

BRIDGE Final Summary

Danielle L. Jacobs
Rider University
2010-2011

1. Identify class level, specify whether core, elective, or major requirement, any other pertinent information on class demographics.

Organic Chemistry I & II

Major requirement for Chemistry, Biochemistry, and Biology majors

Mainly sophomores and juniors

Requirement for entrance into all medical, dental, and veterinary programs

2. What problems or questions about my students' learning and my teaching strategies did I address?

- a. Students do not know how to study correctly when they come into the course. They think that in order to pass they must spend hours *memorizing* basic chemical principles and reactions, as opposed to actually *learning* the basic chemical principles, and *applying* them to reactions. Thus, one of my primary aims was to **assess student study habits**. My ultimate goal was not only to suggest proven studying alternatives, but also to make students cognizant of their own embedded habits, and give them the opportunity to discriminate between their successful and unproductive strategies.
- b. Organic Chemistry is perceived as one of the most intimidating courses a science student will ever take. This poor global reputation that precedes the course even before I enter the classroom is caused by a variety of factors:
 - The inundation of novel symbols and nomenclature can be likened to learning an entirely new language without any prior exposure—being asked to concurrently apply and assess this new language is a daunting task
 - The overwhelming and constantly growing list of named reactions that can occur via organic mechanisms, even though I do not require students to understand every known organic transformation
 - Students' inability to relate the importance of organic chemistry to their majors and personal interests, which is more often biology than any other discipline—they view the course as an insignificant stepping stone to their ultimate goals

To competently address these three issues, my second goal for BRIDGE was to make Organic Chemistry a very **accessible and relevant course**. Although this overarching ambition is quite broad, the tools and methods to be developed would be specific and modular.

3. Did I rethink my course goals?

- a. In addressing study habits, I did not need to rethink the course goals—the study assessment is intended to *enable* students to meet the course objectives. So while improving studying techniques is a personal goal, I am hesitant to make “optimization of study habits” a concrete course goal.
- b. On the other hand, addressing the accessibility and relevancy of the course did force me to rethink my overall course goals for Organic Chemistry. In fact, I am not sure that I ever had a clear notion of the course goals before BRIDGE. The original course goals were:
 - Write structures from names of organic compounds
 - Deduce names from structures of organic compounds
 - Identify various functional groups in organic chemistry by spectroscopy, including IR, MS, ^1H NMR
 - Understand chemical properties of aromatic compounds, carbonyls, imines, carboxylic acid derivatives, and carbohydrates
 - Write “curved arrow” mechanisms for nucleophilic substitution, elimination, pericyclic, aromatic substitution, and carbonyl addition reactions

Upon reflection, these goals foster a “bottom-up” approach to teaching and learning. The course goals undoubtedly reinforce the fundamental knowledge and understanding that is required for succeeding in Organic Chemistry, but fails to stress the importance of these skills in solving relevant problems (a) within organic chemistry, and (b) between other scientific disciplines including biology and biochemistry. I accordingly revised the course goals in Spring 2011 to include two more points:

- Predict the products of various inter- and intramolecular reactions
- Devise synthetic routes to complex organic molecules from simple starting materials and reagents

The new course goals now reflect a “top-down” approach. By incorporating these broader goals into the syllabus, students realize that organic chemistry is relevant right at the outset. The methods described below depict how this relevance was reinforced throughout AY 2010-2011.

4. What methods did I use to gain information? [Specify any CATs here, including changes in assignments and assessments, if relevant.]

- a. Following the 47.9% average on the first exam of the Fall 2010 semester, I offered students extra credit to fill out an exam feedback form (**Appendix I**). While the feedback was somewhat insightful, student recollections of their exam preparation time and methods tend to be an exaggeration of the truth.

I next administered a Study Time Log, modeled after Angelo & Cross CAT #37 *Productive Study Time Logs*. Throughout the three weeks in between their first and second exams, students voluntarily filled out a descriptive time log (**Appendix II**). For any time they worked on organic chemistry, students were asked to state the method, the working conditions, and rank the productivity. At the end of the three-week period, participating students were prompted to further reflect on which methods were the most and least productive, and to suggest new techniques that might work well in the future. Following this reflection, the average on exam #2 was 65.5%.

Later, I individually assessed every participant's Study Time Log results, and emailed a personal summary of their commendable study habits, along with suggestions for improving their productivity (**Appendix III**).

As an aside, I deliberately did not return exams to students with averages below 50%, hopefully motivating them to schedule a one-on-one meeting with me. During these meetings, we discussed their techniques for studying, the importance of metacognition of their personal performance, and brainstormed studying styles from which they could benefit.

- b. To make the course more accessible, I believed it was first necessary to explicitly clarify the skills that students should have by the end of each course section (7-8 each semester). Over the course of AY 2010-2011, I developed Objective & Skill Sets for each section, which have evolved into Study Guides—I am loathe of the title, but students are much more likely to use them when you use those two words together. These Study Guides list the overall objectives, as well as the skills the students should possess, at the end of each section. These skills range the gamut of Bloom's Taxonomical terms. Suggested Practice Problems from the textbook are further listed after each skill. Right before each skill is a line for students to write the date in which they learned the skill in class or as an assignment (**Appendix IV**).

