“I do not know what I may appear to the world; but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.”

-Sir Isaac Newton, President of the Royal Society

“I would... establish the conviction that Chemistry, as an independent science, offers one of the most powerful means towards the attainment of a higher mental cultivation; that the study of Chemistry is profitable, not only inasmuch as it promotes the material interests of mankind, but also because it furnishes us with insight into those wonders of creation which immediately surround us, and with which our existence, life, and development, are most closely connected.”

-Justus von Liebig, German Chemist, “founder” of Organic Chemistry

A bit about the course
Chemistry is all around us. It defines our lives. Regardless of your life interests, regardless of your major or career, chemistry is at the heart of everything you do and everything that happens to you. In this course we will look at a number of chemical principles that shape the world around us. We’ll investigate reaction rates and equilibrium that defines the stability of a compound in the environment. We’ll look at acids, bases, and the coordination chemistry of metals which has been so important to the recent lead poisoning crisis in Flint Michigan. We may even spend a bit of time talking about nuclear chemistry, a topic that never seems to diminish in its importance as part of energy science and politics. We’ll use recent events where applicable: examples of how chemistry really does impact us on a routine basis. If Chem 111 is about providing basic chemistry tools, Chem 112 is your first building project putting those tools to use!

Resources to help you at every step
In the past, I taught this class – all my classes – as a straightforward lecture class. It looked something like this:

You come to class and sit down while I get up and talk for 50 minutes, sometimes lecturing on concepts and sometimes doing some practice problems. You might absorb some of the material, but you might not. You would do some handwritten homework during the week, and another undergraduate student would grade a small fraction of it for which you would get some points … or not. Any feedback on homework would come a week later and it would be minimal at best. You might come to see me to get a bit of help, but it was unlikely. Mainly, you were left to your own study skills – hopefully already developed - to help you learn because we didn’t teach them.
Sounds great, right?!! It worked. Sometimes. Sort of. But the number of students who were unsuccessful was large… very large.

And then… I tried something different, something radical. Well, radical for me. I had read some papers on active learning, and thought I might try to teach my general chemistry courses in a different way. After applying these techniques to Chem 111 with success, I am now employing them in Chem 112.

We will succeed or fail together. If you fail, I fail. And when you succeed, I will have succeeded.

We are a team, and neither you nor I can do it alone. Therefore, it is with great hope that I am providing you with several resources to augment your learning experience and to help you be successful:

1. **Me.** As always, I am your number one resource. I will have office hours each week, and if those don’t match your schedule, you can make an appointment to see me to discuss any aspect of the course or any difficulties you may be having. PLEASE – do come see me with anything!

2. **Videos.** I will be making videos for you to watch that cover the course content. In other words – I’m giving you me – with a pause button! 😊 Each video will be titled and have learning objectives associated with it. Ungraded quizzes will be embedded into the videos for you to assess your own understanding of the material, and in the event that you need to, you can go back and re-watch the videos as many times as you want. I would suggest that completely watching the video twice is a good habit to get into. But make sure to take notes on everything!!! Each video will suggest reading associated with it to enrich your experience.

3. **Class.** Watching videos is good, but it does not mean you can skip class! In class I will work to emphasize all the nuances of the chemistry we are covering. We will go over all the details to make sure your understanding is complete and ready for the exams. We will use active learning techniques to engage you and deepen your understanding. We will do some problems to point out common pitfalls and to help you start to predict other kinds of questions you may see. Just because class won’t be a standard lecture doesn’t mean you don’t have to be there. Show up, participate, and take notes in order to get the most out of the experience!

4. **Near Peers.** To help us in our effort, I have asked 2-4 Near Peers to help us during class. These are undergraduate students who have recently completed the course quite successfully, and I have hand-picked each one to be your guides. Lean on them to help you! Since I can’t be everywhere at all times in class when we are doing certain activities, these are my team members that I trust to help me.

5. **Supplemental Instruction.** Supplemental Instruction (SI) is offered for this course. SI sessions are group study opportunities led by an SI Leader who has recently completed the course successfully. The SI Leaders will attend class, help out with the active learning (just like the Near Peers) and prepare SI sessions based on class content. You can attend SI sessions to ask questions about content and develop learning strategies. SI is not intended as a substitute for going to class! SI attendance is voluntary and anonymous; I don’t get to know who goes and who does not! Therefore, SI will not provide points toward your grade. However, students who attend SI learn new study strategies and problem solving skills that typically result in better exam scores and higher final grades than those that don’t attend.

6. **Textbook.** The textbook is an essential resource. Read it. Read it three times! No, really, I mean three times! Read it once before we cover the material in class (preview), once after we cover it (filling in knowledge gaps), and once right before the exam (reminder for studying). Take notes on what you read. The more you put into your own words, the more you will recognize what you have learned – and what to study next!
7. **Online Homework.** You will have online homework through Sapling Learning. A lot of it. *Please do not procrastinate!* Chem 112 has a lot of math in it, and there is simply no substitute for solving problems. This is your primary means to get that practice, so really, this is important! Most importantly, when you get something incorrect – and you will because that’s simply part of the learning process – Sapling gives you feedback right away. And of course you can always come ask me questions too!

