

# Stoichiometric Calculations

Chem 170

S2018

## Course Description

Chem 170 provides a review of the basic stoichiometric calculations of importance to chemists. Among the topics you will cover are significant figures and dimensional analysis, the mole and molar mass, empirical formulas, balancing chemical reactions, gram-to-mole conversions, limiting reagents, theoretical yields and working with gaseous and aqueous species. This material is equivalent to approximately 2-3 weeks of a traditional first-semester introductory course in general chemistry as offered at other colleges and universities. Chem 170 is a pre-requisite for Chem 260 (Thermodynamics, Equilibria, and Kinetics) and a pre- or co-requisite for Chem 240 (Structure and Function of Biomolecules).

## Required Materials

All course materials are provided to you from the course's web page (see the Department of Chemistry and Biochemistry website). You also will need access to a calculator that can handle scientific notation.

## Personalized System of Instruction

This course is a hybrid of a normal lecture course and a Personalized System of Instruction. While we will have regularly scheduled class meetings, Chem 170 also uses a "personalized system of instruction," or PSI. In a traditional course, class time consists of lectures and discussions with all students progressing through the material at the same pace. In a PSI course, however, there are usually no class meetings. Instead, the course consists of a series of modules that you complete at a pace that best meets your needs. You may complete the course in as few as 3 or 4 weeks, or you may need to spread the work across the entire semester. In this course, you will be able to move through the course material at a pace that is good for you, but you will be required to attend class regularly.

Another key feature of a PSI course is a focus on mastering a limited number of well-defined objectives. To this end, each module consists of the following:

- a list of objectives to be mastered
- a study guide providing a discussion of the objectives
- worked examples illustrating each objective
- practice problems for evaluating your understanding of each objective

To demonstrate mastery in a PSI course you must pass an exam at the end of each module.

There is no penalty for failing a module exam other than the need for additional study of the module's material before retaking the exam. You must pass a module's exam before proceeding to the next module.

The term "mastery," as it applies to a PSI course, deserves additional elaboration. In a traditional course, mastery of the course's basic content usually equates to a grade of C+ or B-. Extending your understanding of the course's basic content by applying it to new areas or to new problems generally leads to a higher grade. In a PSI course, however, the emphasis is on thoroughly mastering a limited number of essential concepts that all students are expected to solve routinely, correctly and with ease. Questions on Chem 170 exams will never ask you to apply your knowledge to completely new situations. If you truly master these concepts, therefore, you should expect to receive a grade of A on the midterm and final exams.

### **Implementing a PSI in Chem 170**

The material in Chem 170 is divided into eight modules, the topics of which are listed here:

1. Units, Scientific Notation, Significant Figures, and Dimensional Analysis
2. Atoms, Molecules, and Moles
3. Characterizing Molecules Using Mass Percents and Empirical Formulas
4. Balancing Chemical Reactions
5. Stoichiometric Calculations Using Balanced Chemical Reactions
6. Limiting Reagents, Theoretical Yields, and Percent Yields
7. Including Liquids and Solutions in Stoichiometric Calculations
8. Including Gases in Stoichiometric Calculations

Begin with Module 1 and carefully read the written material, paying particular attention to the module's objectives. Study the worked examples with the goal of understanding each step in the provided solutions. Next, work through the practice problems, checking your answers with those provided at the end of the module. When you come to class you can get questions answered about parts of the module you don't understand or problems you are having trouble answering correctly. I will typically review topics that I know students are likely to struggle with, and we can do practice problems together. If you don't have any questions you can take a module exam.

Attendance is required at each class session. You will either get help, work on practice problems, or take a module exam. Students have a variety of backgrounds coming into the class. Some may need help with all topics because they either didn't see it before, didn't learn it well in high school, or simply did it so long ago they have forgotten most of it. Others may remember most of these topics from high school and can move through the modules quickly. In this course everyone can move through the modules at the pace that is best for them with the following limitations: everyone must pass the first four module exams and take the midterm exam by Friday, March 9th and everyone must pass the module 8 exam by Wednesday, May 9th. The first of these deadlines is the more challenging to meet. The good news is that you can complete both the midterm and final as early as you want, and when you complete the final you no longer have to come to class.

## **Module Exams**

Each module exam has eight questions that will test your understanding of the module's objectives. You must complete the module exam during class time, but it is likely the exam will take significantly less than the full hour. Nevertheless, you must begin the exam within the first 15 minutes of class to make sure you complete it before class ends.

To demonstrate mastery you must correctly answer all problems on the exam. Correct use of significant figures is checked on every problem on every exam. Your exam will be graded as soon as possible upon completion and always before the next class. If you don't get every question perfectly correct we will review the exam during the next class and you can try again or practice more before taking it later. If you pass the exam, then you are free to move to the next module. For reasons of confidentiality, module exams cannot be returned.

No one likes to fail an exam. It is normal, however, in a PSI course for students to fail one or more module exams. Because the goal of this course is to master the material, such that solving stoichiometry problems becomes routine, there is no penalty for failing a module exam. The number of module exams failed does not affect your final grade.