I also implemented a variation of Angelo & Cross CAT #7 *Muddiest Point* employing these Study Guides. At the close of each class, instead of having the students spend time writing, collecting, and later evaluating what they believed were the major objectives of the day, I asked students to take out their Study Guides and to tell me what they think was covered. One student will read a skill aloud, and if the rest of the class agreed, everyone would record that date on the line. This technique also provided me with immediate feedback as to what topics were presented well, and which ones needed more coverage, which would then be addressed at the opening of the next class period. As an added benefit, I recognized that this opportunity encouraged even the shiest students to raise their hands.

- c. My last objective for BRIDGE was to place organic chemistry in a relevant context for students, the majority of which are not actually chemistry majors.

1. One method not directly related to BRIDGE was the development of an Interdisciplinary Connections group. Throughout AY 2010-2011, I organized bimonthly lunch meetings with a small group of science faculty teaching introductory courses, of which many of our students take concurrently. During these meetings we shared topics covered over the past few weeks, discussed overlapping students' strengths and weaknesses, and strategized instructional techniques that would proffer interdisciplinary thinking for science students. These meetings allowed me to return to the classroom with biological, medicinal, and even geoscientific applications that were relevant to many of my students. Not only is it significant to cross disciplines in order to promote critical thinking and problem solving, but I also recognize that acknowledging interdisciplinary applications further increases the vested interest, and subsequently study time and overall performance, of students.
2. Between 2008 and 2010, I experimented with a variety of research reports, Science in the Community requirements, book reports, and Organic Chemistry in Society essays, to illuminate the relevance of organic chemistry in students' lives. In Spring 2011, Organic Chemistry students pursued a semester-long research report on a marketed drug or drug candidate (**Appendix V**). They were required to provide:
 - Background information on the drug and disease area (public health)
 - Biological profile of the drug activity (biochemistry)
 - Structure, total synthesis and electron-pushing arrow mechanisms for two synthetic steps (organic chemistry)
 - Structure and biological potency of derivatives (medicinal chemistry)

The research report was structured with modular due dates, including a unique annotated bibliography and peer review. The overall purpose was not only to engage students by elucidating the importance of organic chemistry in their own scientific disciplines, but to further instill scientific literacy.

5. What examples or evidence of student performance can I offer to illustrate how I drew conclusions? [If possible, please include samples to illustrate effects of your interventions. Emphasis may be on qualitative or quantitative data.]

- a. Immediately following the study time log, students took exam #2 which had an average of 65.5%. This average was almost 20 points higher than the first exam, and at the time was even the highest average on any exam I had ever administered in Organic Chemistry. This can be attributed to many things besides honest self-reflection of study techniques—but maybe even the thought of the study log made students more conscious about their study habits in general (**Appendix III**).
- b. I referred to course evaluations (**Appendix VI**) to gauge if the Study Guides improved student awareness of the skills required of them, particularly for exams.

The results were compared across different cohorts. A small sample of exemplary questions and results are presented below. Note that scores are on a five-point scale, with a low score (1.0) the best and a high score (5.0) the worst:

*How useful were the section **study guides** in better organizing your notes, and making you well aware of the key concepts and skills required for exams?*

Since Study Guides were initially implemented in Fall 2010, and gradually changed to include a modified “muddiest point” assessment in Spring 2011, there are only results from AY 2010-2011. However, I do believe that the “muddiest point” modification is directly responsible for the improvement of this score from 2.1 (Fall 2010) to 1.8 (Spring 2011) on a five-point scale.

*Were the **tests** reasonable and indicative of material covered in class and on homework assignments?*

I have asked this question on every evaluation administered over the past three years:

Semester	F 08	S 09	F 09	S 10	F 10	S 11
Score	2.5	2.0	2.5	2.5	2.1	1.7

I believe that the Study Guides, particularly the “muddiest point” modification, is the foundation for this improvement. In Fall 2010, I provided study guides, but did not use them in class. By engaging the class with a short recap of the day’s lesson, students are much more in touch with the skills they need to perform well on exams.

- c. To evaluate if students understood the relevance of organic chemistry in their everyday lives, and appreciated the connection between organic chemistry and their other science courses, I again referred to course evaluations, and compared the results between different cohorts:

How would you rate the material contained in this course in terms of relevance? (1) and

Was the instructor able to communicate the subject’s relevance? (2)

These questions are the first and last questions on every evaluation I administer:

Semester	F 08	S 09	F 09	S 10	F 10	S 11
Score 1	1.5	1.7	1.5	1.5	1.4	1.0
Score 2	2.5	1.7	1.5	1.5	1.7	1.3

This spike in score can be at least partially attributed to the new iteration of the research report, as shown below:

How useful was the **research report** in conveying the relevance of organic chemistry in medicine, biology, and biochemistry?

Although students did not write a research report every semester, the score of this question can be compared with scores and comments for *alternate strategies* previously implemented. Note that some evaluations did not ask for scores:

Semester	F 08	S 09	F 09	S 10	F 10	S 11
Strategy	OC	SC	SC	RRR	NB	RRD
Score	--	--	--	2.5	2.6	1.3

OC = Organic Chemistry in Society report

SC = Science in the Community requirement

RRR = Research Report on reaction in Organic Chemistry

NB = Book Reports – *Napoleon's Buttons: How 17 Molecules Changed History*. P. Le Couteur & J. Burreson, Tarcher/Penguin, Los Angeles

RRD = Research Report on drug candidate

It is clear that the structured research report on a drug candidate played a large role in stressing the relevancy of organic chemistry to the students.