8. **Each other.** Yup – your classmates are a resource. Remember, this is a “team effort”. Don’t hesitate to ask your classmates for help. Now, that doesn’t mean you should plagiarize. All work should be your own; you should never take credit for someone else’s work. But talking about concepts and how to generically solve certain kinds of problems is highly encouraged!

**How you and I will know how you are doing**

Along the way it will be important that you and I both know how well you are understanding the material. Throughout the course you will have opportunities to engage in critical thinking, problem solving, and maybe even some personal reflection. The end goal, remember, is to guide you through the learning process and help you see progress in your understanding of chemistry.

**In class engagement.** A critical part of the course is your engagement in class. Memorizing material is easy. Really learning it takes effort, and lots of it. You will struggle at times this semester – even with all the resources we are providing for you. But you aren’t doing it alone! The more you engage with the material, the easier it will be to learn, and the easier it will be for me to help you. Take part in our activities. Read the textbook ahead of time so that you are aware of what is coming. Watch the videos on time so that you can participate fully in class and in so doing develop the deep chemistry knowledge necessary to do really well. In class we’ll use some peer review techniques, I’ll have you do some board work in front of the class, and we’ll probably use many other activities to assess your growth.

**Homework.** Do your homework on time – don’t procrastinate. Use the problems not only as practice for the exam, but also for checking your own understanding. If a problem doesn’t make sense, come ask questions, because it likely means there is a gap in your comprehension of the underlying conceptual material. I’ll be looking at your overall homework scores and individual responses to certain questions to tell me how much you are succeeding or struggling.

**Quizzes.** Although I won’t grade the video quizzes, I will be watching to see your scores. I do this to help me see how well you are doing, and where you and the class may be having difficulties. In addition to the quizzes in the videos, I will present you with some informal (ungraded) quizzes in class, again just to keep an eye on your progress.

**Labs.** Chemistry is a hands-on discipline. That’s why we have you do labs. But don’t just *do* the lab; don’t just finish it. Labs are also a learning experience, putting into practice the topics and concepts we cover in the videos and in class. Use them as an opportunity to really test your chemistry comprehension! Your lab instructors will help keep me up to date on your progress. And who knows, you may even see me in the lab from time to time! 😊

**Exams.** There will be four exams which are designed to assess the content knowledge and skills you have developed through the course. They are your opportunity to show me – and more importantly to show yourself - how much you’ve learned.

**How I’ll determine your grade**

Of course, part of my job is assigning you a grade that you have earned. By staying engaged, that grade will likely be much higher than if you dissociate yourself from class. Grades will be determined by your scores in a combination of areas consisting of lab work, online homework, exams, and the final exam. I
reserve the right to modify the following rubric should the need arise. (This is almost always in the favor of the student!) Please note that passing grades in both the lecture and the lab are required to pass the class.

The *approximate* point breakdown is as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory (225 pts)</td>
<td>100-85%</td>
<td>A</td>
</tr>
<tr>
<td>Homework (120 pts)</td>
<td>84-70%</td>
<td>B</td>
</tr>
<tr>
<td>Four hourly exams (100 pts *4 exams)</td>
<td>69-55%</td>
<td>C</td>
</tr>
<tr>
<td>Final (250 pts)</td>
<td>54-45%</td>
<td>D</td>
</tr>
<tr>
<td><strong>Total Course Points (995 pts)</strong></td>
<td>&lt;45%</td>
<td>F</td>
</tr>
</tbody>
</table>

**What you will need for the course**

**Texts:** Chemistry, 7th Ed., McMurry & Fay  
Laboratory Experiments, 13th Ed., Nelson, Kemp

**Supplies:** Safety Glasses or Goggles (required)  
Lock (required)  
Chemical Tables packet (required and available from SAACS, PhSc 309)  
Molecular Model Kit (optional)

**Homework:** Sapling Learning Account

**Online:** Access to videos – see me if you are unsure about how to do this

**What you’ll be doing**

The following table is an approximate listing for the dates we will be covering certain topics. In some cases, prudence may dictate pushing the topics back a bit. Additionally, I have given you a listing of the labs we will be doing by week. Exam dates are below the table. Homework due dates will be published in class and will be documented through Sapling Learning as well.

