

**UNIVERSITY OF CALGARY  
FACULTY OF SCIENCE  
DEPARTMENT OF CHEMISTRY  
COURSE SYLLABUS  
FALL 2019**

**1. Course: CHEM 209, General Chemistry for Engineers**

LEC	DAY	TIME	ROOM	INSTRUCTOR	OFFICE	EMAIL	OFFICE HOURS
L01	TR	14:00-15:15	SB103	Dr. V. Mozol	SA 144E	vjmozol@ucalgary.ca	TBA
L02	TR	12:30-13:45	SB 103	Dr. N. Sandblom	SA 144I	ntaucoin@ucalgary.ca	TBA
<b>Course Coordinator:</b>				Dr. V. Mozol	SA 144E	vjmozol@ucalgary.ca	TBA
<b>Tutorial &amp; Lab Coordinator:</b>				Dr. Roxanne Jackson	SA 156	rjjackso@ucalgary.ca	TBA

Course website - [CHEM 209 ALL - \(Fall 2019\) - 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](mailto: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*, 2<sup>nd</sup> Canadian Ed.; Silberberg M, Amateis P, Lavieri S, Venkateswaran R, 2016, McGraw-Hill Ryerson.  
*FREE Online option: Open Educational Resource reached via the course management system, D2L.*

**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: Ch.s 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:**

*Ch. 1: Keys to the Study of Chemistry*

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

*Ch. 2: The Components of Matter*

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

*Ch. 3: Stoichiometry of Formulae and Equations*

All sections are included.

*Ch. 4: Gases and the Kinetic-Molecular Theory*

Sections 4.1–4.4 only are included.

*Optional self-assessments are also available via the D2L course website.*

**Big Idea 1: How fast is a reaction?**

*Ch. 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?**

#### *Ch. 15: Equilibrium: The Extent Of Chemical Reactions*

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

#### *Ch. 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.

#### *Ch. 17: Ionic Equilibria in Aqueous Systems*

Sections 17.3 – 17.4 are included.

Section 17.3, omit Selective Precipitation (page 741-742). From Section 17.4, omit Complex Ions of Amphoteric Hydroxides (page 749–750).

#### *Ch. 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)

### **Big Idea 3: How is structure important?**

#### *Ch. 6: Quantum Theory and Atomic Structure*

Portions of Ch. 6.4 are included; omit definitions of quantum numbers and radial probability plots.

#### *Ch. 7: Electron Configuration and Chemical Periodicity*

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

#### *Ch. 8: Models of Chemical Bonding*

Sections 8.1–8.3 omit Born Haber Cycle and Periodic Trends in Lattice Energy (pages 310-314), all 8.5–8.7.

#### *Ch. 9: The Shape of Molecules*

All sections are included.

#### *Ch. 10: Theories of Covalent Bonding*

Portions of 10.2

#### *Ch. 11: Theories of Covalent Bonding*

All 11.3.

**Big Idea 4: How is laboratory work an essential component of an experiential science such as Chemistry?****5. Laboratory Experiments:** (5 weeks, 3 hours biweekly)

1. Kinetics of Fading of Phenolphthalein
  - Topic: *How fast is a reaction?* (Ch. 14)
2. Equilibrium Constant for the Formation of  $\text{Fe}(\text{SCN})^{2+}$ 
  - Topic: *How far does a reaction proceed?* (Ch. 15)
3. Determination of an Unknown Acid
  - Topic: *How far does a reaction proceed?* (Ch. 16)
4. Anodization of Aluminium
  - Topic: *How far does a reaction proceed?* (Ch. 19)
5. Preparation of a Surfactant
  - Topic: *The importance of bonding* (Ch.s 8 & 11)