6. What theories or debates about learning frame or illuminate my inquiry? [Please refer here to specific readings and theories or debates from books distributed and articles handed out.]

One theory that I have truly internalized when designing assignments is the notion of *expert vs novice* as presented by J.D. Bransford in *How People Learn*. Even before BRIDGE, I created worksheets and activities that clearly outlined a systematic thought process for solving problems, based on my own expertise (**Appendix VII**). The goal was for students to ultimately discover the same *patterns* in chemical reactivity and problem solving that I see, and to apply those patterns throughout the course. However, this strategy of simply providing a clear set of rules for problem solving oftentimes backfired—enabling students to *memorize* and apply the process without understanding it like an expert. To overcome this consequence, we now solve a problem together as a class. The students subsequently work backwards to discern the systematic process they subconsciously employed to arrive at their answer. At the end, the students *themselves* have developed a logical process for solving problems in a simple, stepwise fashion. The class then works on assignments that require them to employ their own systematic procedure to solve problems. Not only does this type of assignment design encourage students to think like experts in the moment, but it further supports the expert behavior of finding patterns and systematic processes when approaching different types of problems.

7. What have I learned (or what new hypotheses have I developed) so far?

I constantly encounter struggling students who are practically paralyzed by the constant deluge of organic chemistry information. And once the paralysis begins, it spreads quickly. To ameliorate this, I have learned that students of a discipline need to

think like experts of that discipline. In organic chemistry, thinking like an expert requires two things:

- a. *A foundational organization of functional groups, their reactivity, and transformations.* Students often study, or more often memorize, linearly by date, which does not allow for the incorporation of new information into old categories. This unfortunately results in an extreme disconnect between very related topics, which is resultantly perceived as an overwhelming inundation of dissimilar facts that need to be memorized. It is thus imperative to design assignments and lectures in a way that forces students to organize their knowledge in a logical and easily retrievable manner.
- b. *The opportunity to discern between significant and insignificant information.* The overwhelming cascade of information can be made manageable by clearly describing the skills that students should have at the end of each unit. However, I have learned that merely providing students with a list of skills is not sufficient. This is most likely because they cannot actually connect what is written on the paper with what they have learned—they just don't know what they know; the skill set is just a set of words that have no meaning. However, I found that this problem could be overcome by providing book problems related to each skill, as well as quickly recapping the skills that were covered in class at the end of each period.

Finally, I have learned that regardless of what students admit, they are most likely just not studying enough, and are studying ineffectively. They arrive on the first day with the mindset that all they need to do is pass, because it will be impossible to get a good grade. In this self-fulfilling prophecy, students then do not work as hard as they can because they think it won't be worth the effort—and accordingly perform poorly. I still do not know how to overcome this widespread fatality for Organic Chemistry.

8. Where will I go from here?

I would like to try other CATS that assess learning and study behaviors such as #39 *Process Analysis* and #40 *Diagnostic Learning Logs*. The Study Time Logs were not as informative as I planned. While they may have shown students that their personal study habits need refinement, or a complete overhaul, it did not provide me with any additional information. I believe that these additional CATS will offer more insight into the actual thought process, which as I concluded earlier, is the foundation for success in Organic Chemistry. Discovering their thought processes should enable me to design better assignments that “re-circuit” their studying strategies to be more expert-like.

I also plan on implementing the revised Study Guides and “muddiest point” strategy throughout the entire academic year, and record if student confidence and performance improves. Spring 2011 was the first semester in which no one failed the course, and I believe this is due to both a realignment of the assignments with the new course goals, as well as a greater clarification of the required skills.

Appendix I

Exam I Feedback

The data and comments in this form will be compiled and read by the professor to help improve future classroom lectures and overall participation and performance of the class. We will also discuss the results as a class, and brainstorm productive study habits and homework techniques.

Please be honest, and think hard about your answers. This feedback will be anonymous, and is crucial to improving my teaching, and more significantly your own performance, in this course. If you are dishonest about the way you study, then you are only hurting yourself.

Exam 1 Grade: _____

1. Circle the number that best describes how Exam 1 reflected each of the provided course tools below. You are encouraged to additionally provide any relevant comments:

- | | | | | |
|--------------------------|-------------|---|-------------|-------------------|
| • Lectures & Notes | mostly
3 | 2 | barely
1 | didn't study
0 |
| • Suggested Problem Sets | mostly
3 | 2 | barely
1 | didn't study
0 |
| • Textbook Readings | mostly
3 | 2 | barely
1 | didn't study
0 |
| • On-Line Homework | mostly
3 | 2 | barely
1 | didn't study
0 |
| • Classwork & Worksheets | mostly
3 | 2 | barely
1 | didn't study
0 |
| • Other Homework | mostly
3 | 2 | barely
1 | didn't study
0 |
| • Additional Comments | | | | |

