Syllabus-R0.11: Chemical Science (Chem 100-401), Semester II, 18-19

The Syllabus is subject to change. Any changes will be announced at least once during lecture and posted to D2L as Syllabus-R\(x\), where \(x\) will be greater than the previous value (for example, the version handed out the first day of class usually has \(x = 1.00\)).

Course Description: Introductory course in general inorganic chemistry designed for the student with little or no previous science training.

Lecture: MWF 10:00 – 10:50 AM in Chem 190

Sections: Discussions 601 – 609

Instructor: Dr. Thomas Sorensen Phone: 229-4012

Office Hours: MWF 10:05 – 11:05 AM in Chem 109

Course web-site, see D2L: http://d2l.uwm.edu/

Prerequisites: Not open for credit to students who have credit in Chem 102. Prereq: Math 105(C) or Math 108(C) or Math 116(C) or Level 30 on Math Placement Test.

In order for you to be successful in this course you will be required to identify and set-up problems and perform algebraic manipulations.

Course Materials: See D2L for additional details and options.

<table>
<thead>
<tr>
<th>Component</th>
<th>Estimated Cost</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALEKS 360 (aleks.com)</td>
<td>$70 – $150</td>
<td>Required, code includes an ebook</td>
</tr>
<tr>
<td>Chem 100 Lecture Exercises</td>
<td>$10 – $40</td>
<td>Required, available at Clark Graphics, 2915 N Oakland Ave</td>
</tr>
<tr>
<td>Non-Programmable Calculator</td>
<td>$10 – $50</td>
<td>Required, for exams and quizzes</td>
</tr>
<tr>
<td>Number 2 pencils</td>
<td>$0.05 – $0.50</td>
<td>Required, for exams and quizzes</td>
</tr>
<tr>
<td>TopHat access (tophat.com)</td>
<td>$18 – $38</td>
<td>Required</td>
</tr>
<tr>
<td>Bauer, Birk, and Marks, 5(^{th}) Ed.</td>
<td>$25 – $250</td>
<td>Recommended</td>
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</tbody>
</table>

No programmable calculators will be allowed on quizzes or exams!
To ensure accurate grading, use only Number 2 pencils on Scantron sheets.

Policies: UWM: You must follow the policies and procedures outlined in the current Schedule of Classes. See: http://www.uwm.edu/Dept/SecU/SyllabusLink.pdf

Department of Chemistry and Biochemistry: You are expected to fully understand these policies including the limits placed on the maximum amount of material that can be missed, excused or otherwise, and still pass the course.

Drop, Section Change: These are done on PAWS. Make sure to follow all the rules established by UWM and the Department of Chemistry and Biochemistry.

Incomplete: An Incomplete can be given only to a student who has been doing satisfactory (C) work but who is unable to continue attending the course for a reason judged valid. The request for an Incomplete must be accompanied by documentation.

Academic Dishonesty: Cheating on an examination or other graded material will result in a grade of zero as a minimum consequence. Failure in the course and referral to the Dean may also occur. In short, academic dishonesty in any form will not be tolerated.

Attendance: It will be a significant advantage for you to attend every lecture. You are responsible for all material presented in lecture. If you miss a lecture, you are responsible for obtaining the lecture material.

Discussion: There may be a quiz/worksheet given or attendance taken in each of your scheduled Discussion meetings. These will be combined and recorded four times during the semester. The average of these four grades constitutes your Discussion grade.

Homework: You will need to establish an ALEKS account and complete your Initial Assessment right away (see D2L for details). Most Objectives are due on Sunday, except the last one which is due the last day of class (May 9, 2019, the night before Study Day). ALEKS has the official due dates.

Half (50%) of your homework grade comes from the average of all your ALEKS Objectives (as shown in the ALEKS gradebook). The other half (50%) comes from the percent of the topics you have mastered (as
shown in the last column of the gradebook) as of the last day of the semester (May 9, 2019, the day before the Study Day).

**Lecture**: You will need to establish a TopHat (‘clicker’) account right away (see D2L for details). There will be a quiz associated with the current lectures given about twice a week. It may be given (unannounced) in lecture on paper or using ‘clickers’, or it may be announced in lecture when a quiz on D2L or ALEKS opens and closes. The average of all the lecture quizzes constitutes your Lecture grade.