## CHEMISTRY 209 FALL 2019: LECTURE, LABORATORY, &amp; TUTORIAL SCHEDULE

Week Starting Date	Tentative Schedule for Lecture Topics	Lab Schedule		Tutorial Schedule  Ch. = Chapter
		<i>odd-numbered sections</i> e.g. B01, B03, ... B15, B17, ... B23	<i>even-numbered sections</i> e.g. B02, B04, ... B14, B16, ... B24	
Thursday September 5 <sup>1</sup>	<b>Introduction</b>	<i>No labs</i>	<i>No labs</i>	No tutorials
Monday September 9	<b>How fast are reactions?</b> <i>Chemical Kinetics (Ch. 14)</i>	<b>Lab Orientation</b>	<i>No labs</i>	<b>Tutorial 1</b> <i>Battle</i>
Monday September 16	<b>How fast are reactions?</b> <i>Chemical Kinetics (Ch. 14)</i>	<i>No labs</i>	<b>Lab Orientation</b>	<b>Tutorial 2</b> <i>Group Assignment</i> <i>How Fast</i>
Monday September 23	<b>How fast are reactions?</b> <i>Chemical Kinetics (Ch. 14)</i> <b>How far does a reaction proceed?</b> <i>Equilibrium (Ch. 15)</i>	<b>Experiment 1</b> for odd-numbered lab sections	<i>No Labs</i>	<b>Tutorial 3</b> <i>Quiz</i> <i>How Fast</i> <i>Peer discussion</i> <i>Battle</i>
Monday September 30	<b>How far does a reaction proceed?</b> <i>Equilibrium (Ch. 15)</i> <b>How far does a reaction proceed?</b> <i>Acids &amp; Bases (Ch. 16)</i>	<i>No Labs</i>	<b>Experiment 1</b> for even-numbered lab sections	<b>Tutorial 4</b> <i>Troubleshooting of</i> <i>Battle Box Puzzles</i>
Monday <b>October 7</b>	<b>How far does a reaction proceed?</b> <i>Acids &amp; Bases (Ch. 16)</i>	<b>Experiment 2</b> for odd-numbered lab sections	<i>No Labs</i>	<b>Tutorial 5</b> <i>Group Assignment</i> <i>Acids &amp; Bases</i>
Tuesday October 14 <sup>2</sup>	<b>How far does a reaction proceed?</b> <i>Solubility (Ch. 17)</i>	<i>No Labs</i>	<b>Experiment 2</b> for even-numbered lab sections <i>Note: Mon labs B02 &amp; B04 will be TENTATIVELY rescheduled for 7-10pm on Thurs Oct 17<sup>th</sup></i>	<b>No Tutorials</b> <i>Online Group Member check</i>  <b>Midterm:</b> <i>Wed. Oct 16<sup>th</sup></i> <i>19:00-21:00</i>

<sup>1</sup> Classes start: Thursday September 5<sup>th</sup><sup>2</sup> Thanksgiving: Monday October 14<sup>th</sup>, University closed

Week Starting Date	Tentative Schedule for Lecture Topics	Lab Schedule		Tutorial Schedule
		<i>odd-numbered sections</i> e.g. B01, B03, ... B15, B17, ... B23	<i>even-numbered sections</i> e.g. B02, B04, ... B14, B16, ... B24	
Monday October 21	<b>How far does a reaction proceed?</b> <i>Solubility (Ch. 17)</i> <i>Buffers (Ch. 17)</i>	<b>Experiment 3</b> for odd-numbered lab sections	<i>No Labs</i>	<b>Tutorial 6</b> <i>Quiz</i> Acids & Bases and Solubility <i>Peer discussion</i> Battle
Monday October 28	<b>How far does a reaction proceed?</b> <i>Electrochemistry (Ch. 19)</i>	<i>No Labs</i>	<b>Experiment 3</b> for even-numbered lab sections	<b>Tutorial 7</b> <i>Group Assignment</i> Electrochemistry
Monday November 4	<b>How far does a reaction proceed?</b> <i>Electrochemistry (Ch. 19)</i>	<b>Experiment 4</b> for odd-numbered lab sections	<i>No Labs</i>	<b>Tutorial 8</b> <i>Quiz</i> Electrochemistry <i>Peer discussion</i> Battle <i>Proposal Due</i>
Monday November 11	<i>Reading Week: No Classes, Labs or Tutorials</i>			
Monday November 18	<b>The importance of bonding</b> <i>Electron Configuration &amp; Periodicity (Ch. 7)</i> <i>Models of Chemical Bonding (Ch. 8)</i>	<i>No Labs</i>	<b>Experiment 4</b> for even-numbered lab sections	<b>Tutorial 9</b> <i>Dress Rehearsal</i> <i>Final Battle</i>
Monday November 25	<b>The importance of bonding</b> <i>The Shapes of Molecules (Ch. 9)</i> <i>Shapes of Atomic Orbitals (Ch. 6.4)</i> <i>Theories of Covalent Bonding (Ch. 10)</i>	<b>Experiment 5</b> for odd-numbered lab sections	<i>No Labs</i>	<b>Tutorial 10</b> <i>Quiz</i> Electron Configurations, Atomic Properties & Lewis <i>Peer Check</i> Battle Box Puzzles
Monday December 2	<b>The importance of bonding</b> <i>Intermolecular interactions (Ch. 11)</i>	<i>No Labs</i>	<b>Experiment 5</b> for even-numbered lab sections	<b>Tutorial 11</b> Final Battle

Department Approval

Electronically Approved

Date

August 29, 2019