2. Carefully read all of the phrases under each academic tool listed below. Choose and circle only the phrase(s) that best describes the manner in which you used that tool to study for this course. Then, circle the frequency with which you used that tool, as well as the method. Finally, fill in any other details to help clarify your study habits, and comment on if you believe this method was helpful in preparing for the exam:

a. Textbook

- Reading Whole Chapter Only

daily	weekly	monthly
-------	--------	---------

before	during	after
--------	--------	-------

we cover the material in class

- Reading & Highlighting Whole Chapter Only

daily	weekly	monthly
-------	--------	---------

before	during	after
--------	--------	-------

we cover the material in class

- Reading & Taking Notes In my Own Words

daily	weekly	monthly
-------	--------	---------

before	during	after
--------	--------	-------

we cover the material in class

- Reading Only When I Have a Question on a Particular Concept

daily	weekly	monthly
-------	--------	---------

before	during	after
--------	--------	-------

we cover the material in class

- Reading Only When I Have Trouble with a Homework Question

daily	weekly	monthly
-------	--------	---------

before	during	after
--------	--------	-------

we cover the material in class

- Never Use
- Describe your method in better detail
- Was this method helpful?

b. Suggested Problem Sets

- Do Problem Sets While Looking At Answers

daily weekly monthly

once twice thrice

all problems a few problems

until I:

get it get some of it memorize answer

- Attempt Problem Sets Before Looking At Answers

daily weekly monthly

once twice thrice

all problems a few problems

until I:

get it get some of it memorize answer

- Never Use
- Describe your method in better detail
- Was this method helpful?

c. **Non-Graded Worksheets (Classwork and Homework)**

- Attempt Worksheets While Looking At Answers

daily	weekly	monthly
-------	--------	---------

once	twice	thrice
------	-------	--------

all problems	a few problems
--------------	----------------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------
- Attempt Worksheets Before Looking At Answers

daily	weekly	monthly
-------	--------	---------

once	twice	thrice
------	-------	--------

all problems	a few problems
--------------	----------------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------
- Never Use
- Describe your method in better detail
- Was this method helpful?

d. Online Homework (Now Extra Credit)

- Do Online Homework

daily	weekly	monthly
-------	--------	---------

all at once	a few at a time
-------------	-----------------

once	twice	thrice
------	-------	--------

before	during	after
--------	--------	-------

we cover the material in class
- Use Textbook

before try	after 1 try	never
------------	-------------	-------
- Use E-Book

before try	after 1 try	never
------------	-------------	-------
- Never Use
- Describe your method in better detail
- Was this method helpful?

e. Notecards

- Make & Study Notecards For Concepts I Don't Understand

daily	weekly	monthly
-------	--------	---------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------
- Never Use
- Describe your method in better detail
- Was this method helpful?

f. **Class Notes**

- Reading Only

daily	weekly	monthly
-------	--------	---------

after class	for next class	for exam
-------------	----------------	----------
- Reading & Highlighting Only

daily	weekly	monthly
-------	--------	---------

after class	for next class	for exam
-------------	----------------	----------
- Rewriting Notes Verbatim

daily	weekly	monthly
-------	--------	---------

after class	for next class	for exam
-------------	----------------	----------
- Rewriting Notes in My Own Words

daily	weekly	monthly
-------	--------	---------

after class	for next class	for exam
-------------	----------------	----------
- Reading Only When I Have Trouble with a Homework Question

daily	weekly	monthly
-------	--------	---------

after class	for next class	for exam
-------------	----------------	----------
- Never Use
- Describe your method in better detail
- Was this method helpful?

g. Professor – Visit to:

- Ask About Grades

daily	weekly	monthly
-------	--------	---------
- Get Help on Book Reading

daily	weekly	monthly
-------	--------	---------
- Get Help Understanding Class Notes

daily	weekly	monthly
-------	--------	---------
- Get Help on Suggested Problem Set

daily	weekly	monthly
-------	--------	---------
- Get Help on Homework

daily	weekly	monthly
-------	--------	---------
- Get Help Without Doing Prior Work

daily	weekly	monthly
-------	--------	---------
- Get Help After Doing Prior Work

daily	weekly	monthly
-------	--------	---------
- Chat About Science

daily	weekly	monthly
-------	--------	---------
- Chat About Life

daily	weekly	monthly
-------	--------	---------
- Never Use
- Describe your method in better detail
- Was this method helpful?

h. Returned Graded Materials

- Look At Answer Key

once	twice	thrice
------	-------	--------

upon return	to study for exam	never
-------------	-------------------	-------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------
- Look At Feedback Provided

once	twice	thrice
------	-------	--------

upon return	to study for exam	never
-------------	-------------------	-------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------
- Re-attempt While Looking At Answers

once	twice	thrice
------	-------	--------

upon return	to study for exam	never
-------------	-------------------	-------

all problems	a few problems
--------------	----------------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------
- Re-attempt Before Looking At Answers

once	twice	thrice
------	-------	--------

upon return	to study for exam	never
-------------	-------------------	-------

all problems	a few problems
--------------	----------------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------
- Never Use
- Describe your method in better detail
- Was this method helpful?

i. **Old Exams**

- Look At Answer Key

once	twice	thrice
------	-------	--------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------

- Attempt While Looking At Answers

once	twice	thrice
------	-------	--------

all problems	a few problems
--------------	----------------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------

- Attempt Before Looking At Answers

once	twice	thrice
------	-------	--------

all problems	a few problems
--------------	----------------

until I:

get it	get some of it	memorize answer
--------	----------------	-----------------

