

CHEM 23A PO: DISCOVERING CHEMISTRY W/ LABORATORY

INSTRUCTORS

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OFFICE HOURS & HOMEWORK SESSIONS

Liu: Mondays 9-11 am; Tuesdays 1:30-3:30 pm; by appointment

Muzikar: Wednesdays 2-4; by appointment

O'Leary: Wednesdays 10 am - 12 pm; Thursdays 1-3 pm; drop-ins welcome

Homework Sessions: To Be Determined

LOGISTICS

Course meeting times: Tuesdays and Thursdays, 9:35-10:50 am (SC 103); Fridays, 1:15-5 pm* (SC 103)
**Friday afternoons are Discovery Lab sessions and will sometimes meet in SN 007*

Website: We will use Sakai to post all course materials, including syllabus, class activities, class slides, and homework assignments. Login with Pomona user ID and password.

WELCOME TO DISCOVERING CHEMISTRY!

We are so glad that you are here. We want our classroom to be inclusive, equitable, and full of participation. As your instructors, we are committed to creating a classroom environment that welcomes and supports all students, regardless of race, gender, religious beliefs, etc. No matter where you're starting out, we are committed to helping you succeed in this class. We expect that your unique background will enrich our learning environment and we are excited to have you in this class. We all have implicit biases, and we strive to continually examine our judgments, words, and actions to keep our biases in check and treat everyone fairly. We expect that you will do the same and that you will let us know if there is anything we can do to make sure everyone is successful in this class. If there are any aspects of the instruction or design of the course that result in barriers to your learning, please let us know as soon as possible. If you do not feel comfortable approaching us directly, please feel free to reach out to one of our QSC Partners: Zheous Abalos and Heidi Xu.

It is common that college students experience a great deal of stress. In a class of this size, there will likely be a few individuals who are going through hard times and who are experiencing psychological difficulties. If you are feeling miserable, or you think you are experiencing psychological problems, please do seek help! If you think you may benefit from psychological help, please consider reaching out to Monsour Counseling and Psychological Services (MCAPS), 909-621-8202. You may also use TimelyMD which provides 24/7 free and unlimited medical and mental health services. To register and access this service, please visit: <https://timelycare.com/schools/index.php?school=7chealth&>.

This foundational foray into the field of chemistry will provide a foundation for advanced study in the chemical sciences and related fields. We hope that through this course you will also gain a general appreciation for the molecular nature of our world and how scientific research is done. We aim to foster an environment that produces a cohort of active learners who are intentional about their educational choices. Our goals are that CHEM 23 students will leave the course:

- **Energized to take more science courses and feel confident in their ability to do so, and**
- **Ready and confident to join collaborative research projects.**

After successfully completing the entire CHEM 23 sequence, students will be able to:

- Engage in accurate communication about chemistry through prose, equations, figures, tables and graphs;
- Develop conceptual models and hypotheses from observed chemical data and phenomena;
- Synthesize knowledge to solve complex chemistry problems;
- Ask good questions and have developed intuition for seeking realistic answers;
- Explain and discuss the historical (and continuing) power and identity imbalances within the field(s) of chemistry;
- Provide examples of where chemistry helped to solve major crises and the flip side, where chemistry as a field created major crises.

In addition, active engagement with the course will allow students to increase skills such as: communication of scientific concepts and experimental results; managing group dynamics and using teamwork for effective collaboration; self-management and self-assessment.

Note that many of the intended learning outcomes above are applicable outside of chemistry! Being able to ask questions, synthesize knowledge, interpret data – these are all foundational skills that will allow you to be creative and critical thinkers in any field you apply yourself to.

For each class period, a list of **specific learning outcomes** will be provided to you, so that you can gauge your mastery of the materials and skills covered in CHEM 23.

COURSE MATERIALS

- **Textbook:** OpenStax Atoms First, 2nd edition: <https://openstax.org/details/books/chemistry-atoms-first-2e>. This is a free, online textbook. You can also get a print version – hardcover ISBN: 978-1-94717-264-7, softcover ISBN: 978-1-59399-579-9.
- **Homework:** We will use Aktiv Learning for online homework. The College is covering the costs of this resource and it links directly with your online textbook. At the end of the syllabus is an extra sheet with information on Aktiv Learning. The enrollment code for this class is **KBCB3B**.
- **Additional Resources:** You will routinely need access to a calculator during class time. You will need access to a smartphone, tablet, or computer to access Sakai and Aktiv Learning.
- **Email policy:** We will email the class frequently. You are expected to check your Pomona email account for these emails and to read them. Email is also the best way to get ahold of the instructors for the course.

