ORGANIC CHEMISTRY 2 — CHEMISTRY 232 LECTURE — SPRING 2024

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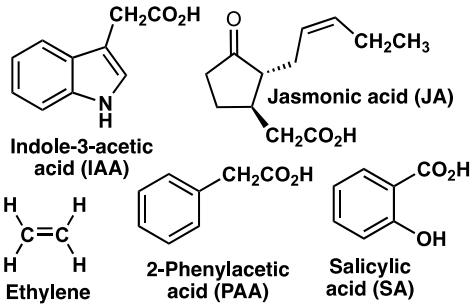
Some Plant-Growth Regulators



OPEN OFFICE HOURS

Please stop by 323 Caputo Hall, anytime *on…*

1. Wednesdays (11:00 am to 12:00 noon).
2. Thursdays (10:00 am to 1:00 pm).
3. Fridays (11:00 am to 12:00 noon).

No appointment needed—just stop by. Please arrive with questions of curiosity or clarification, related to lecture or laboratory course work or learning strategies.

REQUIRED LECTURE CLASS MEETINGS

Please plan to attend and *actively participate* in all lecture class meetings on MWF 10:00 am – 10:50 am, 149 Roddy Hall. If you are unable to attend a lecture class meeting, please email me.

EXPECTATIONS, PARTICIPATION, & CLASSROOM NORMS

The value of actively taking part in class activities is hard to exaggerate; as research has consistently shown, students who actively participate learn more, and retain learning for longer than students who do not.[1] You won't learn well by passively listening to someone lecture at you. Therefore, this class will ask a lot of you. Through completing required readings and practice problems, you are expected to prepare for all class meetings. And you are expected to come to class ready to focus, take good notes, and engage with me and your fellow students on the topics of the day. You will practice skills through in-class exercises, often in groups. And you will play a vital role in your peer's education—you'll help them learn more, and they will, in turn, help you.

A small portion of your participation will be evaluated based on your demonstrated ability to contribute to class activities, discussions, and informal group work in ways that raise the level of dialogue. Talking all the time is not necessarily the same thing as great participation; indeed, talking too frequently can even lead to imbalance and discomfort for others. Actively listening to classmates, responding with relevance to others' comments, reflecting on, building on, and generating questions related to your classmates' ideas lead to authentic and meaningful participation.

I am serious about helping to create a classroom environment in which anyone feels free to ask questions, raise concerns, make brilliant points, and so on. This classroom is your classroom. Please don't keep yourself from asking a question because you fear it will sound silly or unsophisticated or obvious. And becoming fluid in the art of asking questions (of clarification or curiosity) is one of the best ways to increase your learning and critical thinking.[2]

Although I am committed to classroom activities and dialogue in which students exert a great measure of control, I recognize that I have bureaucratic institutional authority as the instructor. I choose to use that authority to forbid any behavior that would make anyone else in the class feel uncomfortable or the subject of ridicule. You are expected to behave courteously and respectfully to your classmates and to me. All students need to feel that this is their classroom; I am committed to protecting those conditions. People first, learning second, bureaucracy last.

LANGUAGE, CRITICAL THINKING, & LECTURE COURSE DESCRIPTION

"The limits of my language mean the limits of my world." – Ludwig Wittgenstein[3]

This course is designed to strengthen your use of a sophisticated graphic, textual, and verbal *scientific language*; and Organic chemistry—an active field of study, research, and scholarship—provides molecular level foundational knowledge and skills for better communication, deeper comprehension, better questioning, and better problem-solving in biochemistry, green chemistry, environmental chemistry, molecular biology, genetics, pharmaceuticals, medicine, biotechnology, toxicology, and numerous related fields. Organic and organometallic chemicals are everywhere and make up over 90% of the more than 273 million (and counting) known chemical substances.[4]

In this course, we will all work together—to increase your ability to ask elucidating questions & to think critically. We will accomplish this through deliberate practice, making lots of mistakes, questioning and adjusting your thinking (based on self-reflection, utilizing appropriate learning strategies, improving metacognition, generating more questions, and timely feedback.

