Chemistry 1011 Curriculum Outline

Nivaldo J. Tro  Travis D. Fridgen  Lawton E. Shaw
Chemistry (2nd Canadian Edition) A Molecular Approach

The lecture and tutorial materials required for this course include:
- Mastering Chemistry Access Code (for all online assignments)
- Learning Catalytics Access Code (for tutorial sessions)

**Important note:** If you purchase a used book and are taking this course for the first time, be careful that you consider the pricing below since if you buy a used book, you will be required to purchase additionally a separate and new Mastering Chemistry access code at $66 (online purchase) followed by a Learning Catalytics access code at $12 US/6 months or $20 US/12 months (online purchase) for use in this course. **Note that the Mastering Chemistry code and Learning Catalytics codes cannot be purchased used.**

**Course Materials** available in bookstore as follows:

- Loose Leaf Version + Mastering with ebook Code $120
- Hardcover Version + Mastering with ebook Code $180

**Note:** The above options include Learning Catalytics codes as well.

**Chemistry Textbook Bundles:**
There are several special packages that can be purchased at the MUN bookstore which include textbooks from chemistry and certain physics and biology courses. If you are taking Chemistry and the additional courses as indicated below then consider these packages as better pricing than purchasing them individually. Note that these bundles include a loose leaf copy of each text and Mastering (with ebook) codes for each course.

- Biology/Chemistry Bundle (Bio1001/Chem) $199.95
- Physics/Chemistry Bundle (Phys1020/Chem) $199.95
- *Biology/Physics/Chemistry Bundle* (Bio1001/Phys1020/Chem) $299.95

**Note:** The above options include Learning Catalytics codes as well.

There is also a Phys1050/Chem bundle for 199.95 and the books not only contain learning catalytics but Mastering Chemistry as well.

*On-line Codes Only (ie. student already has textbook) *

- Mastering Chemistry (available at www.pearsonmylabandmastering.com only) $66
- Learning Catalytics $12 US/6 months or $20 US/12 months (Online only)
Be careful about the choices you make with respect to the purchase of course materials since you don’t want to have to spend more than necessary. If you have questions, please feel free to speak with your instructor upon the start of the semester.

Some of the material in the curriculum is listed as “Suggested Reading” from the textbook. These sections will not be covered to any great extent in class but you are responsible for the material in the “Suggested Reading” sections.

Chapter 16: Aqueous Ionic Equilibrium  p. 683

16.1 The Danger of Antifreeze (Suggested Reading)  p. 684
16.2 Buffers: Solutions that Resist pH Change  p. 685
   Calculating the pH of a Buffer Solution  p. 686
   (Emphasis on Equilibrium Approach)
   (Note: Henderson-Hasselbalch will be discussed briefly in class)  p. 687
   Calculating pH Changes in a Buffer Solution  p. 690
   Buffers Containing a Base and Its Conjugate Acid  p. 693
16.3 Buffer Effectiveness: Buffer Range and Buffer Capacity  p. 695
   Relative Amounts of Acid and Base  p. 695
   Absolute Concentrations of the Acid and Conjugate Base  p. 695
   Buffer Range  p. 696
   Chemistry and Medicine – Buffer Effectiveness in Human Blood  p. 697
   Buffer Capacity  p. 698
16.5 Solubility Equilibria and the Solubility Product Constant  p. 712
   K_{sp} and Molar Solubility  p. 712
   Chemistry in your Day – Hard Water  p. 714
   K_{sp} and Relative Solubility  p. 715
   The Effect of a Common Ion on Solubility  p. 715
   The Effect of an Uncommon Ion on Solubility (Salt Effect)  p. 717
   The Effect of pH on Solubility  p. 717
16.6 Precipitation  p. 718 - 719 (only)

Chapter 18: Electrochemistry  p. 785

18.1 Pulling the Plug on the Power Grid (Suggested Reading)  p. 786
18.2 Voltaic (or Galvanic) Cells: Generating Electricity from Spontaneous Chemical Reactions  p. 786
   Electrochemical Cell Notation  p. 789
18.3 Standard Electrode Potentials  p. 789
   Predicting the Spontaneous Direction of an Oxidation-Reduction Reaction  p. 795
   Predicting Whether a Metal Will Dissolve in Acid  p. 798
18.6 Batteries: Using Chemistry to Generate Electricity  p. 809
18.7 Electrolysis: Driving Nonspontaneous Chemical Reactions with
Chapter 7: The Quantum-Mechanical Model of the Atom  p.241

