

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

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. A. Musgrove	SA 144F	amanda.musgrove@ucalgary.ca	TBA
L02	TR	8:00-9:15	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. Roxanne Jackson	SA 156	rjjackso@ucalgary.ca	TBA

Course website - [CHEM 209 ALL - \(Winter 2019\) - 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

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: 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.

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 17.1 - pages 709-714 included to highlight application of acid-base equilibria

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: The importance of bonding*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 10.1 are included; pages 375-376.

Portions of 10.43 are included; pages 386-389.

Ch. 11: Theories of Covalent Bonding

All 11.3.

Portions of 11.6; pages 438-440.

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?* (Ch. 14)
3. Equilibrium Constant for the Formation of $\text{Fe}(\text{SCN})^{2+}$
 - Topic: *How far does a reaction proceed?* (Ch. 15)
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 WINTER 2019: LECTURE, LABORATORY, & 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 January 10	Introduction	<i>No labs</i>	<i>No labs</i>	No tutorials
Monday January 14	How fast are reactions? <i>Chemical Kinetics (Ch. 14)</i>	Lab Orientation	<i>No Labs</i>	Tutorial 1A <i>A Surprise!</i> <i>(Pre-requisite knowledge)</i>
Monday January 21	How fast are reactions? <i>Chemical Kinetics (Ch. 14)</i>	<i>No Labs</i>	Lab Orientation	Tutorial 2A <i>Group Assignment</i> <i>Kinetics</i> <i>(Ch. 14.1-14.3)</i>
Monday January 28	How fast are reactions? <i>Chemical Kinetics (Ch. 14)</i> How far does a reaction proceed? <i>Equilibrium (Ch. 15)</i>	Experiment 1 for odd-numbered lab sections	<i>No Labs</i>	Tutorial 2B <i>Quiz/Peer Grading</i> <i>Kinetics</i> <i>(Ch. 14.1-14.7)</i>
Monday February 4	How far does a reaction proceed? <i>Equilibrium (Ch. 15)</i> How far does a reaction proceed? <i>Acids & Bases</i> <i>(Ch. 16)</i>	<i>No Labs</i>	Experiment 1 for even-numbered lab sections	Prep for Tutorial 1B
Monday February 11	How far does a reaction proceed? <i>Acids & Bases</i> <i>(Ch. 16)</i>	Experiment 2 for odd-numbered lab sections	<i>No Labs</i>	No Tutorials Midterm: <i>Wed. February 13th</i> <i>19:00-21:00</i>
Monday February 18	<i>Reading Days: Feb 17-24</i>			
Monday February 25	How far does a reaction proceed? <i>Solubility (Ch. 17)</i>	<i>No Labs</i> <i>Last week's lab tied to In-class Assignment</i>	Experiment 2 for even-numbered lab sections <i>Tied to In-class Assignment</i>	Tutorial 3A <i>Group Assignment</i> <i>Acids & Bases</i> <i>(Ch. 16, 17.1-17.2)</i>
		Lab Schedule		Tutorial Schedule

Week Starting Date	Tentative Schedule for Lecture Topics	odd-numbered sections <i>e.g. B01, B03, ... B15, B17, ... B23</i>	even-numbered sections <i>e.g. B02, B04, ... B14, B16, ... B24</i>	
Monday March 4	How far does a reaction proceed? <i>Solubility (Ch. 17)</i> <i>Buffers (Ch. 17)</i>	Experiment 3 for odd-numbered lab sections	<i>No Labs</i>	Tutorial 3B <i>Quiz/Peer Grading</i> <i>Acids & Bases and Solubility (Ch. 17.3 & 17.4)</i>
Monday March 11	How far does a reaction proceed? <i>Electrochemistry (Ch. 19)</i>	<i>No Labs</i>	Experiment 3 for even-numbered lab sections	Tutorial 4A <i>Group Assignment</i> <i>Electrochemistry</i> <i>Galvanic Cells (Ch. 19.1-19.4)</i>
Monday March 18	How far does a reaction proceed? <i>Electrochemistry (Ch. 19)</i>	Experiment 4 for odd-numbered lab sections	<i>No Labs</i>	Tutorial 4B <i>Quiz/Peer Grading</i> <i>Electrochemistry</i> <i>Electrolysis. (Ch. 19.7)</i>
Monday March 25	The importance of bonding <i>Shapes of Atomic Orbitals (Ch. 6.4)</i> <i>Electron Configuration & Periodicity (Ch. 7)</i> <i>Models of Chemical Bonding (Ch. 8)</i> <i>The Shapes of Molecules (Ch. 9)</i>	<i>No Labs</i>	Experiment 4 for even-numbered lab sections	Finalizing Tutorial 1B
Monday April 1	The importance of bonding <i>Intermolecular interactions (Ch. 11)</i>	Experiment 5 for odd-numbered lab sections	<i>No Labs</i>	Tutorial 5 <i>Quiz/Peer Grading</i> <i>VSEPR shapes</i> <i>Intra and Intermolecular Bonding (Ch. 9.2, 11.3)</i>
Monday April 8	The importance of bonding <i>Theories of Covalent Bonding (Ch. 10)</i>	<i>No Labs</i>	Experiment 5 for even-numbered lab sections	Tutorial 1B <i>Follow-up to Surprise!</i>

Department Approval: Approved by Department Head Date: January 7, 2019