This course is more than the memorization of a bunch of facts; and it is more than applying a few simple rules to get the correct answer. Through doing the work, you will know and understand many facts and you will be able to apply some rules; yet you *must think critically* (at the Bloom's Taxonomy levels of analysis, evaluation, and synthesis) to solve problems, which may occasionally have more than one reasonable answer. Therefore, you must learn to think like a detective and piece answers together with everything you know. We will help each other to learn these critical thinking skills.

And Chemistry 232 is a non-mathematical, yet extremely logical, critical thinking and *problem-solving course*. It focuses on verbal, written and symbolic representation of molecular structure, functional groups, nomenclature, physical properties, reactivity, mechanisms, and synthesis of organic compounds. The examples presented contain underling principles and concepts that are applied repeatedly—both explicitly and implicitly—throughout this course, in future organic chemistry courses, and in biochemistry, molecular biology, and many other areas of science and applied science courses. Most of the examples have real-world application; yet the primary focus is learning to problem-solve via the application of chemistry fundamentals.

LECTURE COURSE LEARNING GOALS

As your learning progresses, you should be able to confidently demonstrate your ability to…

1. Recognize, name, and draw organic compounds and organic functional groups.
2. Estimate, explain, and draw the attractive forces within and between molecules.
3. Analyze, explain, and draw structural conformations, configurations, and isomers.
4. Describe relationships between molecular structure, reactivity, and physical properties.
5. Apply acid and base chemistry concepts — ARIO (atom, resonance, induction, orbital) conjugate base stability method and the acid pKa value method — to analyze, draw, and explain a wide variety of reactions.
6. Describe reaction mechanism steps with elementary reaction names, and with Frontier-Molecular Orbital (FMO) notation, and by utilizing curved-arrow notation.
7. Analyze reactants to propose and draw plausible reaction mechanisms (using curved-arrow notation to represent electron flow).
8. Describe, apply, compare & contrast, and evaluate organic functional group reactions.
9. Predict plausible products, reactants, or reagents (based on an understanding of—and application of—acid-base chemistry and functional group reactivity analysis).
10. Design multi-step synthesis of organic products by using functional group transformation reactions and carbon-carbon bond forming reactions.
11. Read, understand, and predict molecular-level details of biosynthetic pathways (based on your knowledge, skills, and ability to apply, analyze, and evaluate functional group transformation reactions).

SEVEN EFFECTIVE LEARNING STRATEGIES

1. Spaced Practice (well-timed daily reading with problem-solving)
2. Concrete Examples
3. Recall Practice
4. Interleaving
5. Dual Coding
6. Elaboration
7. Deliberate Questioning (curiosity & clarification)

LECTURE & LABORATORY COURSE EVALUATION SCHEME:

Lecture & textbook reading pop-quizzes, participation, & practice (50 points)	5.0 %
Required pre-lecture in-chapter problems & reading (50 points)	5.0 %
More required end-of-chapter practice problems (100 points)	10.0 %
Exam 1 (100 points)	10.0 %
Exam 2 (100 points)	10.0 %
Exam 3 (100 points)	10.0 %
Exam 4 (100 points)	10.0 %
Final (200 points)	20.0 %
Laboratory (200 points)	20.0 %
	∑ = 100.0 %

GRADE DISTRIBUTION (in percentage points)

A	100 – 92.0	**B**	87.9 – 82.0	**C**	77.9 – 72.0	**D**	67.9 – 62.0
A-	91.9 – 90.0	**B-**	81.9 – 80.0	**C-**	71.9 – 70.0	**D-**	61.9 – 60.0
B+	89.9 – 88.0	**C+**	79.9 – 78.0	**D+**	69.9 – 68.0	**F**	< 59.9

LECTURE COURSE & EXAMS SCHEDULE OVERVIEW

Wednesday Midterm Exams (7-FEB, 28-FEB, 3-APR, & 24-APR): exam questions are closely aligned to course learning goals. And exam questions will be closely related to required homework problems, lecture participation and practice problems, laboratory practice problems, and lecture discussion examples.