COURSE OVERVIEW

Co-Instructor Model: letting one of us is like letting all of know. If you do prefer to share something with only one of us, however, we would do our best to respect your wishes.

Your Tasks

Before class: *Do initial reading assignments and any assigned activities* (e.g., watch a video, look at a website) before class. These assignments will allow you to be ready for the start of class – your preparation will form part of your participation grade.

In class: *Engage content in class – through discussion and problem solving – to achieve learning gains.*

The in-class work aims to maximize your learning while also developing important skills such as communication, teamwork, management, and self-assessment. During our class meeting time, you will function as a member of a Learning Team, examining chemistry concepts as a unit. Working as a team is also reflective of how science is done – in research groups, through collaboration, etc. Team responses to key questions on in-class activities will be evaluated for correctness and effective communication. The team may also strategize on ways to improve teamwork and team products. Your team effort and these responses is part of your participation grade. Throughout the semester, you will be asked to assess yourself and your teammates. Evaluations will be based on the Team Performance Rubric, which can be found on the course Sakai site. You should refer to this rubric *frequently* throughout the semester to make sure you are fulfilling the criteria of being a productive team.

After class: *Actively* work on questions stemming from the reading and in-class work. This will bring your learning full circle. The key to learning any new skills or concepts is to practice. The point of the assigned homework and optional problems is to give you that practice. “Actively working” means that you work out the problems yourself – you do not simply watch someone else tackle the problem. At the same time, you can (and should!) do your practice with others – it is a chance for you to practice communicating to and learning from others. We provide two sources of practice for you:

- ***Aktiv Learning - Homework:*** The electronic homework is designed to enhance your learning in conjunction with the text. **A set of questions, related to material recently covered in class, is due every Monday at noon.** In the Fall semester, there are 13 Aktiv homework assignments. You must complete all 13, but we will only count the 12 highest scores in your final grade.

Due date extension policy: We expect work to be turned in by the communicated due dates, which were all decided with careful consideration of all the assignments throughout the semester, along with assignments and exams in other courses that students are commonly cross-enrolled in. Learning to manage due dates and multiple responsibilities will also be helpful for future jobs and internships. However, we recognize that the only thing that one can really expect in life is the unexpected. Thus, in this class, you each will have **two “Flex Tokens”**. Application of the Flex Token allows you to receive a no-questions-asked deadline extension. By 11:59 pm the night before the original due date, you must communicate your use of the Flex Token by using the [Google Form](#) (link also available on Sakai) to receive an extension.

When Flex Tokens are not used, **late work will be accepted** for all homework. However, for every day that the assignment is tardy, a 10% deduction will be applied to your grade on that assignment.

- ***Aktiv Learning – Optional Problems:*** For each week, additional problems (from the text and beyond) will be suggested. These additional problems will often form part of the Discovery Check-ins (see below).

Get Help!

One of the most crucial elements of a positive CHEM 23 experience is developing efficient, effective study habits and spending dedicated time practicing what you have learned throughout the week. But this is not something you need to do alone! There are lots of opportunities for you to get help with your learning.

Homework Sessions: We have two Quantitative Skills Center (QSC) Partners to help guide your learning. The Partners are handpicked peers who are committed to helping you succeed in this course. The Partners also serve as liaisons to the instructors as needed. The Partners will be at each of the two Homework Sessions – times in designated spaces where you can join your classmates to work on the course work and deepen your learning. Partners also meet one-on-one with students to provide course specific help. The QSC also offers non-course specific help in general quantitative skills and offers consultations for projects and theses involving quantitative methods. To make an appointment with a Partner or to reach out to the QSC, please visit pomona.mywconline.com, or write to gsc@pomona.edu. The QSC is in SCC (Smith Campus Center) 228.

Office Hours: These are guaranteed times when we can individually be found in our offices, ready and waiting for you to come by. You can come by with specific questions. Lots of students do this: they've organized their class notes, homework, etc. and they bring those documents with them and ask us specific questions. Some students take notes while we chat. Examples of specific questions you might ask:

I didn't understand XX when we talked about it in class. Can we go over it again?

