2011

Inquiry and the New ChemSource

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Inquiry
and the
New ChemSource
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Inquiry

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
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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 $NaHCO_3$
- Determine the correct stoichiometric masses for the reaction

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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

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Level

- Regular chemistry classes
- Advanced chemistry classes
- Honors chemistry classes

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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 $NaHCO_3$ is dropped into acetic acid?

What will the balloon tell us about the reaction in the flask?

Prior Knowledge & Misconceptions

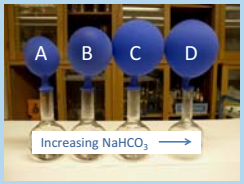
- Evidence for chemical reaction?
- Change quantities of reactants?
- Are there "right amounts" of reactants?
- How could we get the balloon to inflate to greater degree?

Exploration

Reactions:

Constant mass of acetic acid

Increasing mass sodium bicarbonate



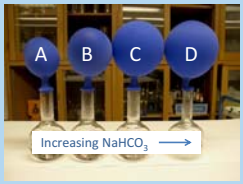
Measure:

Volume of CO_2 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 $NaHCO_3$ 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)