Textbook	**Chapter Topic** (see reading schedule for more detail)	**Exam Schedule**
Chapter 7	**Eliminations & Substitutions** (17-JAN – 24-JAN)	
Chapter 8 & 9	**Alkene & Alkyne Nucleophiles** (26-JAN – 5-FEB)	**EXAM 1 (7-FEB)**
Chapter 10 & 11	**Radicals & Synthesis Design** (12-FEB – 16-FEB)	
Chapter 12	**Alcohols** (19-FEB – 26-FEB)	**EXAM 2 (28-FEB)**
Chapter 13	**Ethers, Epoxides, & Sulfur** (11-MAR – 15-MAR)	
Chapter 18	**Aromatic Reactions** (18-MAR – 22-MAR)	
Chapter 19	**Aldehydes, Ketones, & Derivatives** (25-MAR – 1-APR)	**EXAM 3 (3-APR)**
Chapter 20	**Carboxylic Acid Derivatives** (8-APR – 12-APR)	
Chapter 21	**Enols & Enolates** (15-APR – 22-APR)	**EXAM 4 (24-APR)**
Chapter 22	**Amines & ACS Review** (26-APR & 29-APR)	**FINAL (2-MAY; 8:00 am)**

Chapters 19 – 22 will be a review of CHEM 231 & 232 language, fundamentals, concepts, and problem-solving strategies—within the context of multi-step synthesis.

REQUIRED LECTURE MATERIALS

1. Daily access our D2L course site and your Millersville email account.

2. Klein's Organic Chemistry 4th Edition (1) textbook & (2) study guide & solutions. Please see Millersville University textbook store site for details: https://millersville.textbookx.com/institutional/index.php?action=browse#/books/4052492

REQUIRED PRE-LECTURE TEXTBOOK READING

Due date —> **chapter sections; always *required & due by <u>9:50 am MWF</u>*.**

Work all required in-chapter problems during pre-lecture reading (see page 6).

- ☐ ***19-JAN* —> 7.1 – 7.7.**
- ☐ ***22-JAN* —> 7.8 – 7.12.**
- ☐ ***26-JAN* —> 8.1 – 8.9.**
- ☐ ***29-JAN* —> 9.1 – 9.7.**
- ☐ ***31-JAN* —> 8.10 – 8.15.**
- ☐ ***2-FEB* —> 9.8 – 9.10.**
- ☐ ***5-FEB* —> Re-read 8.14, 8.15, & 9.11.**
- ☐ ***12-FEB* —> 11.1 – 11.4.**
- ☐ ***14-FEB* —> 11.4 – 11.5.**
- ☐ ***16-FEB* —> 11.5 – 11.7.**
- ☐ ***19-FEB* —> 12.1 – 12.6.**
- ☐ ***21-FEB* —> 12.7 – 12.10.**
- ☐ ***23-FEB* —> 12.11 – 12.13.**
- ☐ ***26-FEB* —> Re-read 12.13.**
- ☐ ***11-MAR* —> 13.1 – 13.6.**
- ☐ ***13-MAR* —> 13.7 – 13.0.**
- ☐ ***15-MAR* —> 13.11 – 13.12.**
- ☐ ***18-MAR* —> 18.1 – 18.9.**
- ☐ ***20-MAR* —> Re-read 18.7 – 18.9, then 18.10 – 18.12.**
- ☐ ***22-MAR* —> 18.13 – 18.15.**
- ☐ ***25-MAR* —> 19.1 – 19.11.**
- ☐ ***27-MAR* —> 19.12.**
- ☐ ***29-MAR* —> Re-read 8.15, 9.11, 19.12, 12.13, 13.12, 18.12, & 19.12.**
- ☐ ***1-APR* —> Re-read 8.15, 9.11, 19.12, 12.13, 13.12, 18.12, & 19.12.**
- ☐ ***3-APR & beyond* —> *for* CHAPTERS 20, 21, & 22 —>** Reading optional and *strongly recommended*; we will focus on a review of CHEM 231 & 232 language, fundamentals, concepts, and problem-solving strategies—within the context of multi-step synthesis.

REQUIRED PRE-LECTURE IN-CHAPTER PROBLEMS — 5 POINTS POSSIBLE PER CHAPTER
(Due dates for uploaded work into D2L)

- Complete during required pre-class reading (see page 5).
- Must draw out all structures and write keywords to earn full credit.
- Use the study guide and solutions manual to check your work before turning it in.
- Late required work accepted—up to one-week late, for 70% of total points possible.