- Never Use

- Describe your method in better detail

- Was this method helpful?

j. Goals & Skills Sheets

- Go Through the Checklist to See What I Know

daily	weekly	monthly
-------	--------	---------

once	twice	thrice
------	-------	--------
- Go Through the Checklist to See What I Don't Know

daily	weekly	monthly
-------	--------	---------

once	twice	thrice
------	-------	--------

and then I do more work until I:

can check it off	kinda get it	never
------------------	--------------	-------
- Never Use
- Describe your method in better detail
- Was this method helpful?

k. Tutors And/Or Study Groups

- Use During Prescribed Tutoring Hours

daily	weekly	monthly
-------	--------	---------
- Ask Tutors for Extra Help On Side

daily	weekly	monthly
-------	--------	---------
- Work with Other Students In the Class

daily	weekly	monthly
-------	--------	---------
- Never Use
- Describe your method in better detail
- Was this method helpful?

3. Circle the number that best describes how you view your grade on Exam 1. Be honest about your effort:

• I believe that my grade truly reflects my understanding

mostly		barely	didn't study
3	2	1	0

• I believe that my grade truly reflects my effort

mostly		barely	didn't study
3	2	1	0

4. Estimate the total number of hours you studied for this exam: _____

5. Predict your current grade in this class: _____

6. Read over this survey, and list ideas on how you may improve your own studying habits:

7. Provide suggestions that Dr. Jacobs can follow to improve your comprehension of the material, your motivation, your performance in this class, and your metacognition (personal understanding of how you are doing in the course):

8. Would you be willing to participate in an Organic Chemistry Time Log? You will be asked to log the time you spend doing work (studying or homework) for the course, to transcribe what you are doing, where you are, who you are with, etc...Most of all, it is important that you be honest. Five extra points will be added to the next exam of all participants, as long as the time log is filled in completely.

All of your anonymous answers will be compiled and analyzed, and then shared with the class next week. It is in your best interest to fill in this survey to the best of your ability, in as much detail as possible.

Appendix II

Study Time Log

- (1) Fill in the date, day and time where prompted. Enter any block of 30 minutes or more that you spent studying organic chemistry today – not including lab stuff – on the form below. For example, if you started at 2:00 PM and ended at 2:40 PM, use the line next to 2:00 only.
- (2) Take note of your *method* of studying. For example, you read the book while highlighting, or you read the Resonance Worksheet Answer Key, or you completed the Resonance Worksheet and then looked at the answer key. Check out the Exam I Feedback form for more examples.
- (3) Take note of the following *conditions*:
- *Place*: where you studied – your dorm room, the library, your boyfriend's house...
 - *People*: who you studied with – yourself, with Paul the tutor, with Jane & Tom...
 - *Distractions*: – the TV was on, you were on the phone, “reading” between naps...
- (4) Rate the productivity of each half-hour segment that you studied, using the following scale:
- 1 = *Unproductive*: “Well, that was worthless!”
 - 2 = *Kinda Productive*: “Uggh, it took me 3 hours to just get this? Isn't there any better way of doing this?”
 - 3 = *Productive*: “Ah, I'm getting it. Just a little more practice and I'll be good!”
 - 4 = *Very Productive*: “Damn that is easy now! I am ready for anything you want to throw at me, Dr. J!”

For times when you have Organic Chemistry Class, don't forget to fill out a productivity rating – did you learn anything?) as well as the method – e.g., group work on resonance – as well.

BE HONEST. This survey is anonymous, so the only person you will be “fooling” is yourself. The goal of this survey is to indicate to me how organic students are spending their study time, so that I may offer tips on how to “work smarter, not harder.”

Study Time Log: Follow-Up Questions

(1) At the end of each week, total the amount of hours you spent studying at:

Week 1	Week 2	Week 3
Level 1: _____	Level 1: _____	Level 1: _____
Level 2: _____	Level 2: _____	Level 2: _____
Level 3: _____	Level 3: _____	Level 3: _____
Level 4: _____	Level 4: _____	Level 4: _____

Please give concise, specific answers to the following questions:

(2) Did you find any correlation between the **study method** and the **productivity**? Was this surprising or interesting?

(3) Did you find any correlation between the **conditions** and the **productivity**? Was this surprising or interesting?

(4) Did you find any correlation between the **time of day** and the **productivity**? Was this surprising or interesting?

(5) After reviewing this time log, do you have any ideas on what could make your studying more productive? That is, how might you study differently in the future?

(6) Overall, what is the most important thing you learned from this assessment?

Day 1: _____

Rating	Time	Method	Conditions
	6:00 AM		
	6:30		
	7:00		
	7:30		
	8:00		
	8:30		
	9:00		
	9:30		
	10:00		
	10:30		
	11:00		
	11:30		
	12:00 PM		
	12:30		
	1:00		
	1:30		
	2:00		
	2:30		
	3:00		
	3:30		
	4:00		
	4:30		
	5:00		

	5:30		
	6:00		
	6:30		
	7:00		
	7:30		
	8:00		
	8:30		
	9:00		
	9:30		
	10:00		
	10:30		
	11:00		
	11:30		
	12:00 AM		
	12:30		
	1:00		
	1:30		
	2:00		
	2:30		
	3:00		
	3:30		
	4:00		
	4:30		
	5:00		
	5:30		

Appendix III

Student A

Exam 1: 59

Exam 2: 87

Self Assessment:

Week 1: 2 (Level 1) 3 (Level 2) 9 (Level 3) 2 (Level 4)

Week 2: 0 (Level 1) 4 (Level 2) 8 (Level 3) 1 (Level 4)

Week 3: 0 (Level 1) 0 (Level 2) 12 (Level 3) 9 (Level 4)

Study Method & Productivity:

Doing the suggested problems and then redoing the worksheets you have given us has really helped.

