

# **Argument Driven Inquiry in Chemistry: Lab Investigations for Grades 9-12**

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## **Goals: Participants will . . .**

- Become familiar with the ADI “method” and the ADI Chemistry resources
- Be able to better support students participation in Science and Engineering Practices
- Be able to identify and better integrate Crosscutting Concepts and Nature of Science into current curriculum through laboratory activities
- Be able to implement an ADI Chemistry Lab in classroom

## **Goals and Housekeeping**

- Who are you?
- What do you teach? Where?
- What do you hope to get out of today?
- What's your most embarrassing moment teaching?

## **Introductions**

- Complete Activity 5 (SEP Inventory) and Activity 6 (CCC Inventory– just do Cause and Effect and System Models)
- Now, look at the matrix for SEP and CCC. Focus on your grade band.
- Ask yourself “Am my students doing these at the appropriate level?” Do you need to make any changes on your inventories?

**Self-Diagnose**

- Read the Preface on pages xi-xii
- Read the first two paragraphs in the Introduction on page xvii
- Select one sentence or phrase from the selection that you found especially important or pertinent. Write on white paper.
- Share that phrase with the people in your group. Discuss and respond to each person's golden line as you go.
- Whole Group Discussion: Thoughts? Questions?

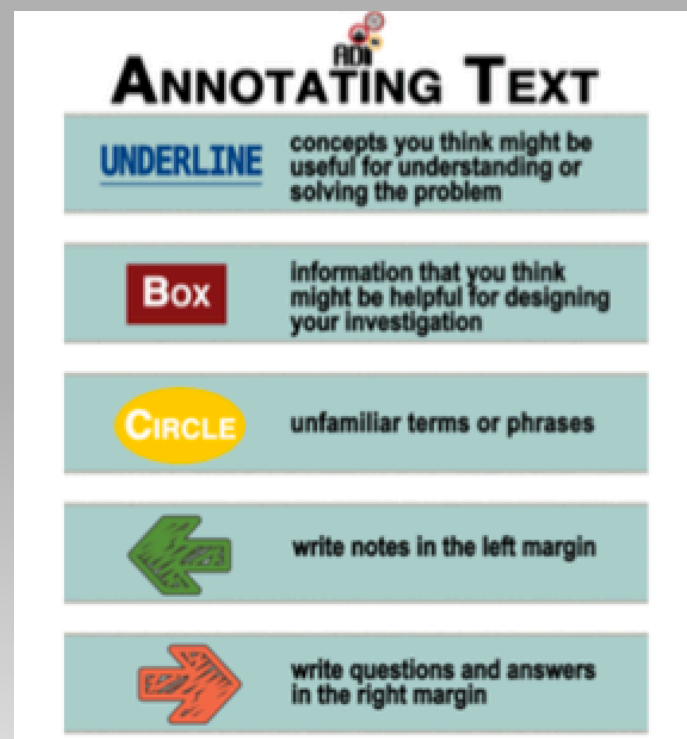
## Golden Lines

- Overview of Argument Driven Inquiry
- This program isn't necessarily labs that you haven't seen before; rather, it takes most-likely familiar labs and does them in a new way.

## **Introduction to ADI**

- Put in something interesting? A discrepant event? Something real world? Formative Assessment prompt? Not sure yet.

- Stage 1: Identification of the Task and the Guiding Question, “Tool Talk”
  - Independently read Lab Handout and Annotate
  - In groups, discuss what your goal is in the investigation. What is your task?
  - Questions?



**Engage in ADI Lab 3: Rate of Dissolution**



- Teacher Tips for Stage 1: Identification of the Task and the Guiding Question, “Tool Talk”
  - Plan for this step.
  - Do a better job than ADI to engage and capture their interest
  - Grouping: Try to keep groups at 3 people
  - Give time to read (Honor the activity with time)
  - Consider annotation protocol or graphic organizer
  - Model a section to start

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- Stage 2: Designing a Method and Collecting Data
  - Review the “Materials, Safety, and Getting Started Section” on lab handout with your group
  - We will use proposal C on page 512
  - Don’t start the collecting data until you’ve written proposal; however, you may handle and look at tools to consider how to approach your task.


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- **Teacher Tips for Stage 2: Designing a Method and Collecting Data**
  - Circulate and ask probing questions about their method
  - Encourage students to ask you questions
  - Consider making materials accessible to students not so they can start investigation but so they can consider them “up close”.
  - Possible Scaffold: At the start of the year, you may want to create your method together. “If this is our question, and these are our materials– what could we do to answer the question?”

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### Stage 3: Data Analysis and Develop a Tentative Argument

- Review the “Initial Argument” section in handouts.
- Add a spot for your model to your white board or be sure to include it with your claim.
- Make sure that everyone in group can answer the questions in the “Argumentation Session” section of handouts.