☐ **CHAPTER 7** ***(11:59 pm on Monday, 22-JAN)***
7.1g, 7.3ac, 7.4, 7.5b, 7.6, 7.7, 7.8, 7.10, 7.12cd, 7.13, 7.14, 7.15bdf, 7.16, 7.17, 7.19def, 7.23, 7.25, 7.32ef, 7.33b, 7.34d, 7.35d, & 7.39d.

☐ **CHAPTER 8 & 9** ***(11:59 pm on Friday, 2-FEB)***
8.1g, 8.2a, 8.5bc, 8.10c, 8.11, 8.15b, 8.17, 8.19, 8.21, 8.25b, 8.26a, 8.28cf, 8.31b, 8.32e, 8.39, 8.41, 8.42, 8.43, & 8.45. **And** 9.1d, 9.2b, 9.5ac, 9.7, 9.9a, 9.10b, 9.16d, 9.17, 9.18b, 9.20a, 9.22, 9.29, 9.30, & 9.31.

☐ **CHAPTER 11** ***(11:59 pm on Friday, 16-FEB)***
11.1, 11.2, 11.3, 11.5bcf, 11.6, 11.7ef, 11.8, 11.9aegj, & 11.10.

☐ **CHAPTER 12** ***(11:59 pm on Friday, 23-FEB)***
12.1bd, 12.2, 12.3, 12.4ad, 12.5c, 12.6cd, 12.7, 12.8, 12.9, 12.10bce, 12.11, 12.12cd, 12.13, 12.14cd, 12.15f, 12.17, 12.18a, 12.19ac, 12.20, 12.21, 12.22abe, 12.23, 12.24, 12.27 & 12.28.

☐ **CHAPTER 13** ***(11:59 pm on Friday, 15-MAR)***
13.1, 13.2, 13.3, 13.4a, 13.5bd, 13.7, 13.11ab, 13.12a, 13.13b, 13.14, 1316abc, 13.18bc, 13.19, 13.20a, 13.21abcd, 13.22abe, 13.23, 13.24abd, & 13.25.

☐ **CHAPTER 18** ***(11:59 pm on Friday, 22-MAR)***
18.1, 18.2, 18.5bc, 18.7, 18.10, 18.16ef, 18.17, 18.18ce, 18.19, 18.22c, 18.23, 18.24bgh, 18.25cf, 18.26bd, 18.30, 18.31, 18.35, & 18.37.

☐ **CHAPTER 19** ***(11:59 pm Friday, 28-MAR)***
19.1, 19.2, 19.3, 19.4, 19.5 (use table 19.2), 19.6, 19.15b, 19.16c, 19.20c, 19.21, 19.23e, 19.24, 19.30c, 19.37, 19.40, & 19.41.

☐ **CHAPTER 20 & 21** ***(11:59 pm Friday, 19-APR)***
20.1, 20.2, 20.3, 20.4, 20.5, 20.6, 20.7, 20.8, 20.9, 20.12, 20.13, 20.30, 20.31, 20.32, & 20.33. **And** 21.1, 21.2, 21.3, 21.5, 21.7, 21.13, 21.30, 21.31, 21.32, 21.33, 21.34, 21.35, 21.36, 21.38c, 21.44, & 21.46.

MORE REQUIRED PRACTICE PROBLEMS — 10 POINTS POSSIBLE PER CHAPTER
(Due dates for uploaded work into D2L)

- Complete near end of our related chapter discussions in lecture.
- Must draw out all structures and write key words to earn full credit.
- Use the study guide and solutions manual to check your work before turning it in.
- Late required work accepted—up to one-week late, for 70% of total points possible.

❍ **CHAPTER 7 (11:59 pm on Wednesday, 24-JAN)**
7.47d, 7.48, 7.49, 7.54, 7.56, 7.61, 7.66, 7.73, 7.76, 7.79, 7.80, 7.81, 7.82, 7.83, 7.84, 7.85, 7.86, 7.87, 7.88, 7.89, 7.90, 7.92, 7.94, 7.98, 7.100, & 7.101.

❍ **CHAPTER 8 & 9** ***(11:59 pm on Monday, 5-FEB)***
8.47e, 8.49, 8.50, 8.57, 8.67bd, 8.70, 8.81, 8.82, 8.83, 8.84, 8.85, 8.86, 8.87, 8.88, 8.89, 8.90, 8.95a, & 8.98. **And** 9.32d, 9.33b, 9.37, 9.41, 9.48a, 9.58, 9.59, 9.60, 9.61, 9.62, 9.63, 9.64, & 9.74.