I don't understand how to start this problem on the homework. Can you help me get started?

I don't understand what this paragraph in the textbook means. What should I be thinking about?

I know we talked about this already, but I am still struggling with this concept. Can you help me again?

If you do not have a specific question, you can still go to office hours! It may help if you have at least a starting point for the conversation. Some things you might say are:

So.... Orbitals..... Yeah. Tell me about that.

I haven't started the homework yet, but I thought I could do that now, with you here to help me.

High school chemistry was really hard for me. So, I'm scared.

I want to do well in this class. What should I do?

If you do not have a specific question and you do not have a starting point for the conversation, that is OK too! By just chatting with us about the course, questions will surely evolve.

Expectations For Working with Others

Scientists of all stripes routinely work in groups and collaborations. It is vital that you become accustomed to responsible participation. Being able to be productive and work in a team is a skill set that all employers expect and need. You and your team must learn to work together, sharing the

workload, collaborating during problem solving, and involving all members in discussions. Form a positive working relationship with any team that you work with by being inclusive, respectful, and supportive of all members of the team. Encourage members to participate in discussions and listen to them speak when they do. Maintain active communication with each other outside of formal class sessions.

Assessments

<u>Final Grade Calculation</u>		<u>Grading Scale</u>			
Preparation / Participation:	10%	A	93-100	C	73-76
Homework (best 12 of 13):	20%	A-	90-92	C-	70-72
Discovery Check-ins (best 7 of 8):	50%	B+	87-89	D+	67-69
Laboratory work:	20%	B	83-86	D	63-66
		B-	80-82	D-	60-62
		C+	77-79	F	≤59

There is no curve for this course – you need only worry about your own performance. Please note that an “A” grade represents excellent mastery and astute discussion of concepts covered in this course.

Your grade for CHEM 23A is ultimately reported as P (pass) or NP (no pass). A grade of C or higher in the course is needed to get a P grade. Because we want you to be aware of the areas that you have mastered and those that are still developing, we will give you graded feedback throughout the course – but the grade on your transcript will be converted to a P or NP.

How to think about your grade: Think about it like a video game. You are starting with zero points in the class, and you are working to earn as many as you can to get a max score. We are not taking points away from you when you get a grade – we are adding points to your total that you have earned.

Discovery Check-ins: During the semester, every other week, we will assess your learning through a quiz. Six in-class check-ins will be given throughout the semester, and a final check-in will take place during finals week (Monday, December 11, 2-5 pm) and is the equivalent of two check-ins. The check-ins will all be cumulative and be comprised of short answer questions based on material from in-class activities, assigned homework, and the optional problems. For each check-in, you may use a calculator as well as one page (front-and-back) of hand-written notes. The check-ins will focus on assessing your ability to apply what you have learned and not rote memorization. The more grades we collect, the less each one will impact your grade. Each check-in is worth ~7% of your grade, but we will only use the best 7 of the 8 check-in grades.

Check-in Retakes. If you score less than 75% on any check-in, you will have the opportunity to re-take that check-in to score up to 75%. One re-take is permitted per check-in. There will be two designated Check-in Retake Days. On those days, during designated hours, students can re-take any check-in that they scored <75% on. One week before these Retake Days, you must communicate with Prof. O’Leary which check-ins you plan to retake.

Make-up Check-ins. Will be given early for verified check-in conflicts. Please notify us of conflicts as soon as possible, preferably two weeks, but no later than one week, before the scheduled check-in. For verified extenuating circumstances, any student who misses a re-take will have the opportunity to make-up that check-in during a Retake Day. Post-check-ins makeups are not eligible for a retake.

Participation: This course is designed for you to come to class and participate. That being said, life happens. We have designed assignments and assessments so that you can miss a certain number without affecting your grade. During class time, in addition to mastering the material yourself, you are responsible for assisting the other members of your team in their understanding of the material. Please be respectful of us and your fellow classmates and show up to class on time. You may miss four classes (inclusive of the Tuesday, Thursday, and Friday sessions) without an excuse for the semester – your participation grade will not be negatively impacted in these cases. All materials from class will be posted on the course Sakai site. **You are responsible for handing in all assignments on time and obtaining all activities, regardless of missed classes.**

If you miss a class because of illness, you do not need a note unless you have already missed four classes. If you are having a lot of difficulty coming to class, eating, sleeping, or generally functioning, we will reach out to the Dean of Students to ask them to help you. We want you to be able to earn points and a grade based on your ability to do chemistry – not based on something out of your control. That would not be fair, and fairness is very important to us.

