

TALK MOVES FOR ORGANIC CHEMISTRY

Adapted with permission from TERC (2012). *Checklist: Goals for Productive Discussions and Nine Talk Moves*. Cambridge, MA.

GOAL ONE: JUMP-STARTING GROUPWORK

Talk Move 1: Ask Your Neighbor

- When a student asks a question during problem-solving time in class, relay the question to their neighbor
- Keep the students talking to each other instead of just to you (the LA)
- Ex: "That's a really insightful question! It looks like X has something written on their paper about that, maybe he/she can help provide some insight."

Talk Move 2: Ice-Breaker

- Many students are too shy to approach the LAs or the professor with a question. Instead, walk around the room and identify students that seem to be stuck (blank look on their face, staring off into space).
- Approach them and ask "So how's it going?" or "Did you get stuck? How can I help?"
- From there, it is often appropriate to use Talk Move #1 to transition the conversation from a Q&A format to a discussion among students.

GOAL TWO: SOLIDIFYING UNDERSTANDING THROUGH TALK

Talk Move 3: Rule-Breaking (Transforming Rule-Based Reasoning)

- Students often seek to find "easy" rules that oversimplify complex chemistry concepts. To combat this, ask the student questions that challenge their perception of the material.
- "Can you think of a counterexample where that rule wouldn't work?"
- "What about if you had...? Would that rule still apply?"
- Reframe the material in terms of the concepts: "Instead of thinking of these molecules as all the same, remember that they have different properties. This one is a strong nucleophile, whereas this one is a weak nucleophile but a strong base"

Talk Move 4: Breaking Down the Fundamentals

- While the definition makes sense, in practice, students may be struggling in applying definitions. Try asking students to use simpler language and identify and characterize some of the common organic terminology.
- "Can you identify the nucleophile and electrophile in this reaction?"
- "What makes this molecule 'nucleophilic,' 'acidic,' 'electrophilic,'...?"
- Ask the students to draw the mechanism and explain reasoning behind the mechanism and how it works to help them understand the foundational concepts that allows the chemistry to work.

GOAL THREE: SHIFTING FROM CONCEPTS TO SYNTHESIS

Talk Move 5: Break Down the Problem

- When first faced with synthesis problems, many students are unaware that they must call upon knowledge that they learned earlier in the course (e.g. SN₁ and SN₂ reactions, good nucleophiles, good leaving groups, etc.)
- Talk move focuses on using the student's knowledge to begin the problem-solving process
- "What's different between the reactant and the product?"
- "What reactions do you know that make an alkene from an alcohol?"

Talk Move 6: Understand Differences between Reactions

- When students begin synthesis, they often try to memorize reactants/reagents/products instead of understanding the mechanisms and chemistry behind the reactions, which can lead to a misunderstanding of the product of a reaction (e.g. stereochemistry of the product, oxidation states of products, whether or not a bond is cleaved, etc.)
- Talk move focuses on getting students to think about the mechanisms and chemistry of reactions in order to see the subtle differences in the product
- "What if I drew the molecule like this?" (e.g. Markovnikov vs. anti-Markovnikov product)
- "Why did you draw the molecule the way you did?" (e.g. why did a student think that an aldehyde would be oxidized by a certain reaction)

GOAL FOUR: HELPING STUDENTS THINK WITH OTHERS

Talk Move 7: Collaborating to Solve Problems

- Students in organic chemistry often tend to work on their own. Talk moves should encourage students to ask their peers for help if they get stuck.
- Ask neighbors, "Does anyone else know the next step in this mechanism?"
- "Has anyone else figured out how to hydrate this double bond?"
- "So, John figured out how to make the alcohol, can anyone else add on to get us to the final product?"

Talk Move 8: Explain Your Answer

- Students should be able to articulate how they solved a problem to their peers or to the LA. Each student in the group should be able to explain the answer, even if they are not the one who came up with the solution.
- "What's the purpose of adding this reagent?"
- "Why did you use acidic conditions instead of basic conditions? Does it make a difference?"
- "Why does this reaction produce the Markovnikov product?"
- "What about this molecule allows it to react with that reagent?"

Talk Move 9: Recognizing Other Possible Answers

- Especially for a subject like organic chemistry, often times there are multiple possible answers for synthesis problems.
- "Can you draw the mechanism and explain your partner's synthetic route?"
- "Does anyone have another suggestion for how to complete this synthesis? Is there more than one answer here?"
- "Are both of these reagents valid to use for this molecule?"
- "Would one of these synthetic routes be better than the other for any reason (possibly faster, easier, safer, greener, etc.)?"