strategies in chemistry and investigate relationships between elements on the periodic table. Both traditional wet and dry labs will be explored with the intention of solidifying student understanding of periodic trends and their role in chemical behavior. An examination of AP* style questions and common student misconceptions will further develop the strategies that can be implemented to facilitate student success.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about problem solving and periodicity.

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Intermolecular Forces and Condensed States of Matter
Module 6

Module 6 Description:

Participants will use a variety of techniques to explore intermolecular forces and the solid and liquid states. Computer simulations, probeware, and traditional lab activities will all be utilized. A discussion of common student misconceptions and strategies to overcome those obstacles will also be developed. Examining Pre-AP assessments will serve to assist participants in better preparing their students for the expectations of AP science.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about intermolecular forces and states of matter.

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Thermodynamics
Module 7

Module 7 Description:

Participants will review concepts in thermodynamics and apply them to problem solving and laboratory experiments. Investigations using probeware and traditional laboratory equipment will be explored with emphasis on developing the conceptual framework necessary for successful problem solving.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about thermodynamics.

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Assessment and Kinetics
Module 8

Module 8 Description:

Participants will spend time examining specific assessment strategies that can be implemented in the Pre-AP classroom to prepare students for AP exams. Reading of actual student samples from a Chemistry End Of Course exam will help participants identify student misconceptions and emphasize the finer points of assessment development. In addition to developing participants' assessment skills, instruction in chemical kinetics and a traditional clock reaction experiment will also be included.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about kinetics.

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Reactions and Equations
Module 9

Module 9 Description:

Participants will discuss types of reactions and the equations that accompany them. Both traditional wet and dry labs will be explored with the intention of solidifying student understanding of chemical reactions. An examination of AP* style net ionic questions and common student misconceptions will further develop the strategies that can be implemented to facilitate student success.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about reactions and equations.

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Solutions
Module 10

Module 10 Description:

Participants will use a variety of techniques to explore the properties and nature of solutions. Multiple wet labs will be performed and colorimeters and data collection devices will be used to analyze solutions. A discussion of common student misconceptions and strategies to overcome those obstacles will also be developed. Examining rigorous assessments will serve to assist participants in better preparing their students for the expectations of AP science.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about solutions.

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Equilibrium
Module 11

Module 11 Description:

Participants will review concepts in equilibrium and apply them to problem solving and laboratory experiments. Investigations using probeware and traditional laboratory equipment will be explored with emphasis on developing the conceptual framework necessary for successful problem solving.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about equilibrium.

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Gases and Wrap Up
Module 12

Module Twelve Description:

Participants will explore lessons and activities relating to gas laws in the chemistry class. In addition, time will be spent analyzing and evaluating the components of a rigorous chemistry lesson and participants will have the opportunity to apply those components to an activity that they can take back to their classroom.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Chemistry.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Chemistry Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about equilibrium as well as to revise a standard lesson into a more rigorous one.

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