

# CHEMISTRY 103 - GENERAL CHEMISTRY

## Calvin College

*“Whoever can be trusted with very little can also be trusted with much....”* Luke 16:10a

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Office hours: MTWF 9:00-9:50, W 12:30-2:30 or by appointment *please do not hesitate to ask.*

*Text: Chemistry: a Molecular Approach* by Tro

*Online homework:* Mastering Chemistry can be accessed via the url:

<http://www.masteringchemistry.com/site?login=1>

NOTE: if you buy a used textbook be sure to also buy an access code for Mastering Chemistry. This can be done at the same website.

*Clicker:* you will need to buy a CPS clicker for class (if you don't already have one)  
Bring your clicker and a calculator to class everyday.

*Co-requisite:* CHEM 103L (laboratory).

*Lab supplies:* you will need to buy goggles, a composition book, and a lab manual

NOTE: lab does not start until the second week of classes.

We will cover roughly the first half of the book: **Chapters 1-11**. It's my first time with this book, so I'm not sure how long each chapter will take. Given that the semester is 14 weeks long minus breaks for Thanksgiving and advising, I can promise that we'll *average* about one chapter per week.

*Grading:*

The graded aspects of the course (and their weights) are:

- Online homework (10%) – weekly due on Fridays (except exam weeks)
- In-class clicker questions\* (10%) – every class day
- In-class quizzes (10%) – every Wednesday that we don't have an exam
- Laboratory (10%)
- Two cumulative midterm exams (20% each)
- Final cumulative exam (20%)

A	93-100%	B-	80-82%	D+	67-69%
A-	90-92%	C+	77-79%	D	63-66%
B+	87-89%	C	73-76%	D-	60-62%
B	83-86%	C-	70-72%	F	0-59%

*\*Clicker Questions:* During class, multiple choice questions will be displayed. Using your clicker, you will answer the questions. Starting next week, if you get 80 (approx. two-thirds) of the questions correct over the course of the semester, then you will get full credit for the clicker questions. Anything lower than 80 and you get a “clicker grade” based on the percentage of 80 that you did get correct.

*Exam schedule:*

- Cumulative midterm #1 Oct. 7 during class time
- Cumulative midterm #2 Nov. 11 during class time
- Cumulative final exam Dec. 17 (section C) or Dec. 18 (section D), 9:00 in the classroom

You may not take the final examination with another section without permission from the instructor. You should not attempt to shorten the examination period for any reason (e.g., flying home a day early).

*No class:* Oct. 27, 28 (advising) or Nov 22 (Thanksgiving).

*How to register your clicker (CPS RF response pad)*

1. Buy the clicker from the bookstore – this is actually cheaper than using a friend’s old clicker since you won’t have to pay for a new access code.
2. Go into the KnightVision course(s) in which you will be using the clicker.
3. Click on **Tools > CPS Connection**
4. Click on **Register Your Clicker or update serial number**.
5. Provide necessary information to complete your registration process.

**Note:** Do not register your clicker through eInstruction or CPSonline. All registration should be handled in KnightVision, as Calvin has already paid for your access code.

*How to access the online homework (Mastering Chemistry)*

1. Go to <http://www.masteringchemistry.com/>
2. To register, click on New Students and follow instructions
3. Use the access code that came with your textbook to set up your unique Login Name and Password.
4. Remember your Login Name and Password or write it in a safe place! If you do not have an access code, you will need to purchase one online.
5. Once you are registered with Mastering Chemistry, you need to assign your registration to this course.
  - a. Student ID. If you are prompted for a Student ID, enter your Calvin College Student ID number.
  - b. Course ID. Enter **CHEM103FALL09FYNEWEVER1030**. This should be entered with no spaces and just as written here. Be careful not to make a mistake in typing this, as it will be difficult to change later.

*How to pass the class:*

1. Work regularly (daily is better than weekly) on the homework. Go ahead and try it (even before reading the book if you feeling adventurous!)

2. Try the homework again. Read the book for hints. Use the computer for hints. But then be honest with yourself – could you have answered correctly without the hints? Remember, on exams the hints won't be there.
3. Prepare for exams by working homework again and/or working extra (odd numbered) problems available in your text. Pretend that you're taking the quiz/exam. Can you do it without the hints?
4. Get enough sleep the night before the exam. Cramming doesn't work for chemistry. You have to study regularly. You have little hope of getting it all down in one night.

*Not showing up for an exam or quiz will result in a zero for the exam or quiz. If you know you will have a conflict, let me know ahead of time and we can arrange for an alternate time. Letting me know afterwards is not allowed except in the case of unexpected, serious events (e.g. severe illness or accident). These serious events require documentation (e.g. doctor's note or police report).*

**Chem 103R:** Chem 103R is a chemistry regular study session led by a professor. It is a time to work together with your classmates and the instructor on any problems you have. The commitment is your attendance – Chem 103R does not require any additional work. You stay in your present Chem 103 class section, and add Chem 103R to your schedule. You receive one hour of course credit for Chem 103R. The recitation meets M & W (Dr. Sinniah) or T & Th (Dr. Fynewever) 5:00-5:50 in SB302 – come check it out.