**Early/Make-Up/Late Work**: There are no early, make-up, or late exams, homework, or quizzes. For a scheduled absence (e.g. University athletics, music, etc.), the instructor must be notified at least 24 hours prior to the absence. If an exam or quiz is missed for a non-medical reason not approved beforehand, a grade of zero (0) will be given. For medical absences, a written letter signed by your physician is required. For an excused absence the next quiz or exam will count double.

**Assessment**: Your course grade will be determined from the following elements:

<table>
<thead>
<tr>
<th>Element</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion</td>
<td>100 pts</td>
</tr>
<tr>
<td>Homework</td>
<td>100 pts</td>
</tr>
<tr>
<td>Lecture Quiz + Lecture Attendance + Classroom Salon</td>
<td>150 pts</td>
</tr>
<tr>
<td>Hour Exam I (Monday, 2-11-19, 5:30 – 6:30 PM)</td>
<td>100 pts</td>
</tr>
<tr>
<td>Hour Exam II (Monday, 3-11-19, 5:30 – 6:30 PM)</td>
<td>100 pts</td>
</tr>
<tr>
<td>Hour Exam III (Monday, 4-15-19, 5:30 – 6:30 PM)</td>
<td>100 pts</td>
</tr>
<tr>
<td>Redemption Exam (Monday, 5-06-19, 5:30 – 6:30 PM)</td>
<td>Extra Credit</td>
</tr>
<tr>
<td>Final Exam See Schedule of Classes</td>
<td>200 pts</td>
</tr>
</tbody>
</table>

If you score less than 60% on the final exam, or miss the final exam for any reason other than a legitimate medical excuse you cannot pass the course, regardless of your other grades.

**Approximate R0.11 Schedule for Chemical Science (Chem 100-401), Semester II, 18-19**

<table>
<thead>
<tr>
<th>Week of</th>
<th>Lecture</th>
<th>ALEKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 22</td>
<td>Lec01</td>
<td>Initial Assessment</td>
</tr>
<tr>
<td>29</td>
<td>Lec02 – Lec03</td>
<td>Obj1</td>
</tr>
<tr>
<td>Feb 4</td>
<td>Lec04 – Lec05</td>
<td>Obj2</td>
</tr>
<tr>
<td>11</td>
<td>Lec06</td>
<td>Obj3b</td>
</tr>
<tr>
<td></td>
<td>Exam I, Monday, 2-11-19, 5:30 – 6:30 PM Over Lec01 – Lec06</td>
<td></td>
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<tr>
<td></td>
<td>Lec07 – Lec09</td>
<td>Obj4</td>
</tr>
<tr>
<td>18</td>
<td>Lec10 – Lec12</td>
<td>Obj5</td>
</tr>
<tr>
<td>25</td>
<td>Lec13 – Lec15</td>
<td>Obj6</td>
</tr>
<tr>
<td>Mar 4</td>
<td>Lec16 – Lec17</td>
<td>Obj7b</td>
</tr>
<tr>
<td>11</td>
<td>Exam II, Monday, 3-11-19, 5:30 – 6:30 PM Over Lec07 – Lec17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No Class</td>
<td>Spring Break</td>
</tr>
<tr>
<td>18</td>
<td>Lec18 – Lec19</td>
<td>Obj8</td>
</tr>
<tr>
<td>Apr 1</td>
<td>Lec20 – Lec22</td>
<td>Obj9</td>
</tr>
<tr>
<td>8</td>
<td>Lec23 – Lec25</td>
<td>Obj10</td>
</tr>
<tr>
<td>15</td>
<td>Lec26</td>
<td>Obj11b</td>
</tr>
<tr>
<td></td>
<td>Exam III, Monday, 4-15-19, 5:30 – 6:30 PM Over Lec18 – Lec26</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Lec27 – Lec29</td>
<td>Obj12</td>
</tr>
<tr>
<td>29</td>
<td>Lec30 – Lec32</td>
<td>Obj13</td>
</tr>
<tr>
<td>May 6</td>
<td>Review</td>
<td>Obj13</td>
</tr>
<tr>
<td></td>
<td>Redemption Exam, Monday, 5-06-19, 5:30 – 6:30 PM Covers lectures and the text</td>
<td></td>
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<tr>
<td></td>
<td>Final Exam (covers lectures and the text)</td>
<td></td>
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<tr>
<td></td>
<td>See Schedule of Classes</td>
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*a* See ALEKS for exact due dates. Start assignments well before their due date. Everything due by May 9, 2019.

*b* An ALEKS assessment is required before you are allowed to start the next assignment.

You will find that your understanding of the material increases as you work more problems. Please get help when you need it. Sometimes 10 – 15 minutes spent in the TA or my office saves hours of confusion.
and frustration. I will attempt to remain on schedule as much as possible, but changes may be made with reasonable notice.

**D2L Resources include:**

- Information on ALEKS and TopHat.
- PowerPoint slides for each chapter.
- Handouts, chapter summaries, and additional examples.
- Your grades.

**Learning Objectives:**

Because this is a general education course, there are GER Distribution Outcomes of providing the “students with a broad body of knowledge” (UWM Fac. Doc. 1382, p. 2, II, par 1). Additionally, this course has objectives of:

- developing of ‘a strong foundation of verbal and quantitative skills’
- understanding ‘the rules of methods and processes’ (UWM Fac. Doc. 1382, p. 1, par. 2)
- introducing ‘major concepts of a natural science discipline, providing insights into its breadth and its relationship to other disciplines’
- illustrating ‘relationships between experiments, models, theories and laws’
- illustrating ‘the generation and testing of data and the application of concepts and knowledge to the solution of problems’ (UWM Fac. Doc. 1382, p. 3, par. 7)

In order to set these objectives within the framework of this course, a set of objectives have been designed to give you a better understanding of what you are expected to learn over the course of the semester, and some indication of how it will be measure as to what degree this has occurred. These will be incorporated through all types of assessments but will be formally measured on the weekly quizzes and hourly exams. In order to prepare for this, there will be certain objectives, which will be presented each week in discussion with exercises for practice.

**The examples of how these may be measured are examples ONLY and should not be interpreted as an inclusive ‘check list’.”

**1. Understand spatial scale, particularly to the very sizes (on the order of atoms).**

As an example you should be able to: estimate measurement, conceptualize relative sizes, use measurement tools skillfully, correctly compare numbers, convert measurements and scales, be able to compare specific objects (atoms and molecules, for example) by size and use the atom as a starting point in representing matter and changes.

**2. Understand the language of chemistry including naming simple compounds.**

As an example you should be able to: properly define important key terms, give a name for a chemical formula of a simple compound, give the chemical formula for a name, give the charges and names for the monoatomic and polyatomic ions of interest (these will be specified).

**3. Understand the relationship between macroscopic, particle and symbolic representations of matter including atom relationships in molecules and compounds.**

As an example you should be able to: identify macroscopic vs particle representations, read chemical formula, represent bonding detail in molecules, know that some elements exist as diatomic molecules, and be able to interpret organic chemical formulas from line drawings.

**4. Understand the relationship between the composition of atoms and their properties.**

As an example you should be able to: identify the number of protons, neutrons, and electrons for any isotope or ion, approximate the relative abundance of certain isotopes given the periodic table and additional information (for example, the number of isotopes and the number of neutrons in each), and calculate weighted averages, isotopic masses or relative abundances.
5. **Understand the basics of chemical reactions.**
   As an example you should be able to: balance chemical equations, correctly use terms and states of matter and correctly represent chemical formula.

6. **Understand the basics of mixtures and chemical reactions involving water as a solvent.**
   As an example you should be able to: define key terms of mixtures, represent solutions on a macroscopic and particle-level, quantitatively represent concentrations using various units.

7. **Understand quantitative relationships between substances represented in a balanced chemical equation.**
   As an example you should be able to: do stoichiometric calculations involving moles, masses, volumes, pressures, particles, and concentrations of reactants and/or products also including limited quantities of a reactant.

8. **Understand the basics of the properties and behavior of gases on both the macroscopic and particle level.**
   As an example you should be able to: relate pressure, volume, temperature and amount of an ideal gas, explain the ideal gas law in terms of gas particles, and calculate properties of a mixture of gases.