7.1 Quantum Mechanics: The Theory that Explains the Behaviour of the Absolutely Small (Suggested Reading)  p. 242
7.2 The Nature of Light  p. 242
The Wave Nature of Light  p. 243
The Electromagnetic Spectrum  p. 245
Interference and Diffraction  p. 246
The Particle Nature of Light  p. 249
7.3 Atomic Spectroscopy and the Bohr Model  p. 253
Chemistry in Your Day – Atomic Spectroscopy, a Bar Code for Atoms  p. 257
7.4 The Wave Nature of Matter: The de Broglie Wavelength, the Uncertainty Principle, and Indeterminacy  p. 259
The de Broglie Wavelength  p. 260
The Uncertainty Principle  p. 261
Indeterminacy and Probability Distribution Maps  p. 263
7.5 Quantum Mechanics and the Atom  p. 264
Solutions to the Schrödinger Equation for the Hydrogen Atom  p. 264
7.6 The Shapes of Atomic Orbitals  p. 266
s orbitals (\( l = 0 \))  p. 267
p orbitals (\( l = 1 \))  p. 269
d orbitals (\( l = 2 \))  p. 270
f orbitals (\( l = 3 \))  p. 270
(Phase of Orbitals and the Hydrogen-like wave functions will not be covered)
7.7 Electron Configurations: How Electrons Occupy Orbitals  p. 274
Electron Spin and the Pauli Exclusion Principle  p. 275
Sublevel Energy Splitting in Multielectron Atoms  p. 276
Electron Configurations for Multielectron Atoms  p. 280
Electron Configurations of Transition Metals  p. 282
Electron Configurations and Magnetic Properties of Ions  p. 285

Chapter 8: Periodic Properties of the Elements  p. 294

8.1 Nerve Signal Transmission (Suggested Reading)  p. 295
8.2 The Development of the Periodic Table  p. 295
8.3 Electron Configurations, Valence Electrons, and the Periodic Table  p. 297
Orbital Blocks in the Periodic Table  p. 298
Writing an Electron Configuration for an Element from its Position in the Periodic Table  p. 299
The d-block and f-block Elements  p. 300
8.4 The Explanatory Power of the Quantum-Mechanical Model  p. 301
8.5 Periodic Trends in the Size of Atoms and Effective Nuclear Charge  p. 302
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Nuclear Charge</td>
<td>p. 304</td>
</tr>
<tr>
<td>Slater's Rules</td>
<td>p. 306</td>
</tr>
<tr>
<td>Atomic Radii of d-block Elements</td>
<td>p. 308</td>
</tr>
<tr>
<td>8.6 Ionic Radii</td>
<td>p. 309</td>
</tr>
<tr>
<td>8.7 Ionization Energy</td>
<td>p. 312</td>
</tr>
<tr>
<td>Trends in First Ionization Energy</td>
<td>p. 312</td>
</tr>
<tr>
<td>Exceptions to Trends in First Ionization Energy</td>
<td>p. 314</td>
</tr>
<tr>
<td>Ionization Energies of Transition Metals</td>
<td>p. 315</td>
</tr>
<tr>
<td>Trends in Second and Successive ionization Energies</td>
<td>p. 315</td>
</tr>
<tr>
<td>8.8 Electron Affinities and Metallic Character</td>
<td>p. 316</td>
</tr>
<tr>
<td>Electron Affinity</td>
<td>p. 317</td>
</tr>
<tr>
<td>Metallic Character</td>
<td>p. 317</td>
</tr>
<tr>
<td>8.9 Some Examples of Periodic Chemical Behaviour: The Alkali Metals,</td>
<td>p. 318</td>
</tr>
<tr>
<td>Halogens and Noble Gases</td>
<td>p. 319</td>
</tr>
<tr>
<td>The Alkali Metals (Group 1)</td>
<td>p. 320</td>
</tr>
<tr>
<td>The Alkaline Earth Metals (Group 2)</td>
<td>p. 321</td>
</tr>
<tr>
<td>The Halogens (Group 17)</td>
<td>p. 321</td>
</tr>
<tr>
<td>The Noble Gases (Group 18)</td>
<td>p. 322</td>
</tr>
<tr>
<td>Chemistry and Medicine – Potassium Iodide in Radiation Emergencies</td>
<td>p. 323</td>
</tr>
</tbody>
</table>