Grading Policy: Any query regarding scores on graded assignments or exams should be presented within three days of return of the assignment/exam. It is your responsibility to meet with one of us to make any adjustments. Please note that we reserve the right to regrade the entire submission, and as a result, we may raise or lower your entire score. After three days, all scores become final and unalterable.

Special circumstances: If there are special circumstances, such as illness or other form of emergency, which should be considered regarding any of the stated class policies, please inform us as soon as possible so that alternative arrangements can be made.

Accommodations: Pomona College is committed to making all courses accessible for everyone. We encourage you to meet with Prof. Muzikar early in the semester to discuss your Accessibility Resources and Services (ARS) authorized accommodation needs for this course. If you need academic accommodations or have any questions about the accommodations procedure, please contact ARS in the Dean of Students office at disability@pomona.edu or 909-621-8017.

Religious Observances Policy: Our community is strengthened by our great diversity, including various religious and spiritual identities. If you have religious accommodation needs, with respect to specific religious holidays that will affect class attendance and participation, remember the structure of the course is set up to provide flexibility for such instances. You are also welcome to speak to Prof. Liu about your needs. For further advice and consideration, please reach out to the chaplains' office, chaplains@claremont.edu.

Academic ethics and integrity policy: It is important that you develop the ability to work independently as well as the ability to problem-solve with others. We want you to learn how to collaborate with others and at the same time develop your own deep understanding of the course material. Any work that you turn in for a grade should be your own work, written by you. You are expected to abide by the Pomona College Standards of Academic Integrity. For the official policy go to: <https://catalog.pomona.edu/content.php?catoid=46&navoid=9114>. Anyone found responsible for violating the College's Academic Honesty Policy will receive a failing grade on that assignment and the Dean of the Students will be notified in accordance with policy.

PUBLIC HEALTH

The College has guidelines in place to protect public health. In our class specifically, if you are required to wear a mask, we will gently remind you to do so. These guidelines may change during the semester to reflect changing conditions and knowledge; we will let you know if this happens. If you forget your mask, ask us, we may have one for you. If a student is unwilling to do their part to preserve public health in in-person classes, then we will ask them to leave the class. As in class participation is a major part of the class, this could affect your grade in the class.

What do to if you are not feeling well: One of the most important things you can do is to stay home if you are sick. We often have a culture of trying to “push through” when we are not feeling well, saying things like, “Yeah, I am sick, but I will be OK – I can still go to class”. While this sort of perseverance in general is a good thing, coming to class when you are sick puts other people’s health at risk. So, if you have any symptoms at all, stay home. Again, the structure of the course is set up to provide flexibility for such instances.

What to do if you are seriously ill. If you have an illness or injury that interferes with your ability to do working our class, talk to us! The Accessibility Resources and Services (ARS) office helps students with short-term injuries and illnesses – concussions, broken bones, etc. Please know that you can also always reach out to your class dean for support in navigating these challenges. If you are sick or hurt, we will work with you and with ARS and/ or your class dean to do whatever we can to accommodate your condition.

INCLUSION

Everyone in this class is an equally valued member of this college and our community. We expect you to treat your classmates as honored colleagues in the collective endeavor we are all involved in – to understand the chemical world and use that understanding to improve our society.

Bias against or denigration of anyone in our class because of their gender or how they express it, their sexual orientation, their religion, their national origin, their race or ethnicity, or a disability they may have will not be tolerated. If you are the target of this sort of bias or if you witness it, please report it directly to us and we will take swift action. If you don’t feel comfortable talking to us, you may report it anonymously to the course QSC Partners.

SOME FINAL THOUGHTS

We expect that you are committed to doing the work to understand the material in this course. We also expect that the level of work each person needs to commit for each part will vary person-to-person and topic-to-topic. Our role is to act as your coaches to guide you in your learning. Ultimately, the learning process belongs to you alone. Consider your learning much like how you would learn a new physical skill, such as shooting hoops, playing an instrument, or a new dance move. You should practice on your own and you can self-assess your progress. We will help you, but we cannot do it for you. Some additional things to keep in mind:

Learning requires practice. To become a master at something, you need to practice it for 10,000 hours. For most chemistry courses, we would expect you to practice, on average, 10 hours a week.