❍ **CHAPTER 11** ***(11:59 pm on Monday, 19-FEB)***
11.11, 11.12, 11.15, 11.18bc, 1.21e, 11.26, 11.27, 11.28, 11.29, 11.30, 11.31, 11.32, 11.34, 11.38, 11.39, 11.40, 11.41, 11.43, & 11.45.

❍ **CHAPTER 12** ***(11:59 pm on Monday, 26-FEB)***
12.29, 12.30, 12.32, 12.33ac, 12.34abegi, 12.35, 12.36de, 12.39bf, 12.40, 12.44b, 12.45ac, 12.47, 12.49, 12.53, 12.54, 12.55, 12.56, 12.57, 12.58, 12.59, 12.60, 12.61, 12.62, 12.65abegpq, 12.78, & 12.83.

❍ **CHAPTER 13** ***(11:59 pm on Monday, 18-MAR)***
13.26, 13.34, 13.35, 13.37, 13.38ace, 13.42b, 13.44, 13.45, 13.46, 13.47, 13.48, 13.49, 13.50, 13.51, 13.52, 13.53, 13.59, & 13.80.

❍ **CHAPTER 18** ***(11:59 pm Monday, 25-MAR)***
18.38, 18.39, 18.40, 18.42, 18.43, 18.44, 18.45bh, 18.46, 18.52ab, 18.73, 18.74, 18.75, 18.76, 18.77, 18.78, 18.79, 18.88, & 18.99.

❍ **CHAPTER 19** ***(11:59 pm Monday, 1-APR)***
19.43, 19.44, 19.45, 19.57, 19.62, 19.64, 19.67, 19.69, 19.73, 19.74, 19.75, 19.76, 19.77, 19.78, 19.79, 19.80, 19.81, 19.83, 19.84, 19.85, 19.93, 19.95, 19.96, 19.97, & 19.99.

❍ **CHAPTER 20 & 21** ***(11:59 pm Monday, 22-APR)***
20.35, 20.36, 20.37, 20.38, 20.50, 20.51, 20.53, 20.59, 20.60, 20.64, 20.69, 20.70, 20.71, 20.72, 20.73, 20.74, 20.75, 20.76, 20.77, 20.78, 20.89, 20.91, 20.92, 20.93, & 20.95. **And** 21.47, 21.48, 21.59, 21.66, 21.73, 21.77, 21.78, 21.88, 21.89 – 21.96, 21.110, & 21.123.

OUR EPPICC VALUES
Exploration, Professionalism, Public Mission, Inclusion, Integrity, and Compassion.[5]

LABORATORY — CHEMISTRY 232 — ORGANIC CHEMISTRY 1 — SPRING 2024
All weekly handouts will be provided in lab.

AT THE COMPLETION OF CHEM 232, YOU SHOULD BE ABLE TO…

1. Demonstrate proper laboratory safety & waste disposal when working in the lab.
2. Keep a neat and organized record of laboratory data in a notebook.
3. Set up apparatus for experimental techniques: reactions, distillations, filtrations, etc.
4. Purify organic products by recrystallization (solids) and distillation (liquids).
5. Characterize organic products by physical, chemical, and spectroscopic properties.

LABORATORY SCHEDULE

Week	Activity
1	Safety, Check-In, & Reaction Review
2	Steam Distillation
3	Beta-Elimination (E1 Dehydration) and Fractional Distillation
4	Gold Cat. Alkyne Hydration Reaction & Thin-Layer-Chromatography (TLC)
5	Synthesis Practice, SciFinder, & Library Resources
6	IR, MS, Proton & Carbon NMR Review & Practice — Part 1
7	Finish Weeks 1 — 6 Work & Notebooks Due by 1-MAR
8	Spring Break
9	Suzuki-Miyaura Cross-Coupling
10	Electrophilic Aromatic Substitution (Nitration)
11	Aspirin Synthesis
12	Finish % Yield, IR, MP, NMR, data collection and analysis
13	ACS Final Exam (ACSFE) Practice Problems — Part 1
14	IR, MS, Proton & Carbon NMR Practice — Part 2
15	IR, MS, NMR & ACSFE Practice Problems, Clean-up, & Check-out