**Chapter 9: Chemical Bonding I: Lewis Theory  p. 330**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1 Bonding Models and AIDS Drugs <em>(Suggested Reading)</em></td>
<td>p. 331</td>
</tr>
<tr>
<td>9.2 Types of Chemical Bonds</td>
<td>p. 331</td>
</tr>
<tr>
<td>9.3 Representing Valence Electrons and Dots</td>
<td>p. 333</td>
</tr>
<tr>
<td>9.4 Lewis Structures: An Introduction to Ionic and Covalent Bonding</td>
<td>p. 334</td>
</tr>
<tr>
<td>Drawing Lewis Structures for Molecular Compounds</td>
<td>p. 334</td>
</tr>
<tr>
<td>Writing Lewis Structures for Polyatomic Ions</td>
<td>p. 337</td>
</tr>
<tr>
<td>Ionic Bonding and Electron Transfer</td>
<td>p. 338</td>
</tr>
<tr>
<td>9.7 Electronegativity and Bond Polarity</td>
<td>p. 350</td>
</tr>
<tr>
<td>Electronegativity</td>
<td>p. 351</td>
</tr>
<tr>
<td>Bond Polarity, Dipole Moment and Percent Ionic Character</td>
<td>p. 352</td>
</tr>
<tr>
<td>9.8 Resonance and Formal Charge</td>
<td>p. 355</td>
</tr>
<tr>
<td>Resonance</td>
<td>p. 355</td>
</tr>
<tr>
<td>Formal Charge</td>
<td>p. 357</td>
</tr>
<tr>
<td>9.9 Exceptions to the Octet Rule: Drawing Lewis Structures for</td>
<td>p. 360</td>
</tr>
<tr>
<td>Odd-Electrons Species and Incomplete Octets</td>
<td>p. 360</td>
</tr>
<tr>
<td>Odd-Electron Species</td>
<td>p. 360</td>
</tr>
<tr>
<td>Vacuum Cleaner</td>
<td>p. 360</td>
</tr>
<tr>
<td>Incomplete Octets</td>
<td>p. 360</td>
</tr>
<tr>
<td>9.10 Lewis Structures for Hypercoordinate Compounds (Expanded Octet)</td>
<td>p. 362</td>
</tr>
</tbody>
</table>

**Chapter 10: Chemical Bonding II: Molecular Shapes, Valence Bond Theory**
10.1 Artificial Sweeteners: Fooled by Molecular Shape (Suggested Reading)  p. 374
10.2 VSEPR Theory: The Five Basic Shapes  p. 374
   Two Electron Groups: Linear Geometry  p. 375
   Three Electron Groups: Trigonal Planar Geometry  p. 375
   Four Electron Groups: Tetrahedral Geometry  p. 376
   Five Electron Groups: Trigonal Bipyramidal Geometry  p. 377
   Six Electron Groups: Octahedral Geometry  p. 377
10.3 VSEPR Theory: The Effect of Lone Pairs  p. 378
   Four Electron Groups with Lone Pairs  p. 378
   Five Electron Groups with Lone Pairs  p. 380
   Six Electron Groups with Lone Pairs  p. 381
10.4 VSEPR Theory: Predicting Molecular Geometries  p. 383
   Predicting the Shapes of Larger Molecules  p. 384
10.5 Molecular Shape and Polarity  p. 386
   Chemistry in Your Day – How Soap Work  p. 389
10.6 Valence Bond Theory: Orbital Overlap as a Chemical Bond  p. 389
10.7 Valence Bond Theory: Hybridization of Atomic Orbitals  p. 392
   \( sp^3 \) Hybridization  p. 393
   \( sp^2 \) Hybridization and Double Bonds  p. 394
   \( sp \) Hybridization and Triple Bonds  p. 399
   Writing Hybridization and Bonding Schemes  p. 400

Chapter 11: Liquids, Solids, and Intermolecular Forces  p. 427

11.1 Climbing Geckos and Intermolecular Forces (Suggested Reading)  p. 428
11.2 Solids, Liquids and Gases: A Molecular Comparison  p. 428
   Changes Between States  p. 430
11.3 Intermolecular Forces: The Forces that Hold Condensed States Together  p. 431
   Ion-Induced Dipole Forces  p. 432
   Dispersion Force  p. 432
   Dipole-dipole- Force  p. 434
   Hydrogen Bonding  p. 437
   Dipole-Induced Dipole Forces  p. 439
   Ion-Dipole Force  p. 439
11.5 Vaporization and Vapour Pressure  p. 445
   The Process of Vaporization  p. 445
   The Energetics of Vaporization  p. 446
   Vapour Pressure and Dynamic Equilibrium  p. 448
11.6 Sublimation and Fusion  p. 455
   Sublimation  p. 455
Chapter 12: Solutions  p. 485

12.1 Thirsty Solutions: Why you Shouldn't Drink Seawater  
(Suggested Reading)  p. 485
12.2 Types of Solutions and Solubility  
Nature's Tendency Toward Mixing: Entropy  p. 487
The Effect of Intermolecular Forces  p. 488
12.4 Solution Equilibrium and Factors Affecting Solubility  p.495-496
12.5 Expressing Solution Concentration  
Molarity  p. 500
Molality  p. 501
Parts by Mass and Parts by Volume  p. 502
Mole Fraction and Mole Percent  p. 504
12.6 Colligative Properties: Vapour Pressure Lowering, Freezing Point Depression, Boiling Point Elevation, and Osmotic Pressure  p. 507
Vapour Pressure Lowering  p. 507-508
Freezing Point Depression and Boiling Point Elevation  p. 513
Osmotic Pressure  p. 516