Inquiry and the New ChemSource

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Inquiry Continuum

Traditional Structured Guided Open
Less student centered More student centered

Inquiry Essentials

Learners are engaged by scientifically oriented questions.
Learners give priority to evidence.
Learners formulate explanations from evidence.
Learners evaluate their explanations.
Learners communicate their explanations.

Adapted from "Inquiry in the National Science Education Standards," NAP, 2000, p. 25

Inquiry - Methods

All science inquiry for students requires the use of multiple methods of instruction.

Inquiry - ChemSource

Guided Inquiry:
• Leading questions
• Student prior knowledge & misconceptions
• Engagement
• Exploration
• Formative assessment
• Student reflection

Inquiry - ChemSource

Guided Inquiry: Modified ChemSource labs to include elements of inquiry.
• Added engagement activity
• Added leading questions
• Modified questions
• Modified instructions and procedures
• Modified post-lab questions
• Included formative assessment
Inquiry and the New ChemSource

ChemSource Inquiry
Exploring Mass and Mole Relationships in Chemical Reactions: An Inquiry Approach

Major Chemical Concept
Students will:
• Observe a reaction between sodium hydrogen carbonate and acetic acid
• Measure the volume of gas produced in several trials using constant mass of acetic acid and increasing masses of NaHCO₃
• Determine the correct stoichiometric masses for the reaction

National Standards
1. Unifying Concepts and Processes
   • Evidence, models, and explanations
2. Science as Inquiry
   • Abilities necessary to do scientific inquiry
3. Physical Science
   • Chemical reactions
   • Structure and properties of matter

Level
• Regular chemistry classes
• Advanced chemistry classes
• Honors chemistry classes
Inquiry in Mass and Mole Relationships Lab Activity

Student prior knowledge & misconceptions
Engagement
Exploration
Formative assessment
Student reflection

Engagement

Teacher demonstration:

What will happen when NaHCO₃ is dropped into acetic acid?
What will the balloon tell us about the reaction in the flask?

Prior Knowledge & Misconceptions

• Evidence for chemical reaction?
• Change quantities of reactants?
• Are there “right amounts” of reactants?
• How could we get the balloon to inflate to greater degree?

Exploration

Reactions:
Constant mass of acetic acid
Increasing mass sodium bicarbonate

Measure:
Volume of CO₂ produced

Formative Assessment

Evidence of student learning:
Ask students: Compare balloons. What’s increasing?

Why is balloon D same size as balloon C, even though NaHCO₃ increased?

Probing Questions

What is the limiting reactant in trial B?

OR

Explain how you know that in trial B there must be some unreacted acetic acid in the container?
**Student Reflection**

Measure circumference of each balloon and plot these. What is the shape of the curve and what does the curve tell us about the reacting masses?

**Student Reflection**

Based on all of your observations of this reaction, in which trial were both reactants used up completely? Explain.

**ChemSource Inquiry**

Synthesis and Qualitative Analysis of a Gas – An Inquiry-Based Approach to the Study of the Atmospheric Gases

(if we have time)