

Lecture	Date	Chapter topics (McMurry and Fay, 2nd edition, General Chemistry, Atoms First)	
1	26-Aug	Syllabus and Course Outline	
		0.1 Experiment-Hypothesis-Theory	
		0.2 Experimentation and Measurement in Chemistry	
		0.3 Fundamental Units: Measuring Mass (typically m = mass but could be meters (context clue))	
		0.4 Fundamental Units: Measuring Length	
		0.6 Derived Units: Measuring Volume (V = volume and not V = voltage)	
		0.5 Fundamental Units: Measuring Temperature	
		0.7 derived Units: Measuring Density (apps of m and V)	
		start on significant figure guidelines (not rules) -- ALE to be collected -- collaborative or individual	
2	28-Aug	0.9 Accuracy, Precision and Significant Figures (Guidelines and PEMDAS)	
		0.10 Rounding Numbers	
		0.11 Converting from One Unit to Another (i.e., how many drams in a fluid ounce?)	
		1.1 Chemistry and the Elements	
		1.2 Elements and the Periodic Table	
		1.3 Some Common Groups of Elements and Their Properties	
Recitation	30-Aug	Dimensional Analysis (using formulae or derivations) -- turn in recitation ALEX for 0.5% FCG...	
	31-Aug	CH 00 Units and Measurements (MasteringChemistry online homework) -- 10 questions/problems	
	1-Sep	Labor Day (institute closed for R and R)	
		September 2 (Tuesday) -- Last day of 7-day Add/Drop period	
3	2-Sep	1.4 A bit of History: The Conservation of Mass and the Law of Definite Proportions	
		1.5 More History: The Law of Multiple Proportions and Dalton's Atomic Theory	
		1.6 The Structure of Atoms: Electrons	
		1.7 The Structure of Atoms: Protons and Neutrons	
		1.8 Atomic Numbers	
		1.9 Atomic Masses, Atomic Weights, and the Mole	
		1.10 Nuclear Chemistry: The Change of One Element into Another	
		1.11 Nuclear Change and Radioactivity	
4	4-Sep	Concentrations (using mass, volume, and molar mass -- density, molarity, mass percent and ppm)	
		What is m versus mm versus <u>m</u> versus <u>M</u> for amount of material? Are they related?	
		Molar Mass (Practice chapter "Worked Problems" WE 1.6 and 1.7) -- exam Qs always...	
Recitation	5-Sep	Chemical Proportions and apps of Chemical Communication (elemental names + symbols)	
	8-Sep	CH 01A structure and atom stability up to Ch.Sec 1.8 -- 20 questions/problems	

<b>5</b>	9-Sep	Weighted average applications: Course Average, Paychecks, Molar Mass of Rochester Air	
		Active Learning Exercise -- be there or be square...(Simple problem: WE 1.5, page 47)	
		2.1 The Nature of Radiant Energy and the Electromagnetic Spectrum	
		2.2 The Interaction of Radiant Energy with Atoms	
<b>6</b>	11-Sep	2.3 Particle like Properties of Radiant Energy	
		2.4 Wavelike Properties of Matter	
		2.5 Quantum Mechanics and the Heisenberg Uncertainty Principle	
		2.6 The quantum Mechanical Model of the Atom: Orbitals	
		2.7 Orbitals and their Shapes	
		2.8 A Fourth Quantum Number: Electron Spin and Pauli's Exclusion Principle	
<b>Recitation</b>	12-Sep	Quantum Numbers and Electron Configurations -- elements that behave	
	15-Sep	CH 01B Sec9 Moles to grams + Sec10/11 nuclear atom stability -- 10 questions/problems	
<b>7</b>	16-Sep	2.9 The Quantum Mechanical Model and Atomic Line Spectra	
		2.10 Orbital Energy Levels in Multielectron atoms -- relationship to quantum number and periods (rows)	
		2.11 Electron configurations in Multielectron Atoms (as elements and not ions)	
		ALE for quantum numbers -- should be collected -- work in pairs or as individuals	
<b>8</b>	18-Sep	2.12 Some Anomalous Electron Configurations (Hund's Rule and reshuffle to $4s^1 3d^5$ )	
		2.13 Electron Configurations and the Periodic Table	
		3.3 Electron Configurations of Ions (iron(II) versus iron(III) and others)	
		3.1 Ions, Molecules, and Chemical Bonds (metallic vs covalent and contrast with ionic bonds)	
		3.2 Naming Ionic Compounds (see list of recommended cations and anions for lab and lecture)	
		$Li_2CO_3$ and $NaHCO_3$ and $KOOCCH_3$ and $Mg(OH)_2$ and $NaClO$ and $NaCN$ and $Ca_3(PO_4)_2$ and $Na_2S$	
		Predicting ionic compounds based on family -- printing complete ionic equations (maybe net ionic...)	
<b>Recitation</b>	19-Sep	Electron Configurations (Good, Beautiful (Na, Ga, S, Ar) versus the Bad, Ugly (Fe, Co, Ni, