

**UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF CHEMISTRY
COURSE SYLLABUS
FALL 2017**

1. Course: CHEM 209, General Chemistry for Engineers

| LEC | DAY | TIME | ROOM | INSTRUCTOR | OFFICE | EMAIL | OFFICE HOURS |
|--|-----|------------|--------|----------------------------|---------|----------------------------------|--------------|
| L01 | TR | 12:30-1:45 | SB103 | Dr. N. Sandblom | SA 144J | nicole.sandblom@ucalgary.ca | TBA |
| L02 | TR | 2:00-3:15 | SB 103 | Dr. V. Mozol | SA 144E | vjmozol@ucalgary.ca | TBA |
| Course Coordinator: | | | | Dr. V. Mozol | SA 144E | vjmozol@ucalgary.ca | TBA |
| Tutorial & Lab Coordinator: | | | | Dr. Amanda Musgrove Richer | SA 144F | amanda.musgroveriche@ucalgary.ca | TBA |

Course website - [CHEM 209 ALL - \(Fall 2017\) - General Chemistry For Engineers](#) (can be reached via the course management system, D2L).
Departmental Office: SA 229, Tel: 403- 220-5341, email: chem.undergrad@ucalgary.ca

2. Course Description: Basic chemical concepts. Atomic and molecular structure. Chemical bonding. Chemical kinetics and equilibria. Acid-base and solubility equilibria. Oxidation-reduction phenomena and electrochemistry. The chemistry of water. The chemistry of energy sources. Basic environmental issues.

3. Textbook: *Chemistry: The Molecular Nature of Matter and Change*, 2nd Canadian Ed.; Silberberg M, Amateis P, Lavieri S, Venkateswaran R, 2016, McGraw-Hill Ryerson.

4. Topics Included and Suggested Readings:

Students are responsible for all material included in the lectures, laboratories, and tutorials. Most of the relevant material for these content areas are in the designated sections from the textbook: Chapters 1-4, 6-10, 14-17 and 19.

Note that some material is regarded as review of high school chemistry and will not be addressed in lectures; however, being fundamental to many other topics in chemistry, they will certainly be included in tutorials and exams.

Background knowledge to review before the course begins:

Chapter 1: Keys to the Study of Chemistry

Although all sections are included; the focus will be on sections 1.4–1.6.

Chapter 2: The Components of Matter

Although all sections are included; the focus will be on sections 2.5–2.9.

Chapter 3: Stoichiometry of Formulae and Equations

All sections are included.

Chapter 4: Gases and the Kinetic-Molecular Theory

Sections 4.1–4.4 only are included.

Big Idea 1: How fast is a reaction?

Chapter 14: Kinetics: Rates And Mechanisms Of Chemical Reactions

All sections 14.1–14.7 are included. In 14.5, omit the effect of molecular structure on rate (page 582). In 14.6, omit discussion of reactions with a fast initial step (pg. 589-591), but include multistep reaction energy diagrams (p. 592). In 14.7, omit biological catalysts (page 595–596).

Big Idea 2: How far does a reaction proceed?*Chapter 15: Equilibrium: The Extent Of Chemical Reactions*

All sections are included, but omit Equations 15.4 and 15.5 on page 615.

Chapter 16: Acid–Base Equilibria

Sections 16.1–16.2 should be reviewed before lectures begin on this topic.

Sections 16.3–16.4 and selected topics from 16.6 (pg. 689-690 only) will be included.

Chapter 17: Ionic Equilibria in Aqueous Systems

All sections are included.

Selected topics from Section 17.2 will be included in laboratory but not in lecture, and we will omit discussion of poly-protic acids and amino acids, pg. 729-730. From Section 17.3, omit Selective Precipitation (page 741-742). From Section 17.4, omit Complex Ions of Amphoteric Hydroxides (page 749–750).

Chapter 19: Electrochemistry

Section 19.1 should be reviewed before lectures begin on this topic.

All sections are included; omit parts of section 19.4 dealing with Gibbs Energy (pages 835-837) and parts of Section 19.7 dealing with over-potential and electrolysis stoichiometry (pages 855-858)

Big Idea 3: What makes a bond?*Chapter 6: Quantum Theory and Atomic Structure*

Portions of Chapter 6.4 are included – omit definitions of quantum numbers and radial probability plots.

Chapter 7: Electron Configuration and Chemical Periodicity

All sections are included; omit electron configurations of transition elements (pages 283-284 and 295-296).

Chapter 8: Models of Chemical Bonding

Sections 8.1–8.3 and 8.5–8.7 are included.

In Section 8.2, omit the Born-Haber cycle (pages 310-312).

Chapter 9: The Shape of Molecules

All sections are included.

Chapter 10: Theories of Covalent Bonding

Sections 10.1 and 10.2 are included.

Omit discussion of sp^3d and sp^3d^2 hybridization (page 380)

5. Laboratory Experiments: (5 weeks, 3 hours biweekly)

1. Determination of the Hardness of Tap Water
 - Topic: *Previous background knowledge*
2. Kinetics of Fading of Phenolphthalein
 - Topic: *How fast is a reaction?* (Chapter 14)
3. Equilibrium Constant for the Formation of $Fe(SCN)^{2+}$
 - Topic: *How far does a reaction proceed?* (Chapter 15)
4. Potentiometric Acid-Base Titrations
 - Topic: *How far does a reaction proceed?* (Chapters 16 & 17)
5. Electrochemical Determination of K_{sp} for Silver Salts
 - Topic: *How far does a reaction proceed?* (Chapter 17)
 - Topic: *What makes a bond?* (Chapters 6 & 7)

CHEMISTRY 209 FALL 2017: LECTURE, LABORATORY, & TUTORIAL SCHEDULE

| Week Starting Date | Tentative Schedule for Lecture Topics | Lab Schedule | Tutorial Schedule |
|--------------------|---|--|--|
| September 11 | Introduction How fast are reactions? <i>Chemical Kinetics (Chapter 14)</i> | Orientation for odd-numbered lab sections | No Tutorials **Look ahead: next week's tutorial quiz will require reviewing a lot of material.** |
| September 18 | How fast are reactions? <i>Chemical Kinetics (Chapter 14)</i> | Orientation for even-numbered lab sections | Tutorial 1 Quiz Review Material (Ch. 1 – 4) **See "CHEM 209 Preparation" handout** |
| September 25 | How fast are reactions? <i>Chemical Kinetics (Chapter 14)</i> How far does a reaction proceed? <i>Equilibrium (Chapter 15)</i> | Experiment 1 for odd-numbered lab sections | Tutorial 2A <i>In-class Assignment</i> Kinetics (Ch. 14.1-14.3) |
| October 2 | How far does a reaction proceed? <i>Equilibrium (Chapter 15)</i> | Experiment 1 for even-numbered lab sections | Tutorial 2B Quiz Kinetics (Ch. 14.1-14.7) |
| October 9 | How far does a reaction proceed? <i>Solubility (Chapter 17)</i> <i>Thanksgiving: Monday Oct 9 University is closed.</i> | Experiment 2 for odd-numbered lab sections <i>Students in B01-B03 will attend Thu Oct 12, 7-10 PM – See D2L.</i> | Review tutorial **Students in T09 & T10 (Monday) will be rescheduled. Follow directions on D2L.** |
| October 16 | How far does a reaction proceed? <i>Acids & Bases (Chapter 16)</i> | Experiment 2 for even-numbered lab sections | No Tutorials Midterm: Wed. Oct 18th From 19:00-21:00. |
| October 23 | How far does a reaction proceed? <i>Acids & Bases (Chapter 16)</i> <i>Buffers (Chapter 17)</i> | Experiment 3 for odd-numbered lab sections | Tutorial 3A <i>In-class Assignment</i> Acids & Bases (Chapter 16) |
| October 30 | How far does a reaction proceed? <i>Buffers (Chapter 17)</i> <i>Electrochemistry (Chapter 19)</i> | Experiment 3 for even-numbered lab sections | Tutorial 3B Quiz Acids & Bases and Solubility (Chapter 17.3 & 17.4) |

| Week Starting Date | Planned Schedule for Lecture Topics | Lab Schedule | Tutorial Schedule |
|---------------------------|--|---|--|
| November 6 | <p>How far does a reaction proceed? <i>Electrochemistry (Chapter 19)</i></p> <p><i>Reading Days: Friday Nov 10</i> <i>No Classes or Labs on Friday.</i></p> | <p>Experiment 4 for B01-B03 ONLY (Monday)</p> <p><i>T-F No Labs</i></p> | <p>No Tutorials</p> <p><i>Reading Days: Nov 10-13</i></p> |
| November 13 | <p>What makes a bond? <i>Atomic Structure (Chapter 6)</i> <i>Electron Configuration (Chapter 7)</i></p> <p><i>Reading Days: Mon Nov 13</i> <i>No Classes or Labs on Monday.</i></p> | <p>Experiment 4 for odd-numbered lab sections</p> <p><i>Monday: No Lab</i></p> | <p>Tutorial 4A <i>In-class Assignment</i> Acids & Bases and Buffers (Chapters 16 & 17.1 – 17.2)</p> <p><i>**Students in T09 & T10 (Monday) will be rescheduled. Follow directions on D2L.**</i></p> |
| November 20 | <p>What makes a bond? <i>Models of Chemical Bonding (Ch. 8)</i></p> | <p>Experiment 4 for even-numbered lab sections</p> | <p>Tutorial 4B <i>Quiz</i> Electrochem. (Chapters 17.3, 17.4 & 19)</p> |
| November 27 | <p>What makes a bond? <i>The Shapes of Molecules (Chapter 9)</i></p> | <p>Experiment 5 for odd-numbered lab sections</p> | <p>Tutorial 5A <i>In-class Assignment</i> Atomic Structure & Electron Configurations (Chapters 6 & 7)</p> |
| December 4 | <p>What makes a bond? <i>Theories of Covalent Bonding (Ch. 10)</i></p> | <p>Experiment 5 for even-numbered lab sections</p> | <p>Tutorial 5B <i>Quiz</i> Atomic Theories & Bonding (Chapters 6-8)</p> |

Department Approval: Approved by Department Head

Date: September 6, 2017