Learning involves failure. There is no problem with trying and failing, as long as you learn something. In fact, in science, your goal is often to test a model, theory, or hypothesis, and try to get it to FAIL. When it fails, and how it fails, teaches us something. Thus, as scientists, we strive for failure. We do not work to “prove” anything. Some people get caught up in failure, success, grades, being a hero, but in science,

there is really no such thing. So, be brave, try your best, failure is just nature's way of telling us what is real and true.

Science, learning, and teaching are all cumulative. In fact, the structure of our entire chemistry curriculum is set up to build one class on top of the other. Our curriculum is iterative, much like real science, so you will also see several topics several times in new contexts and with new jargon and concepts attached.

Science is collaborative. Scientists do not work alone, and they do not work in a vacuum. They work with others. You are in teams in this class because learning to collaborate is an essential element to learning and doing science.

Science is creative. Science is often taught as having "right" and "wrong" answers. For those of you who like this aspect of science (the ability to be right), there is good news and bad news. The good news: your homework problems will still have a right answer. The bad news: cutting edge science may not. This is where a lot of scientific ingenuity and creativity come into play.

We are really excited about teaching you in this course. We endeavor to do things in the class to help you struggle well, so that you learn. That is the most important part for us – that you learn. We are here to coach you. Also, we are admittedly human, so if we make a mistake, please let us know (with kindness). We are looking forward to working with you all!

Aspects of this syllabus were adapted from Jenny Ross's Introductory Physics syllabus, Syracuse University.

Calendar (Subject to Change)

Blue shading = Classroom Days (9:35-10:50 am); **Green shading** = Discovery Lab Days (1:15-5 pm)

SUNDAY	MONDAY	TUESDAY	WEDNES.	THURS.	FRIDAY	SAT.
AUG 27 WEEK 1	28	29 (CLASS 1) FIRST DAY OF CLASS	30	31 (2)	SEPT 1 (3)	2
3 WEEK 2	4 HW DUE, NOON	5 (4)	6	7 (5)	8 (6) DISCOVERY CHECK-IN	9
10 WEEK 3	11 HW DUE, NOON	12 (7)	13	14 (8)	15 (9)	16
17 WEEK 4	18 HW DUE, NOON	19 (10)	20	21 (11)	22 (12) DISCOVERY CHECK-IN	23
24 WEEK 5	25 HW DUE, NOON	26 (13)	27	28 (14)	29 (15)	30
OCT 1 WEEK 6	2 HW DUE, NOON	3 (16)	4	5 (17)	6 (18) DISCOVERY CHECK-IN	7
8 WEEK 7	9 HW DUE, NOON	10 (19)	11	12 (20)	13 (21) RETAKE DAY	14
15 WEEK 8	16 FALL RECESS	17 FALL RECESS	18 HW DUE, NOON	19 (22)	20 (23) DISCOVERY CHECK-IN	21
22 WEEK 9	23 HW DUE, NOON	24 (24)	25	26 (25)	27 (26)	28
29 WEEK 10	30 HW DUE, NOON	31 (27)	Nov 1	2 (28)	3 (29) DISCOVERY CHECK-IN	4
5 WEEK 11	6 HW DUE, NOON	7 (30)	8	9 (31)	10 (32)	11
12 WEEK 12	13 HW DUE, NOON	14 (33)	15	16 (34)	17 (35) DISCOVERY CHECK-IN	18
19 WEEK 13	20 HW DUE, NOON	21 (36)	22	23 THANKSGIVING	24	25
26 WEEK 14	27	28 (37) RETAKE DAY	29	30 (38)	DEC 1 (39)	2
3 WEEK 15	4 HW DUE, NOON	5 (40) LAST DAY OF CLASS	6	7 READING DAY	8 READING DAY	9
10	11 FINAL CHECK-IN (2-5 PM)	12	13	14	15	16

Schedule (Subject to Change)