CHEMISTRY 232 LABORATORY ATTENDANCE STATEMENT

Make-up labs are not an easy option—due primarily to scheduling and space limitations. If you are planning to miss a lab due to an official Millersville University event, or due to a foreseeable life event absence, or if you miss a lab due to an emergency, please email, as soon as possible, to begin discussing options; failure to begin discussing options within a timely manner will lead to this course policy: missing the first lab equals a zero for the lab activity, missing two labs equals a zero for the second lab activity, missing three or more labs equals failure of the entire course (lecture & lab).

ADDITIONAL COURSE POLICIES

University approved class attendance policy

Students are expected to attend all classes [and lab meetings]. It is the student's responsibility to complete all course requirements even if a class is missed. If a student misses a class for an officially excused reason, then they are entitled to make up the missed work but only at the convenience of the faculty member. Responsibility for materials presented in, assignments made for, and tests/quizzes given in regularly scheduled classes lies solely with the student.

1. The University policy is that faculty will excuse absences for the following reasons: personal illness, bereavement or critical illness in the family, participation in a university-sponsored activity, jury duty, military duties, or religious holidays.
2. Faculty judge the validity of student absences from class within the University's approved guidelines and may require documentation for excused absences. Faculty will evaluate any reason, other than those listed above, for a student missing class and determine whether the absence is justified. In these circumstances, a student may make up missed work at the discretion of the instructor.
3. In the case of foreseeable absences, students are encouraged to notify the faculty member in advance. A student who will miss class due to participation in an official University activity must notify the instructor well in advance of the activity to assure that the absence is excused.

Diversity, Inclusion, and Anti-Racism Policy

This course is a judgement free and anti-racist learning environment. Our class includes students from a wide variety of social identities and life circumstances. Everyone will always treat one another with respect and consideration or be asked to leave the classroom.

Americans with Disabilities Act

Millersville University is committed to equality of opportunity and freedom from discrimination for all students, employees, applicants for admission or employment, and all participants in public University-sponsored activities. In keeping with this commitment, and in accordance with the Americans with Disabilities Act (ADA) the University will make every effort to provide equality of opportunity and freedom from discrimination for all members of the University community and visitors to the University, regardless of any disability an individual may have. Accordingly, the University has taken positive steps to make University facilities accessible to individuals with disabilities and has established procedures to provide reasonable accommodations to allow individuals with disabilities to participate in programs. The University administration and management are obligated to report any allegation of discrimination to the appropriate office as defined in this policy. If you have a condition that may impact your ability to perform laboratory exercises, to exit lab safely from the premises in an emergency, or which may cause an emergency during class, or lab, please discuss this in confidence with your instructor, as soon as possible; appropriate accommodations may then be provided.

Title IX Statement

Millersville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment, comply with Title IX of the Education Amendments of 1972, 20 U.S.C. §1681, et seq., and act in accordance with guidance from the Office for Civil Rights, the University requires faculty members to report to the University's Title IX Coordinator incidents of sexual violence shared by students. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report to the person designated in the University Protection of Minors policy incidents of sexual violence or any abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is available at www.millersville.edu/titleix.

Additional Resources & Counseling Reminder

Additional resources include Health Services (717-871-5250), Center for Health Education and Promotion (717-871-4141), Campus Ministries, and Learning Services (717-871-5554). Students sometimes face mental health or drug/alcohol challenges in their academic careers that interfere with their academic performance and goals. Millersville University is a caring community and resources are available to assist students who are dealing with problems. The Counseling Center (717-871-7821) is an important resource for both mental health and substance abuse issues.