You should not look at taking the module exams the same way as taking an exam in other classes, where a grade is riding on your ability to answer problems. Instead, think of it as testing yourself and your ability to do the material. Take advantage of these exams. If you do well on the module exams chances are good that your scores on the midterm and final exams will be high.

Modules 1-4 must be completed before the Midterm exam, and all eight modules must be completed before taking the final.

## **Midterm Exam**

Your grade on the midterm exam will count for 33% of your final grade. The midterm exam consists of 16 questions and covers modules 1 – 4. When ready, schedule an appointment for the exam, reserving two hours (although you probably will need less time). If you do not take the midterm exam by the March 9th deadline, you will receive a zero for the midterm and a grade of F in the course. In this case we recommend you withdraw from the course. Please keep in mind that if you are enrolled in 3.0 credits, withdrawing from the course may have implications for financial support and insurance coverage.

## **Final Exam**

Your grade on the final exam will count for 67% of your final grade. The cumulative final exam for this course may be taken anytime after you successfully complete the last module, but you must complete it by the last day of final exams. The final exam has 16 problems; it covers all eight modules but is weighted toward modules 5 – 8. When ready, schedule an appointment to take the final exam, reserving two hours to complete the exam (again, you probably will not need the full time).

## Grading

The following scale determines your grade for this class:

| Score = $\frac{1}{3} \times \text{Midterm Exam} + \frac{2}{3} \times \text{Final Exam}$ | Grade |
|---|-------|
| 100 – 93  | A     |
| 92 – 90   | A-    |
| 89 - 87   | B+    |
| 86 – 83   | B     |
| 82 – 80   | B-    |
| 79 – 77   | C+    |
| 76 – 73   | C     |
| 72 – 70   | C-    |
| 69 – 60   | D     |
| 59 and below  | F     |

Failing to complete the eight modules will result in a grade of F.

## How Do I Get Help?

Of course you can get help during class. If you are having trouble with something that requires more help, you have plenty of opportunity to get it.

- *Instructor:* Ask your instructor when you can get help outside of class time. In addition, you may contact the instructor by email with questions.
- *Q-Center:* The Q-center is a valuable resource for any chemistry course at DePauw. The Q-center is located in Room 115, Asbury. Once the semester is started they make regular tutoring available (see their web site for the schedule). You can also drop by the Q-center for assistance without an appointment.
- *Other Students:* Talk with your classmates or with other students who have already completed Chem 170.

## Calculators/cell phones

We require the use of a calculator that can handle scientific notation. If you plan to continue studying science, this is an appropriate time to invest in a good scientific calculator. Smartphones may not be used as calculators or clocks for the exams, must be left in your backpack and cannot be used in any way during a module exam, midterm or final.

## **Academic Honesty**

The majority of DePauw students are honest, hard-working students. Unfortunately, academic dishonesty does occur. Academic dishonesty serves no educational function and it undermines science more generally. Scientific progress occurs only when ideas, experiments, and results are shared among the scientific community. This process depends absolutely on honesty and trust among scientists. We should be modeling such scientific and academic integrity whenever we are engaged in scientific pursuits. Academic dishonesty is prosecuted at DePauw; the policy stipulates that the penalty should always be worse than not completing or failing the assignment. If you are caught cheating you will fail the course. Since the majority of your grade depends on only two exams, if you are caught cheating on either the midterm or final exam in Chem 170, you will fail this class. If you need further clarification about what constitutes academic dishonesty, please ask your instructor. If you suspect that any another student is engaging in dishonest activities in this class, you should report it to your instructor.

## **Disability Services**

It is the policy and practice of DePauw University to provide reasonable accommodations for students with properly documented disabilities. Written notification from Student Disability Services is required. If you are eligible to receive an accommodation and would like to request it for this course, please contact Student Disability Services. Allow one week advance notice to ensure enough time for reasonable accommodations to be made. Otherwise, it is not guaranteed that the accommodation can be provided on a timely basis. Accommodations are not retroactive. Students who have questions about Student Disability Services or who have, or think they may have, a disability (psychiatric, attentional, learning, vision, hearing, physical, medical, etc.) are invited to contact Student Disability Services (Union Building, Suite 200 or by phone at 765-658-6267) for a confidential discussion.

## **Incompletes**

University policy dictates that a grade of incomplete may not be given for failing to complete work on time because of inadequate planning, or to extend time for improving a grade. An incomplete grade can be given only for extenuating circumstances, such as an extended illness. In most circumstances, therefore, failing to complete all eight modules will result in a grade of F for the course. You may re-enroll in the course in a subsequent semester and pick-up where you left off rather than repeating previously completed modules if you so choose. Upon successfully completing the course, the new grade will be used in calculating your GPA, although the original grade will remain on your transcript. Please keep in mind that University policies only allow you to repeat a course once, and that second grade is always the one that counts towards your GPA.

Now that you have read the syllabus, you should have a strong handle on how to succeed in this course. If you e-mail your professor with the subject line "Chem 170 Bonus Point" by 5:00 pm of the second- Friday of the semester, you will receive an extra point on the midterm test. What a great offer!