  
**ARGUMENT PRESENTATION ON A WHITEBOARD**

<b>THE GUIDING QUESTION:</b>	
<b>OUR CLAIM:</b> YOUR ANSWER TO THE GUIDING QUESTION	
<b>OUR EVIDENCE:</b>  <p>This graph indicates... This graph shows... This graph suggests...</p>	<b>OUR JUSTIFICATION OF THE EVIDENCE:</b> <p>We used this evidence because... This evidence is important because...</p>
<p><b>ANALYSIS</b> SHOW A TREND, DIFFERENCE OR A RELATIONSHIP</p> <p><b>INTERPRETATION</b> EXPLAIN WHAT THE ANALYSIS MEANS</p>	<p><b>REASON</b> EXPLAIN WHY THE EVIDENCE MATTERS</p>

## Engage in ADI Lab 3: Rate of Dissolution

- Teacher Tips for Stage 3: Data Analysis and Develop a Tentative Argument
  - Explicitly go over/model what should be in each part the first time and how to create a board. Think aloud.
  - Posters at ADI Website to help prompt students.
  - If evidence includes a graph, use the I2 strategy.
  - Circulate and ask questions as students work. "What are you trying to figure out? Why is that measurement important? Does your explanation fit with all the data or other scientific principles we know?"

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## Stage 4: Argumentation Session

- Review “Argumentation Session” section in handouts
- Everybody but one person leaves.
- Take your lab handouts with you so you know what kinds of questions to ask.
- Focus your attention on evaluating others’ evidence.
- At end: Are there anything you’d like to revisit in investigation? Any tweaks to board?



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- Teacher Tips for Stage 4: Argumentation Session
  - Scaffold by possibly doing whole group first or a fishbowl
  - Have students take lab sheets with them for prompts
  - Establish norms with students to help students focus on ideas rather than individuals

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- Stage 5: Explicit and Reflective Discussion



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- Teacher Tips for Stage 5: Explicit and Reflective Discussion
  - Look at the checkout questions for ideas
  - Have a picture or model related to Core Ideas and ideas used in justification and have students explain it to you.
  - Use Talk Moves

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## Stage 6: Writing the Investigation Report

- Review “Report” section in handouts
- 1 page single-spaced or 2 pages double-spaced MAX
- 3 Sections
  - Introduction and Guiding Question: What were you trying to do and why?
  - Method: What did you do and why?
  - Argument: What is your argument?
- Don't Forget to include any helpful tables or graphs



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### Teacher Tips for Stage 6: Writing the Investigation Report

- Include time for writing in class the first time you do it
- Provide them with a graphic organizer, possible paragraph stems
- Have them verbally GIST each section together before writing.
- Show them an example (could be from a different, simpler lab)
- Go over the peer-review rubric with them before they start writing
- Have individuals read each other's out loud before submitting for peer review.

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## Stage 7: Double Blind Group Peer Review

- Student submits 2-4 copies to teacher with no name, just #
- Teacher distributes to groups
- Students review reports as a group and offer feedback



**Engage in ADI Lab 3: Rate of Dissolution**

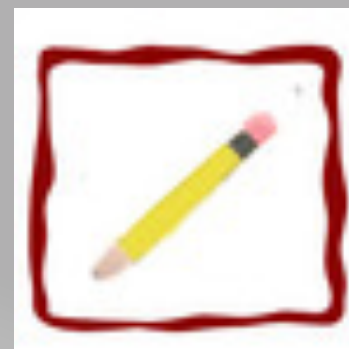
## Teacher Tips for Stage 7: Double Blind Group Peer Review

- Set norms and hold reviewers accountable
- Practice on the same report first. Could first do whole group and then in smaller groups, coming back together to then compare what separate groups noticed.
- Have discussion about what kind of feedback students would appreciate and find helpful.

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## Stage 8: Revision and Submission of the Investigation Report

- Based on peer review, address any changes that need to be made to your investigation report. Rewrite, revise, and edit.
- Submit to teacher with original draft and peer-review sheet.



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## Teacher Tips for Stage 8: Revision and Submission of the Investigation Report

- Give time in class the first time
- Have them work on revisions, etc with partner if appropriate

**Engage in ADI Lab 3: Rate of Dissolution**

- Look back at the SEP Matrix. Which practices did we really engage in?
- Look back at the CCC matrix. Which CCC were explicitly addressed in the lab and discussion?
- The Role of the Teacher, Page 13-16

**Reflect on Lab 3: Rate of Dissolution**



- Which properties of the Periodic Table follow a periodic trend?
- Read the Student Handouts. Excel file can be found at my wiki or at NSTA Extras website for this book.

**Engage in Lab 7: Periodic Trends**

- Book talk: Chap 1-2 and Appendices
- Skim and Scan through your assigned labs
- Think to yourself about the following questions.
  - Would you do this lab? Why or why not?
  - What gaps, if any, do you find?
  - What kind of scaffolding would you have to do as a teacher for students to be able to successfully engage?
- In your assigned group, give a summary of the investigation as well as the main points in your answers of the questions above.

**ADI Book Walk**

- <https://www.nsta.org/publications/press/extras/adi-chem.aspx>

<http://www.argumentdriveninquiry.com>

**ADI Web Walk**

- What labs look appealing to you?
- What ideas can you implement this coming year?
- What support or materials do you need?
- What can I do for you?

## **Planning for Implementation**

- Final Thoughts? Reflections?
- How can I be of service to you? How can you be of service to each other?
- This book is not one you can implement in your classroom without some outside planning and thinking.

**Wrap-it Up!**