<table>
<thead>
<tr>
<th>Week</th>
<th>Week of</th>
<th>Lecture/Chapter Topics</th>
<th>Laboratory: Experiments &amp; Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan. 23</td>
<td>C13: Chemical Kinetics</td>
<td>Check In; EX1: Factors that Affect Reaction Rates (<em>handout</em>)</td>
</tr>
<tr>
<td>2</td>
<td>Jan. 30</td>
<td>C13: Rate Laws</td>
<td>E30: Rate and Order of H2O2 Decomposition</td>
</tr>
<tr>
<td>3</td>
<td>Feb. 6</td>
<td>C14: Chemical Equilibrium</td>
<td>E22: Colorimetric Determination of K of an Aqueous Solution</td>
</tr>
<tr>
<td>5</td>
<td>Feb. 20</td>
<td>C15 &amp; C16: Applications of Aqueous Equilibria</td>
<td>E25: Determination of a Dissociation Constant of a Weak Acid, Parts A &amp; B</td>
</tr>
<tr>
<td>6</td>
<td>Feb. 27</td>
<td>C16: Titration</td>
<td>E25: Determination of a Dissociation Constant of a Weak Acid, Part C</td>
</tr>
<tr>
<td>7</td>
<td>Mar. 6</td>
<td>C16: Solubility</td>
<td>E24: Hydrolysis of Salts &amp; pH of a Buffer Solution</td>
</tr>
<tr>
<td>13</td>
<td>Mar. 13</td>
<td>Spring Break</td>
<td>Spring Break</td>
</tr>
<tr>
<td>8</td>
<td>Mar. 20</td>
<td>C17: Thermodynamics</td>
<td>E27: Determination of Ksp of a Sparingly Soluble Salt</td>
</tr>
<tr>
<td>9</td>
<td>Mar. 27</td>
<td>C17: Thermodynamics</td>
<td>E34: Solubility and Thermodynamics</td>
</tr>
<tr>
<td>10</td>
<td>Apr. 3</td>
<td>C18: Electrochemistry</td>
<td>E37: Oxidation-Reduction Titration of Oxalate</td>
</tr>
<tr>
<td>11</td>
<td>Apr. 10</td>
<td>C18: The Nernst Equation</td>
<td>E17: Electrochemical Cells &amp; Thermodynamics</td>
</tr>
<tr>
<td>12</td>
<td>Apr. 17</td>
<td>C21: Metals</td>
<td>EX2: Spectrochemical series, Part I (<em>handout</em>)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C20: Transition Elements</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Apr. 24</td>
<td>C20: Coordination Compounds</td>
<td>EX2: Spectrochemical series, Part II (<em>handout</em>)</td>
</tr>
<tr>
<td>14</td>
<td>May 1</td>
<td>C20 &amp; C19: Nuclear Chem.</td>
<td>E39: Analysis of bleach</td>
</tr>
<tr>
<td>15</td>
<td>May 8</td>
<td>C19: Biological Effects of Radiation</td>
<td>Clean-Up and Check-Out</td>
</tr>
</tbody>
</table>

**Exam Schedule:**

**EXAM 1** Monday, February 13  
**EXAM 2** Friday, March 10  
**EXAM 3** Monday, April 10  
**EXAM 4** Friday, May 5  
**FINAL** TBD
A few course policies

1. Enrollment:
   You need to have achieved a grade of at least a C- in Chem 111 or its equivalent to enroll in this course. Please see me IMMEDIATELY if you have any doubts. We want you to succeed, and this is the first check.

2. Homework:
   Homework is assigned through an account in Sapling Learning. Each assignment is worth 8 points. I would prefer homework to not be late – it doesn’t help you as much that way! In the rare instances where it is, I will take off 33% of the achieved total per weekday.

3. Labs:
   On the first day of lab, you must be in lab on time. If you are not, your spot in the class may be released to another student; you may be dropped if you are late! Please be on time.

   Labs are usually due in lab, at the end of the week they are given. Late labs will be penalized 33% per day late. Missed labs can be made up only if you can find another lab room in which to do the lab that week. Furthermore, both your lab instructor, and the lab instructor in whose room you will be doing the lab must agree to it ahead of time. *NO* make-up labs will be done in the week(s) following the missed lab. **Missing 3 or more labs in the semester constitutes failure of the lab and consequent failure of the course.**

   Copying of any part of a lab from your classmates, labs from students of other semesters, your own old labs, or any other site is expressly prohibited and will be considered plagiarism. It just doesn’t help you educationally to copy anything, so please don’t do it.

   Glasses or goggles will be worn at all times while chemistry is occurring in the lab room – regardless of who is doing the chemistry. Long pants and closed toed shoes are required in lab per department policy – no exceptions (although lab instructors may be lenient week 1). Please clean up after yourselves in lab as a dirty lab can be an unsafe lab.

4. Plagiarism:
   Copying of material from anyone in the course (including yourself), past or present, is forbidden. Solutions manuals to this or any other textbooks are expressly prohibited. ALL work on tests, homework, and labs must be your own and from this semester. While I encourage you to work together to understand homework and concepts, **the work you turn in must be your own**. Anything else is a disservice to your own understanding of the material, is a hindrance toward receiving the help you need, and importantly is a violation of academic integrity. Any plagiarism or cheating found in the course will be dealt with severely; failure to follow these rules may result in expulsion from the course and a concomitant grade of ‘F’ for the semester.

5. Continuation:
   Please note that if you wish to continue on to Chem 320 (Quantitative Analysis) in the future, you must pass this class with a C- or better. This is department policy.

6. Exams:
   Late exams will not be given except under extraordinary circumstances and arrangements for those few exams must be coordinated with the instructor as early as possible.

Final note
Look, I'm not going to lie to you, this course can be pretty hard. But we can get through it together. Stay engaged, keep up to date on videos and homework, come to class, go to SI..... Do these things and I do believe you will learn quite a bit of chemistry, and maybe even have some fun along the way.

Remember, we are in this together!