**Advanced Placement:** Scores on Advanced Placement Tests are treated as follows:

Score of 5: Credit for both Chem 103 and Chem 104

Score of 4: Credit for Chem 103 only

**Credit/Exemption test:** offered Wednesday, September 9 4:00 p.m., SB 301

If you have a strong background in science and chemistry (two or three years of High School Chemistry or an AP Chemistry score of 3 with four years of HS math and HS physics), you may wish to consider the Chemistry 103/4 Exemption/Credit exam. By doing well on this test you will either receive exemption or credit for one or both of these courses. An exemption means that you do not have to take the course whereas credit means that the course will appear in your transcript with a grade. You can see your score before you have to decide on exemption versus credit. If you receive exemption or credit for Chemistry 103, you can drop Chemistry 103 and still enroll in another course. A fee will be charged to your tuition account for taking either credit or exemption, but not for taking the test itself.

*Feedback mechanisms to students: how do you know if you are doing well in the course?*

Immediate:

1. *Online homework:* have you submitted and resubmitted the homework until it is mastered (a perfect score)? These problems were chosen because they match the course objectives.
2. *Clicker questions and think-pair-share discussions:* During a given class period we will have about three clicker questions. Often these questions will be followed

by a discussion with your nearest neighbor. Are you doing well on these questions? Can you explain your thinking clearly to your neighbor?

Less immediate:

1. *Self-reflection*: look over the list of learning objectives for the chapter that we are studying. Are you confident that you are proficient at these objectives? Your confidence is a good (but not perfect) predictor of your achievement
2. *Written quizzes and exams*: We will have regularly scheduled quizzes (every Wednesday) and exams. Although you will not receive these back until the next class period, be sure that you take time to reflect on the feedback given about whether you are mastering the course objectives. This reflection makes a summative evaluation serve a formative assessment purpose.

*Feedback mechanisms to instructor: how will I know if my teaching is helping you reach the learning objectives?*

Immediate

1. *Clicker questions*: After you answer the clicker questions, we will see a histogram displaying what percentage of students made each choice. If there's clearly disagreement, then I'll know that we need to spend more time on this topic.
2. *Think-pair-share and small group discussions*: While you are talking with your neighbor or in small groups I will circulate amongst the class and "spy" on you. If it sounds like there's a lot of divergent ideas or uncertainty, then we will discuss your thoughts together as a class.

Less immediate

1. *Minute papers*: Sometimes at the end of class I will pass out an index card. On the card you should write the most important thing you learned today and the muddiest point that remains. I will read these and we will discuss any commonly held misconceptions to begin the next class.
2. *Homework and written work*: I will carefully examine how the class is doing on the online homework and on quizzes and exams. Any frequently held misconceptions will be addressed in class and in subsequent assignments.

**College Academic Integrity Statement**

The student-faculty relationship is based on trust and mutual respect, which can be seriously undermined by the suspicion or reality of academic dishonesty. Academic Dishonesty includes, but is not limited to, plagiarism (students plagiarize when they do not credit the sources of their writing – the words, information, ideas, or opinions of others), improper group work, reuse of a paper from another course, and/or cheating on a test. Students are encouraged to speak to their faculty member with specific questions related to academic dishonesty.

## Specific Learning Outcomes by chapter with corresponding example problems

*Chapter 1:* The student will be able to...

- given written or graphic descriptions, distinguish between pure substances (compounds or elements) and mixtures (homogeneous or heterogeneous) (1.37, 1.41)
- distinguish between physical and chemical properties and physical and chemical changes (1.43, 1.47, 1.49)
- convert between temperature scales (1.51)
- use scientific notation (1.55, 1.57)
- use mass and volume data to calculate density or vice versa (1.61, 1.63)
- read graduated instruments to the correct number of significant figures (1.67)
- identify how many significant figures are in a number and use the correct number of significant figures when calculating (1.71, 1.77, 1.79)
- perform all sorts of unit conversions (1.83, 1.89)

*Chapter 2:* The student will be able to...

- recount the features of the modern atomic model and its connection to the experiments that provide evidence for it (2.43, 2.49)
- use isotope symbols to determine number of neutrons, protons, and electrons or vice versa (2.55, 2.63)
- use isotope masses and fractional abundances to sketch mass spectrum and to calculate atomic mass or vice versa (2.73, 2.78)
- convert between mass, moles, and number of things (2.79, 2.81, 2.85)

*Chapter 3:* The student will be able to...