9. **Understand the basics of the modern model of the atom as it applies to electrons in atomic orbitals as well as writing electron configurations.**
   As an example you should be able to: define key terms, know the general rules for relative energy of atomic orbitals, apply Hunds rule and correctly write electron configurations.

10. **Understand periodicity of certain properties of the elements.**
    As an example you should be able to: define key terms, give periodic trends for certain properties, and give general descriptive chemistry facts.

11. **Understand chemical bonding and molecular shape.**
    As an example you should be able to: be able to draw a Lewis dot structure, determine a molecular shape from VSEPR theory, determine molecular polarity.

12. **Understand the experimental nature of science.**
    As an example you should be able to: define all components of the scientific method, identify key experiments and the conclusions made (particularly in atomic and electronic theory), conduct simple experiments in laboratory, use measurement tools accurately, and read equipment to the correct number of significant figures and maintain the correct number of significant figures throughout the calculations.

**Time Spent on the Course:**
To estimate the time that a student should expect to spend on this course, one can use the standard method of a minimum of 3 hours outside of class for every hour in class (lecture and discussion). Therefore, for a four (4) credit course a student may expect to spend a minimum of twelve (12) hours **per week** on the course outside of class. This includes studying, reading, doing homework, writing laboratory reports and rewriting class notes.

**Some notes on studying:**
Learning in this class may come with hard work and dedication. Please remember that much of your learning takes place through your own reading of the textbook, reading of your lecture notes, working problems, and conversations with me, your TA, and your classmates. Please do not expect to learn all of the concepts by attending lecture only. Your teaching team (your discussion TA, instructor, Chemistry tutors, CSI instructor, etc) will work cohesively to present you with learning opportunities. For best use these opportunities, please come prepared. Otherwise much of what is discussed may be confusing or frustrating. I am hopeful that by the end of the semester, you will find that learning chemistry is exciting and rewarding.

**Some tips for success in Chemistry 100:**
- **Read the text** (on the lecture material for the day) **before** attending the lecture.
• **Attend lecture and discussion sessions.** Take these times seriously. Be on time, stay attentive and take notes.

• **Use your lecture notes.** These may be very individual to you. This could include recopying or rereading after lecture (the closer to the lecture the better), adding to lecture notes from textbook material, adding problems, or discussing within a study group. Your lecture notes should be considered another source of information for this course (like your textbook).

• **Do as many problems as you are able — more than just those assigned.**

• **You will probably have to average 5 — 6 problems a day, seven days a week to be successful in the course.** Don’t wait until right before the exam — you will most likely be overwhelmed and unable to properly understand the material. If you have difficulty solving a particular problem, go back to the more straightforward related problems in the text and work them first. Indeed, one of the main purposes of this course is to help you develop your own method of thinking through problems. See your homework as an opportunity to test yourself on your own learning — this will allow you to find where you have succeeded in understanding and where you may still need to work through some concepts. Please do not wait until a quiz or exam to test your learning. See me if you would like help with ways to check your learning.

• **Form a study group or attend the group tutoring sessions.** These can be a very effective method of learning.

• **Strive for understanding instead of just familiarity.** It may take several attempts to gain the level of understanding that will allow you to articulate and use the models presented in this course. Be patient with yourself!

• **Be proactive!** If you are struggling to understand something, seek help. Chemistry builds on previous concepts. Without fully understanding one concept, it is very difficult to understand the next concept on which it builds.

**Reading and associated problems from the textbook by lecture.**

**Lec01: Introduction to Chemistry**

Reading- Ch01: 1.1, 1.2, and Ch02: 2.5 (p 75 – 78). Qualitative only, calculations will be done later.


**Lec02: Atomic Theory — The Basics**

Reading- Ch02: 2.1 and 2.2.

Problems- Ch02: 3 – 42.

**Lec03: Atoms and Ions**

Reading- Ch02: 2.3.


**Lec04: Atomic Theory — Isotopes**

Reading- Ch02: 2.4.


**Lec05: Light, Electrons, and the Bohr Model**

Reading- Ch07: 7.1 and 7.2 (ignore calculations for now).

Lec06: **Electron Configurations and the Periodic Table**  
Reading- Ch07: 7.3 and 7.4.  
Problems- Ch07: 37 – 70.