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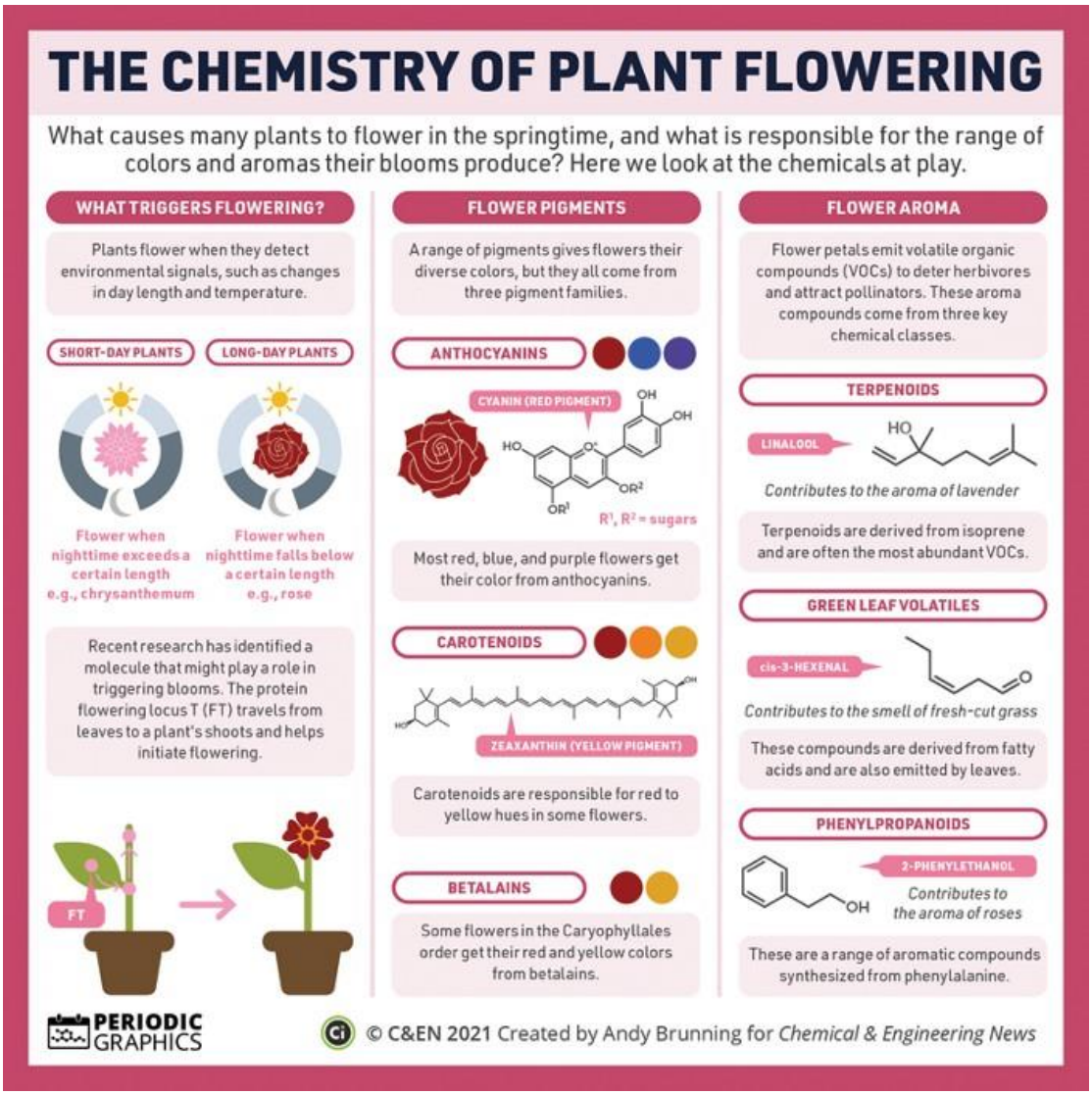
[1] David Gooblar, *The Missing Course: Everything They Never Taught You About College Teaching* (Cambridge: Harvard University Press, 2019).

[2] Paul Hanstedt, *Creating Wicked Students: Designing Courses for a Complex World* (Sterling, Virginia: Stylus Publishing, 2018).

[3] Brené Brown, *Atlas of the Heart: Mapping Meaningful Connection and the Language of Human Experience* (New York, Random House, 2021).

[4] Chemical Abstract Services (CAS) website, accessed August 1, 2022, https://www.cas.org/about/cas-content.

[5] Millersville University website, accessed August 1st, 2022, https://www.millersville.edu/about/eppiic-values/.



Chemical and Engineering News website, accessed December 20th, 2022, https://cen.acs.org/biological-chemistry/Periodic-Graphics-chemistry-plant-flowering/99/i9.