Conditions & Productivity:

I know I do best when I am by myself, less distraction, no talking or getting side tracked. Listening to music really helps me, I don't get as frustrated. I know that sounds weird but it really helps! Also, not good when TV is on.

Time of Day & Productivity:

I study better at night. This didn't surprise me, there are less distractions, not as many people/classes interrupting me.

Higher Productivity in Future:

Keep redoing suggested problems, they really helped!

Most Important:

I need to keep going over concepts, doing it once isn't enough (or just hearing in class isn't enough). I need to apply what we learn in class to problems (suggested problems).

Professor Feedback:

You have a great work ethic. You do a few hours of organic work every day (2.5-4 including class), in your room, alone, with no distractions. To me it actually appears that you do better with the music off at your desk, rather than in your bed with the music on, but I know studying sucks, so making yourself comfortable is important for endurance. I like to see the words "doing" "redoing" and "thinking" as opposed to "reading". You appear to be working on relevant questions and problem sets around the time we are actually doing them in class, and immediately reviewing and redoing your quizzes after you get them back. Doing questions and explaining why you got them wrong is a fantastic strategy. Also, your productivity in class seems to improve doing group work.

Student B

Exam 1: 48

Exam 2: 72

Self Assessment:

Week 1: 0 (Level 1) 9 (Level 2) 6 (Level 3) 1 (Level 4)

Week 2: 1 (Level 1) 9 (Level 2) 4.5 (Level 3) 0 (Level 4)

Week 3: 0 (Level 1) 8 (Level 2) 7.5 (Level 3) 6 (Level 4)

Study Method & Productivity:

Studying with a tutor or extra help seemed to be the most productive and best to get work done.

Conditions & Productivity:

Conditions really don't distract me. I'm pretty good at tuning people out or TV.

Time of Day & Productivity:

I am most productive during the day, most work gets done then because I'd rather get enough sleep at night.

Higher Productivity in Future:

In the future I might continue to study at the same time but with a tutor when I can or other people.

Most Important:

Most important thing I learned was that a lot of time was used not as productive as I first thought.

Professor Feedback:

Right off the bat, without even reading your time log, it is obvious that something has to change. You are studying an excessive amount every week at a low level of productivity. In reality, you should be able to study fewer hours with higher productivity. Your dedication is great, so your mode of studying must be improved. I see that you are most productive after meeting with the professor – so obviously you should do that more. However, you are less productive most of the time, which appears to be spent reading a bit, attempting problems and then looking at the answers. However, you did not say anything about *understanding and internalizing the answers and concepts you missed, and then redoing and practicing the questions*. This is essential for high productivity. Reading the book and notes does not appear to help you, and even when you're alone, texting is a distraction. Studying with your boyfriend while babysitting with the TV isn't such a great idea, either. Meeting with your tutor works well, except you should do it on a weekly basis, not once a month.

Appendix IV

Section 6: Reactivity of Ketones & Aldehydes (Ch 16)

Theme: Metabolism of Carbohydrates

Objectives:

1. Identify and predict the reactivity of ketones and aldehydic compounds
2. Appreciate the nature and importance of equilibrium structures of carbohydrates
3. Understand the biological metabolism of carbohydrates as an organic reaction

Skills:

- _____ Easily recognize reaction conditions, and predict the products, of the addition of strong, basic nucleophiles to ketones or aldehydes (39, 43, 62, 67, 69, 70)
- _____ Draw complete electron-pushing arrow mechanisms for the addition of strong nucleophiles to ketones or aldehydes (46)
- _____ Easily identify conditions for the Wittig olefination, and draw a complete electron-pushing arrow mechanism (28, 57)
- _____ Rationally and thoughtfully use retrosynthesis to construct synthetic routes to complex alkenes from ketones or aldehydes (29)
- _____ Easily recognize reaction conditions, and predict the products, of the addition of weak nucleophiles to ketones or aldehydes (39, 62)
- _____ Draw complete electron-pushing arrow mechanisms for the reversible addition of weak nucleophiles to ketones or aldehydes (42, 50, 56)
- _____ Identify acetals in complex organic molecules and polymers
- _____ Critically assess and rank the equilibrium concentration of acetals for various ketones and aldehydic compounds
- _____ Draw complete electron-pushing arrow mechanism for the formation of acetals from ketones or aldehydes, and the reversible hydrolysis (13, 14, 16, 51, 52, 64)
- _____ Rationally and thoughtfully use retrosynthesis to construct synthetic routes to complex alcohols from simple ketone and aldehyde starting materials (24, 26, 27, 48, 49)
- _____ Recognize the need for, and appropriately use, protecting groups in the synthesis of complex carbonyl-containing molecules

Appendix V

Research Report Instructions

Each student is required to write a 4+ (double-spaced, Times New Roman font, size 12) research report concerning one of the potent organic pharmaceutical agents below. Follow the outline below as a guide for the information that must be included.

