

UNIVERSITY OF CALGARY  
DEPARTMENT OF CHEMISTRY  
**COURSE SYLLABUS**  
**Fall 2016**

**COURSE: CHEM 209, General Chemistry for Engineers**

LEC	DAY	TIME	ROOM	INSTRUCTOR	OFFICE	PHONE	EMAIL	OFFICE HOURS
L01	TR	14:00-15:15	SB103	Dr. A. Musgrove Richer	SA 144F	220-2745	amanda.musgroveriche@ucalgary.ca	TBA
L02	TR	12:30-13:45	SB103	Dr. V. Mozol	SA 144E	210-9816	vjmozol@ucalgary.ca	TBA
<b>Course Coordinator:</b>				Dr. A. Musgrove Richer	SA 144F	220-2745	amanda.musgroveriche@ucalgary.ca	TBA
<b>Lab / Tutorial Coordinator:</b>				Dr. R. Jackson	SA 156	220-8274	rjjackso@ucalgary.ca	TBA

**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.

**TOPICS INCLUDED AND SUGGESTED READING:**

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, 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 omitting discussion of polyprotic 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 overpotential 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)

**LABORATORY EXPERIMENTS:**

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  $\text{Fe}(\text{SCN})^{2+}$ 
  - 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  $K_{\text{sp}}$  for Silver Salts
  - Topic: *How far does a reaction proceed?* (Chapter 17)
  - Topic: *What makes a bond?* (Chapters 6 & 7)

# CHEMISTRY 209 FALL 2016: LECTURE, LABORATORY, & TUTORIAL SCHEDULE

Week Starting Date	Tentative Schedule for Lecture Topics	Lab Schedule	Tutorial Schedule
September 12	<b>Introduction</b>  <b>How fast are reactions?</b> <i>Chemical Kinetics (Chapter 14)</i>	Orientation for odd-numbered lab sections	No Tutorials  <i>**Look ahead: next week's tutorial quiz will require reviewing a lot of material.**</i>
September 19	<b>How fast are reactions?</b> <i>Chemical Kinetics (Chapter 14)</i>	Orientation for even-numbered lab sections	<b>Tutorial 1</b> <i>Quiz</i> Review Material (Ch. 1 – 4) <i>**See "CHEM 209 Preparation" handout**</i>
September 26	<b>How fast are reactions?</b> <i>Chemical Kinetics (Chapter 14)</i> <b>How far does a reaction proceed?</b> <i>Equilibrium (Chapter 15)</i>	Experiment 1 for odd-numbered lab sections	<b>Tutorial 2A</b> <i>In-class Assignment</i> Kinetics (Ch. 14.1-14.3)
October 3	<b>How far does a reaction proceed?</b> <i>Equilibrium (Chapter 15)</i>	Experiment 1 for even-numbered lab sections	<b>Tutorial 2B</b> <i>Quiz</i> Kinetics (Ch. 14.1-14.7)
October 10	<b>How far does a reaction proceed?</b> <i>Acids &amp; Bases (Chapter 16)</i>  <u><b>Note:</b> Monday Oct 10 is Thanksgiving. B01 &amp; B03 will perform Expt 2 on Thurs. Oct 13, from 19:00-22:00.</u>	Experiment 2 for odd-numbered lab sections  <i>*see note*</i>	<b>Review tutorial</b>  <i>**Students in T09 &amp; T10 (Monday) may attend any other section this week**</i>
October 17	<b>How far does a reaction proceed?</b> <i>Buffers &amp; Solubility (Chapter 17)</i>	Experiment 2 for even-numbered lab sections	No Tutorials  <b>Midterm:</b> Wed. Oct. 19 <sup>th</sup> From 19:00-21:00.
October 24	<b>How far does a reaction proceed?</b> <i>Buffers &amp; Solubility (Chapter 17)</i> <i>Electrochemistry (Chapter 19)</i>	Experiment 3 for odd-numbered lab sections	<b>Tutorial 3A</b> <i>In-class Assignment</i> Acids & Bases (Chapter 16)
October 31	<b>How far does a reaction proceed?</b> <i>Electrochemistry (Chapter 19)</i>	Experiment 3 for even-numbered lab sections	<b>Tutorial 3B</b> <i>Quiz</i> Acids & Bases and Buffers (Chapters 16 & 17.1 – 17.2)

Week Starting Date	Planned Schedule for Lecture Topics	Lab Schedule	Tutorial Schedule
November 7	<b>How far does a reaction proceed?</b> <i>Electrochemistry (Chapter 19)</i>	No labs	No Tutorials <i>Reading Days: Nov. 10-11</i>
November 14	<b>What makes a bond?</b> <i>Atomic Structure (Chapter 6)</i>  <b>What makes a bond?</b> <i>Electron Configuration (Chapter 7)</i>	Experiment 4 for odd-numbered lab sections	<b>Tutorial 4A</b> <i>In-class Assignment</i> Solubility (Chapter 17.3 & 17.4)
November 21	<b>What makes a bond?</b> <i>Models of Chemical Bonding (Ch. 8)</i>	Experiment 4 for even-numbered lab sections	<b>Tutorial 4B</b> <i>Quiz</i> Solubility & Electrochem. (Chapters 17.3, 17.4 & 19)
November 28	<b>What makes a bond?</b> <i>The Shapes of Molecules (Chapter 9)</i>	Experiment 5 for odd-numbered lab sections	<b>Tutorial 5A</b> <i>In-class Assignment</i> Atomic Structure & Electron Configurations (Chapters 6 & 7)
December 5	<b>What makes a bond?</b> <i>Theories of Covalent Bonding (Ch. 10)</i>	Experiment 5 for even-numbered lab sections	<b>Tutorial 5B</b> <i>Quiz</i> Atomic Theories & Bonding (Chapters 6-8)

Department Approval: \_\_\_\_\_

Date: August xx 2016