

Unit Planning- Stoichiometry PBL - Pharmaceutical Challenge - Should this reaction be used to make an aqueous nutrient used in an IV?

I. Overview of Unit:

Essential Questions:

- How can we use stoichiometry to understand reactions?
- What is the meaning of mole ratio?
- What are the meanings of limiting reactant and excess reactant?
- How can we use stoichiometry to understand how "good" or "useful" a reaction is with percent yield and percent error?

Objectives:

1. Define a mole ratio.
2. Explain how to combine reactants in order to make the most product from a reaction.
3. Identify a limiting reactant.
4. Complete stoichiometric calculations for a variety of chemical reactions.
5. Complete stoichiometric calculations involving limiting reactant.
6. Calculate percent yield when the actual yield is known.

Learning Sequence (~15 days):

1. Entry event + problem statement development + group contract + get organized (digitally and on paper so no students are left out)
2. POGIL - mole ratios
3. Leveled Stoichiometry Practice (1 day) - students are provided with five leveled options for practice (students must achieve mastery of 3 consecutive levels to meet a class goal).
 1. Memo #1 + Project work time (planning reaction)
 2. POGIL - limiting reactant
 1. HW video: percent yield (this is part of a larger weekly practice set with more stoichiometry practice).
 3. Limiting reactant/Percent yield practice + project work time
 4. Toxins 5 TEST (so they can get feedback on content!)
 5. Project work time (6 days - includes memo #2, memo #3, completing reaction, and peer review)
 6. Project presentations + students reflect on process while watching presentations
 7. (Ran out of time last year) Project debriefs with each group while they do something else. (I do this with my S1 project while students are working on the accompanying lab reports that went along with the project).

II. This is the calendar I shared with students: [LINK](#)

- Why? We had crazy amounts of testing at this time. Ultimately, this was meant to relieve anxiety during that time and hold students accountable.

III. Summary of Personal Reflections from 2014-15 School Year

- This was the last unit of the school year, and I was tight on time. We really needed a few more days of time for general chemistry to get a bit more solid on the foundations of the stoichiometry. While most could do mole ratios and then convert to masses, they struggled to connect these ideas to how to plan to make 2.00 g of aq nutrient.
 - This year, I've worked to shorten earlier units to build this time back in so students may do a short lab or something to help with this gap.
 - I will also revisit the leveled stoichiometry practice to mix up the types of problems that they are encountering as I may not be giving them enough variety in scenarios.
- On the flip side, most of my honors students were fine with this timeline.

IV. Major Nuts and Bolts

Note #1: This is based on the 2014-15 inception - every year, this morphs into a better and better experience as I learn and grow as a teacher.

Note #2: You may distribute these items in a limited fashion (e.g., your classroom). Please do NOT post any of these resources on the open, un-password protected internet so that anyone can search for them. Not only are some of these items proprietary (e.g., FlinnSci resources), but the items I have made I have spent YEARS developing. Please do not make me start over by posting these items so that clever and resourceful students can find them. Thank you!

Inspiration for project	FlinnSci resource
Entry document for project	<ol style="list-style-type: none">1. Entry event: video of panelist that will come in to assess project from pharma company Entry documents: gen chem (for honors, the optional pieces were mandatory) Scaffolds for generating problem statement with students before the group contract . (link to a previous blog post of mine with docs embedded) *VITAL SAFETY NOTE for honors version- make sure that products are safe to evaporate to dryness and won't decompose /produce toxic byproducts at high temperatures! <ul style="list-style-type: none">• Memo 1 - must get this approved by me before doing any lab work• Memo 2• Memo 3
Project scaffolding	<p>Group contract - this is an important norm setting time for kids. I can't tell you how many times I've had to tell kids to go back for this, especially for contact info, etc.</p> <ol style="list-style-type: none">2. Keeping students communicating expectations with one another - Sample Knows, Need to Knows, Next Steps (credit for inspiration: London Jenks)3. Content scaffolds (differentiating by readiness)<ul style="list-style-type: none">• Hint Cards folder• Workshops for students (mini-lessons that are optional)4. Formal project check-ins (in addition to traditional quizzes and tests):<ul style="list-style-type: none">• Midpoint• If does not meet expectations contract5. Presentation scaffolds folder
Presentation Rubrics	<ul style="list-style-type: none">• Rubrics for panelists: link [edited from the AACU's value rubrics found here]• Content rubric I fill out during presentations link• Individual student end of project reflection.

Sample Presentation	<ul style="list-style-type: none"> • Sample presentation
How to get project panelists?	<ul style="list-style-type: none"> • Parents of students and their extended families • Admin/Other teachers • Local businesses • School partners/sponsors • Skype/google hangout • Make youtube videos/you send video links to your out of state friends
Supporting project panelists so they will come back	<p>I send out as much info as possible. For instance, rubrics, school address, reminders about lunch and what's nearby.</p> <p>The day of presentations, I make a packet for each panelist with:</p> <ul style="list-style-type: none"> • the day's schedule/where they can find lunch/etc. • packet per class for recording their scores • thank you card/small gift card <p>I have them choose one "winner" per class and I give them no other criteria. Sometimes I'm surprised, sometimes I'm not, but it's more authentic that way.</p> <p>Very rarely do all my panelists (1-3 per class period) know the content.</p> <p>I also ask them to give me feedback on their experience as a panelist, tweaks for students for next time, etc. Not only do panelists feel a ton of ownership after spending 10 hours at my school, their feedback gives me new perspectives that make projects SO much better.</p> <p>The day after the presentations, when students are finishing reports, I conference with each group. I often will start out with "How do you think it went?" and go into feedback from there. I always "screen"/paraphrase feedback from panelists.</p>