Lec07: **Hund’s Rule, Valence and Core Electrons**  
Reading- Ch07 7.5 and 7.6.  
Problems- Ch07: 71 – 84.

Lec08: **Lewis Dot Structures**  
Reading- Ch03: 3.1, Ch08: 8.1 (p 304 – 306) and 8.3 (p 313 – 322).  
Problems- Ch03: 5 – 8, Ch08: 3 – 12, and 45 – 65.

Lec09: **Molecular Shape**  
Reading- Ch08: 8.5.  
Problems- Ch08: 83 – 94.

Lec10: **Polarity**  
Reading- Ch08: 8.1 (p 307 – 309) and 8.5 (p 333 – 335).  
Problems- Ch08: 17 – 26, 107 – 116, 119, and 120.

Lec11: **Intermolecular Forces**  
Reading- Ch10: 10.2 (p 410 – 420).  
Problems- Ch10 41 – 74.

Lec12: **Ionic Compounds and Chemical Formulas**  
Reading- Ch08: 8.2, Ch03: 3.2 and 3.3.  
Problems- Ch08: 28, 35, 36, 40 – 42, and CH03: 11 – 38.

Lec13: **Periodic Trends**  
Reading- Ch07: 7.7.  

Lec14: **Nomenclature**  
Reading- Ch03: 3.5.  
Problems- Ch03: 39 – 50, 53 – 64.

Lec15: **Algebraic Review and Scientific Notation**  
Reading- Math Tool Box 9.2 (p 379 and 380) and Math Tool Box 1.1 (p 35 and 36).  
Problems- Ch01: 3 – 8.

Lec16: **Significant Figures**  
Reading- Math Tool Box 1.2 (p 37 – 41).  
Problems- Ch01: 9 – 18.

Lec17: **Unit Conversions – Dimensional Analysis**  
Reading- Math Tool Box 1.3 (p 41 – 45).  
Problems- Ch01: 19, 20, 23, 24, 122, 128, and 131 – 133.

Lec18: **Density and the Temperature Scales: Fahrenheit, Celsius, and Kelvin**  
Reading- Ch01: 1.2 (p 16 – 23).  
Problems- Ch01: 70 – 78 and 83 – 87.
Lec19: Formula Calculations – The Mole  
    Reading- Ch04: 4.2.  
    Problems- Ch04: 9 – 30.

Lec20: Formula Calculations – The Mole, Part II  
    Reading- Ch04: 4.2.  
    Problems Ch04: 36 – 48 and 53 – 60.

Lec21: Percent Composition and Empirical Formulas  
    Reading- Ch04: 4.1 and 4.3.  
    Problems- Ch04: 3, 4, 8, and 67 – 74.

Lec22: Empirical Formulas and Molecular Formulas  
    Reading- Ch04: 4.3 (p 148 and 149).  
    Problems- Ch04: 82 – 89.

Lec23: Solutions  
    Reading- Ch04: 4.4.  
    Problems- Ch04: 91 – 114.

Lec24: Chemical Reactions – General  
    Reading- Ch05: 5.1 – 5.3 and 5.4 (p 182 – 190).  
    Problems- Ch05: 3 – 52.

Lec25: Chemical Reactions – Single Displacement  
    Reading- 5.4 (p 190 – 193).  
    Problems- Ch05: 61 – 68.

Lec26: Chemical Reactions – Double Displacement – Precipitation Reactions  
    Reading- Ch05: 5.4 (p 193 – 196).  

Lec27: Mole and Mass Ratios  
    Reading- Ch06: 6.1 – 6.3.  

Lec28: Formula Units – Molecules  
    Reading- Ch06: 6.1 – 6.3.  

Lec29: Limiting Reactant, Theoretical Yield, and Percent Yield  
    Reading- Ch06: 6.4 and 6.5.  

Lec30: Solutions and Stoichiometry  
    Reading- Ideas from Ch04 and Ch06.  
    Problems- Lecture Exercises.

Lec31: Gases – General Principles and Concepts  
    Reading- Ch09: 9.1 – 9.3.  
    Problems- Ch09: 1 – 36 and 81 – 93.
Lec32: Gases – Ideal Gas Law and Stoichiometry

Reading- Ch09: 9.1 – 9.3.

Problems- Ch09: 37 – 80 and 115 – 118.