Week	(Class) Date	Unit/Topic	Atoms 1st Assigned Reading*
Unit 1: What is Chemistry?			
1	(1) 8/29	Introduction to Discovering Chemistry	1.2, 1.3
1	(2) 8/31	What is Matter?	1.1, 1.2, 1.3, 2.3, 3.6
1	(3) 9/1	Discovery Lab 1: Measurements	1.4, 1.5
2	(4) 9/5	What is a Mole?	2.4, 6.1
2	(5) 9/7	What is a Chemical Reaction?	7.1, 7.3
2	(6) 9/8	Discovery Check-In #1 Discovery Lab 2: Solutions and Concentrations	TBD
Unit 2: Climate Change-What's CO₂ and Why is it Bad?			
3	(7) 9/12	Context definition: Climate Change Electronic Structure of Atoms	3.3, 3.4
3	(8) 9/14	Periodic Variations in Element Properties The Periodic Table Ionic and Molecular Compounds	3.5, 3.6, 3.7
3	(9) 9/15	Discovery Lab 3: Color of Salt Solutions	TBD
4	(10) 9/19	Ionic Bonding Covalent Bonding Chemical Nomenclature	4.1, 4.2, 4.3
4	(11) 9/21	Lewis Structures Formal Charge & Resonance Molecular Structure (VSEPR Theory)	4.4, 4.5, 4.6
4	(12) 9/22	Discovery Check-In #2 Discovery Lab 4: Thin Layer Chromatography	TBD
5	(13) 9/26	Valence Bond Theory (s and p bonds) Dipole Moments Hybrid Atomic Orbitals	5.1, 5.2
5	(14) 9/28	Multiple Bonds Molecular Orbital Theory	5.3, 5.4

5	(15) 9/29	Discovery Lab 5: Computational Investigation of CO₂ (Vibrational Frequencies & IR Spectroscopy)	TBD
Unit 3: Water (Ocean Acidification)			
6	(16) 10/3	What are acid-base reactions?	7.1, 7.2, 14.1
6	(17) 10/5	How far will a reaction go?	13.1-13.3
6	(18) 10/6	Discovery Check-In #3 Discovery Lab 6: Working with acids and bases	13.1-13.3
7	(19) 10/10	How far will an acid-base reaction go?	14.1-14.3
7	(20) 10/12	How do we think about acid-base reactions?	14.1-14.3
7	(21) 10/13	Discovery Lab 7: CHECK-IN RETAKES	
8	10/17	Fall Recess	
8	(22) 10/19	What makes an acid strong or weak?	14.3
8	(23) 10/20	Discovery Check-In #4 Discovery Lab 8: Acid-Base Titrations	14.7
9	(24) 10/24	What is a buffer?	14.6
Unit 4: Water (Clean Drinking Water)			
9	(25) 10/26	Context definition: Clean Drinking Water (Pb and other metals) Identify acid/base, Precipitation, complexation in chemical reactions Predict reaction products, write balanced net ionic equations perform reaction stoichiometry	15.1
9	(26) 10/27	Discovery Lab 9: Synthesis of Aspirin	TBD
10	(27) 10/31	Revisit the equilibrium state	15.2, 15.3
Unit 5: Energy (Combustion)			

10	(28) 11/2	What kind of reaction is combustion?	7.2
10	(29) 11/3	Discovery Check-In #5 Discovery Lab 10: Gases	8.1 (skim), 8.2
11	(30) 11/7	What is energy?	8.5, 9.1
11	(31) 11/9	What is enthalpy?	9.2-9.3
11	(32) 11/10	Discovery Lab 11: Spectroscopy	TBD
12	(33) 11/14	What is entropy?	12.1-12.4
12	(34) 11/16	When is a reaction spontaneous?	12.4
12	(35) 11/17	Discovery Check-In #6 Discovery Lab 12: Research	
13	(36) 11/21	Wrapping up combustion unit	12.1-12.4
13	11/23	Thanksgiving Recess	
13	11/24	Thanksgiving Recess	
14	(37) 11/28	CHECK-IN RETAKES	
14	(38) 11/30	Averages and Standard Deviation	TBD
14	(39) 12/1	Discovery Lab 13: How much copper in a penny?	TBD
15	(40) 12/5	Last day of class	TBD
16	12/11	FINAL CHECK-IN	

*Assigned reading indicates book chapter (sections) that should be read prior to that day's class.