1. Background Information

The importance of the drug or drug candidate – this should include the chemical structure, its trade name(s) and company(ies) it is marketed by, and its target application. Also address the importance of the target disease area in terms of history, politics, economics, and/or global health issues.

2. Biological Information

The overall potency of the drug – this should include the drug class, its specific biological activity, an elucidation of the potent pharmacophore, and the structure-activity relationship (SAR)

3. Total Synthesis

An overall scheme of **one total synthesis approach from the primary literature** – Commercially available starting material(s) to the left of the arrow, and the product to the right of the arrow. The number of steps should be written above the arrow.

4. Arrow-Pushing Mechanisms

Complete electron arrow-pushing arrow mechanisms must be included for **two steps of the synthesis**. If stereochemistry is involved, you must include a rationalization for the observed stereoselectivity. You must also briefly describe the mechanisms in paragraph form.

All structures and mechanisms must be drawn using chemical-drawing software. **You may not cut and paste figures from an internet or print source.**

5. Derivatives

Descriptions and drawings of some derivatives that have been synthesized, and results of their biological assays.

6. References

Your references must be taken from the **primary literature**. Use search engines such as SciFinder as your principle tool to search for literature on your topic. The following SciFinder tutorial will lead you through registration, teach you how to search for articles and books relevant to your topic, and instruct you on how to access these resources:

http://library.rider.edu/wiki/index.php/SciFinder_for_Chemistry_Students

In addition, the following books, available at the Rider University Library, may be helpful in understanding complicated mechanisms:

Kurti, L.; Czako, B. *Strategic Applications of Named Reactions in Organic Synthesis*; Academic Press: New York, 2005. **QD262.K87 2005 (reference)**

Adams, R, et. al., Eds. *Organic Reactions*. John Wiley & Sons: New York, 1942-Present. **QD251.O7 (stacks)**

Although you may not use websites as your primary sources, the internet can be helpful in elucidating mechanisms that are unclear. The following website may be helpful, but be aware that secondary sources are not peer-edited, are incomplete, and often plagued by incorrect information:

www.organic-chemistry.org

References must be cited within the paper. Citations can follow any proper scientific format, but must be consistent. Use the following books, available in the reference section of the library, as guides:

ACS Format: Coghill, A.M.; Garson, L.R., Eds. *The ACS Style Guide*. Oxford University Press: New York, 2006. **QD262.K87 2005 (reference desk)**

AMA Format: JAMA and Archives Journals. *AMA Manual of Style*; Oxford University Press: New York, 2009. **R119.AS33 (reference desk)**

CBE Format: Huth, Edward J. *Scientific Style & Format: The CBE Manual for Authors, Editors, & Publishers*; Cambridge University Press: New York, 1994. **T11.S386 1994 (reference section)**

7. Important Dates

Tuesday February 1 – Optional SciFinder Tutorial in LPC-1

- #1: Topics must be approved by 5:00 pm on **Monday, February 14**.
- #2: Print copies of at least one primary literature sources due in class on **Friday, February 25**
- #3: Thesis, background, and biological information due for peer review on turnitin.com by 5:00 pm on **Monday, March 21**
- #4: SciFinder Midterm Assessment due **Wednesday, March 23**
- #5: Peer review on turnitin.com due by 5:00 pm on **Monday, March 28**
- #6: **Final draft and final feedback are due Monday, May 9**

Appendix VI

Course Evaluation Form

Organic Chemistry II

CHE 214

Spring 2011

Instructor: Dr. Danielle Jacobs

Date

For the purposes of evaluation, please choose **A, B, C, D,** or **F** which may be considered “grades” for your responses. Click on the shaded box to choose your answer. Additional constructive comments are also appreciated.

A. Course

- A 1. How would you rate the material contained in this course in terms of relevance?
- A 2. How useful was the **textbook** in this course?
- A 3. How helpful were the **in-class** and **out-of-class assignments** in understanding the material?
- A 4. How important were the nightly **suggested problems** in understanding the material?
- A 5. How useful were the section **study guides** in better organizing your notes, and making you well aware of the key concepts and skills required for exams?
- A 6. How would you rate the impact that daily **quickfire challenge** quizzes had on your motivation to complete and understand homework assignments?
- A 7. How important were the **group homework assignments** in understanding and practicing the course material?
- A 8. How useful was the **research report** in improving your ability to search and understand the primary literature?
- A 9. How useful was the **research report** in conveying the relevance of organic chemistry in medicine, biology, and biochemistry?
- A 10. How would you rate **Napoleon's Buttons** in improving the relevance of the course material?