- determine number of each type of atom from a molecular formula or model (3.23, 3.73)
- classify elements as naturally atomic or molecular (3.27, 3.31)
- classify compounds as ionic or molecular (3.29, 3.31)
- given elements or polyatomic ions, predict ionic compounds likely to form (3.33, 3.35)
- given formulas, write the names of ionic and molecular compounds or vice versa – including hydrated compounds and acids (3.37, 3.39, 3.43, 3.45, 3.47, 3.49, 3.53, 3.55)
- given a formula, calculate the molar mass of a compound (3.57) or the molecular mass (3.61)
- given a sample mass of a certain compound, find the mass of elements within that compound (3.75, 3.77)
- find empirical formula from mass percent or mass data or combustion analysis (3.81, 3.83, 3.89)
- find molecular formula from empirical formula and molar mass (3.87)
- write and balance chemical equations from written descriptions (3.97, 3.99)

*Chapter 4:* The student will be able to...

- balance an unbalanced equation (4.25)
- use a balanced equation to find moles of one reactant or product given the moles of another reactant or product (4.29)
- use a balanced equation to find grams of one reactant or product given the grams of another reactant or product (4.33)
- given molecular diagrams, identify limiting reactants and amount of product to be produced (4.39, 4.99, 4.121)
- given balanced reaction and amount of reactant find limiting reactant and theoretical yield. Also, when given actual yield find percent yield. (4.45)
- determine mass needed of a substance to produce a known molarity solution of a known volume or vice versa (4.53)
- work with a dilution of a solution to determine the volume or molarity of the initial or the final solution given all but one quantity (4.57)
- do stoichiometry calculations using molarity (4.61)
- use the solubility rules to predict ions present in solution (4.65)
- complete and balance precipitation reactions (4.67, 4.71), acid base reactions (4.77) and gas forming reactions (4.81)
- given a reaction, write balanced complete and net ionic equations (4.71)
- use titration data to calculate the concentration of an unknown acid or base (4.79)
- use density data to calculate percent by mass or vice versa (4.91)
- complete combustion reactions given hydrocarbon fuel (4.95)
- using precipitation data, determine what ions are present in a contaminated aqueous solution (4.111)

*Chapter 5:* The student will be able to...

- use  $PV=nRT$  to find one variable when given the others (5.41, 5.43)
- use  $PV=nRT$  in a situation where two variables change with the others constant, e.g.  $P_1V_1=P_2V_2$  (5.45, 5.49, 5.52)
- find density of a gas given temperature and pressure or find pressure given density and temperature (5.55)
- given mass, volume, pressure, and temperature; find the molar mass of a gas (5.57)
- find partial pressures and total pressures for a gas mixture given initial conditions before mixing (5.63)
- given temperature, pressure, volume and Table 5.4 (water vapor pressure dependence on temperature on page 209 in your text) find mass or moles of gas collected over water (5.67)
- given a balanced equation, P and T data find V of gas given mass or vice versa for a reactant or product in a reaction (5.71, 5.73, 5.101, 5.103)
- use kinetic molecular theory to compare the kinetic energy, velocity, pressure, and rates of effusion/diffusion of gases (5.79, 5.133)

- given two gases calculate effusion time of one given the effusion time of the other or calculate the mass of one given the mass of the other and the effusion times of both (5.85)
- interpret velocity distributions of two gases or a gas at two temperature (5.87, 5.88)
- given gas identity, predict which would be the least ideal based on size or strength of interactions (5.134)

*Chapter 6: the student will be able to . . .*

- use mass, heat capacity, and change in T to calculate heat or vice versa (6.45, 6.48)
- determine whether a described process is endo- or exothermic and predict the sign of delta H (6.55)
- given a reaction and its delta  $H_{\text{rxn}}$ , find the delta H for a given mass of a reactant or product (6.57, 6.96)
- find a delta  $H_{\text{rxn}}$  from data on mass, temperature change, and the specific heat of water for an aqueous reaction (6.65)
- use Hess' Law to find delta  $H_{\text{rxn}}$  from other reaction enthalpies or enthalpies of formation (6.67, 6.69, 6.77, 6.73, 6.96)
- find final temperature for a thermal equilibration of two substances involving a phase change (6.91, 6.107) or not (6.93)

*Chapter 7: the student will be able to ...*

- calculate wavelength given frequency or vice versa (7.41)
- calculate energy of a photon or a mole of photons given wavelength or frequency (7.47) or vice versa (7.71)
- use rules of quantum numbers to determine which orbitals or quantum number combinations are possible (7.57, 7.59, 7.79)
- use the quantum mechanical model for the hydrogen atom to compare transitions to predict which would have the longer wavelength (or lower frequency or lower energy) (7.65)