So you're taking chemistry…

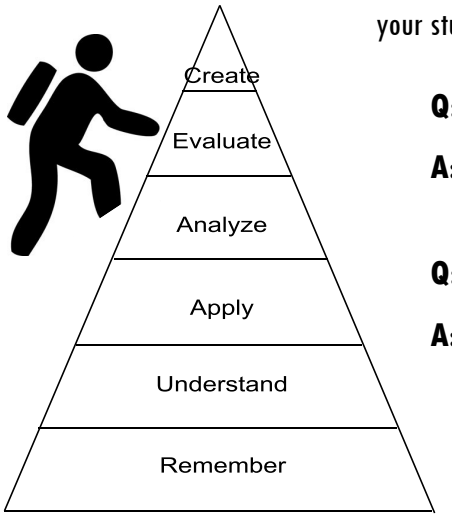
Study **smarter**, not *harder*!

Q: Why is chemistry so much harder than high school chemistry or other classes I'm taking at Carolina?

A: College chemistry moves at a rapid pace where the material piles up fast if you don't have a good system for keeping up! Also, the material is more difficult, requiring deeper levels of understanding. Because most chemistry classes are cumulative, the problems are more complex. Many students notice this most on tests where the question requires you to connect several concepts at once to reach an answer.

Q: Do I have to think differently for college chemistry?

A: Well… yes! College chemistry wants you to use *application* and *analysis* to solve problems. Where you may have previously relied on *remembering* and *understanding* to get through a class, you'll need higher order learning skills for college chemistry. Bloom's taxonomy (see pyramid below) represents this hierarchy of learning levels. With analysis and application in mind, you can tailor your study time in order to develop and hone your critical thinking skills.



Q: What does this higher order thinking look like?

A: It's the difference in *remembering* that HCl is a strong acid versus *analyzing* the present species to calculate the pH at equivalence point in a titration.

Q: How do I move up the pyramid?

A: Unfortunately, there isn't a "one size fits all" fix to move from understanding to analyzing and eventually evaluating and creating (skills you'll definitely need for professional and graduate schools). This handout provides several study strategies you can incorporate in to your routine to help you achieve those higher level learning skills. Read on to learn more about them and see what works for you!

1. Metacognition

Q: Meta what?

A: Metacognition is basically thinking about your thinking. Checking in with yourself while you study is a great way to assess your level of understanding. You ask lots of why, how, and what questions to be reflective about your learning and to strategize about resolving issues.

Q: How do I practice metacognition in my chemistry class?

A: You can ask yourself some of the questions below or come up with your own!

* Does this answer make sense given the information provided? Why or why not?
* What did I hear/read that conflicts with my prior understanding?
* How did what I just heard/read relate to what I studied yesterday (previously)?
* What questions are popping up during class and when I study? Where am I making a note of these questions? (Taking note of these questions can help you make the most of office hours and discussion sessions.)
* When I do something like this again, what would I do differently? What worked well and should be used again?

2. Incorporate the Study Cycle

Preview the class material	Attend class	Review what you just learned	Study	Assess your learning
Skim through the chapter, review chapter objectives, and identify questions you'd like to answer from the lecture.	Take useful notes and get answers to the questions you identified in the previous step.	Read over notes, fill in any gaps, and take note of new questions. This is best done as soon after attending class as possible.	Read textbook, work problems, supplement class notes with readings, and generate figures/diagrams from notes.	Test yourself using end-of-chapter questions and other practice problems. Don't look at the answer before attempting the problems!

Q: How is this cycle helpful?

A: It strategically organizes your studying into manageable pieces of enhanced and focused learning! It also exposes the class content to you three different times in typically less than 24 hours.

Q: When should I use the Study Cycle?

A: You can use this cycle every day! This type of spaced repetition will help you to put the content information in long term memory so you won't need to cram before an exam. Aim to finish one whole cycle before beginning another.

3. Intensify your study time

Q: Intensify?!? That sounds scary!

A: When studying, you definitely want to get "more bang for your buck."

An intense study session often follows this model:

1. Set a goal (<2 minutes)
2. Study with focus (30 - 50 minutes)
   - ⇒ Work homework problems without a key
   - ⇒ Make a concept map
   - ⇒ Paraphrase the lecture notes or textbook passages
   - ⇒ Talk through figures and diagrams
3. Take a break (10 minutes)
4. Review what you just studied (5 - 10 minutes)
   - ⇒ Use self-testing to gauge what you learned and what you still need to work on.

For help implementing any of these strategies, come see an academic coach in the Learning Center. You can also check out the other great study resources on the Learning Center website!

References: Cook, E.; Kennedy, E.; McGuire, S. Y. *J. Chem. Educ.* **2013**, *90*, 961—967.

Tanner, K. D. *CBE Life Sci. Educ.* **2012**, *11*, 113—120.