- A 11. Were the **tests** reasonable and indicative of material covered in class and on homework assignments?
- A 12. How useful were **review sessions** in understanding the material? (If you don't know because you never attended or were unable to attend, answer N/A)
- B 13. Did the **size of class** affect your ability to work and learn in this class? (A – class size was helpful, C – class size had no effect, F – class size was a hindrance)

B. Instructor

- A 1. How well would you rate the instructor in terms of being **prepared and organized**?
- A 2. Did the instructor present the material at an **appropriate pace**? (A – too fast; F – too slow; C – just right)
- A 3. How well was the instructor able to **communicate** the material presented in class?
- A 4. Did the instructor **respond to questions** reasonably?
- A 5. How would you rate the instructor's **accessibility** outside of the classroom in the **office suite**? (If you don't know because you didn't try, answer N/A)
- A 6. How would you rate the instructor's **accessibility** outside of the classroom via **email**? (If you don't know because you didn't try, answer N/A)
- A 7. In comparison to other courses you have taken, how would you rate the **course overall**? (A – top 10%; B – top 30%; C – middle; D – bottom 30%; F – bottom 10%)
- A 8. In comparison to other courses you have taken, how would you rate your **instructor overall**? (A – top 10%; B – top 30%; C – middle; D – bottom 30%; F – bottom 10%)
- A 9. Did the instructor provide **timely feedback** and answers for quizzes, examinations, and other assignments?
- A 10. Did the instructor provide **adequate, helpful, and meaningful feedback** for quizzes, examinations, and other assignments?

- A 11. Was the instructor's **grading** unambiguous and fair?
- A 12. Was the instructor **motivating** and encouraging?
- A 13. Was the instructor able to **communicate the subject's relevance** to everyday life and subject of study (ie; biology & medicine)?

C. Free Response

Please provide meaningful feedback below:

Provide advice for incoming organic chemistry students on how to study for this course:

Comment on the overall process and significance of the research report:

Provide feedback on what you found beneficial and/or detrimental of group assignments:

What about the course can be improved?

What about the course should remain the same?

Appendix VII

EAS Regioselectivity for Multifunctional Rings

When performing EAS reactions on aromatic molecules with complex substitution patterns, one must fully consider two key concepts:

- Substituent effects of the functional groups already on the starting material. These include:

Activation effects

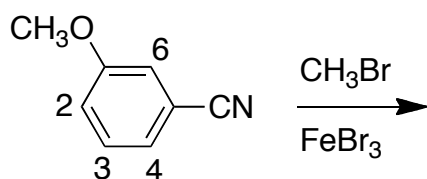
Directing effects

- Reagents that will provide the desired functionality.

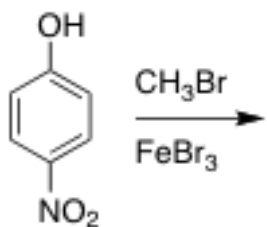
When determining the regioselectivity of EAS, approach the problem systematically:

1. **Determine the substituent that will do the directing.** The most activating or least deactivating substituent directs the regioselectivity of the ensuing addition.
2. **Determine position(s)** where the EAS can occur.
3. **Look for mutually reinforcing effects** with other substituents on the ring.
4. **Choose the sterically least hindered position.**
 - Substitution will rarely occur in between two substituents, even if mutually reinforced.
 - Unless otherwise stated, ortho and para directors can be assumed to direct preferentially to the para position.

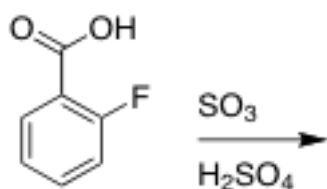
For example:



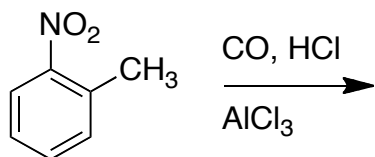
1. methoxy will direct
2. ortho or para (2,6,4)
3. no sites are mutually reinforcing
4. 6 is sterically hindered, 2 is ortho, will preferentially substitute at site 4



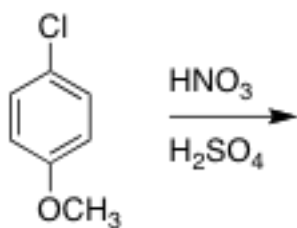
1. Directing substituent
2. Position of substitution
3. Mutually reinforcing effects
4. Sterically least hindered



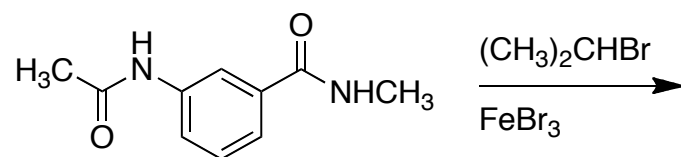
1. Directing substituent
2. Position of substitution
3. Mutually reinforcing effects
4. Sterically least hindered



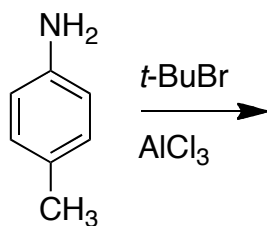
1. Directing substituent
2. Position of substitution
3. Mutually reinforcing effects
4. Sterically least hindered



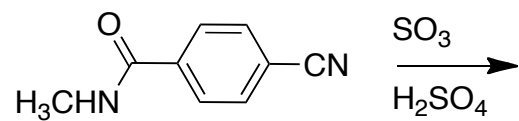
1. Directing substituent
2. Position of substitution
3. Mutually reinforcing effects
4. Sterically least hindered



1. Directing substituent
2. Position of substitution
3. Mutually reinforcing effects
4. Sterically least hindered



1. Directing substituent
2. Position of substitution
3. Mutually reinforcing effects
4. Sterically least hindered



1. Directing substituent

2. Position of substitution

3. Mutually reinforcing effects

4. Sterically least hindered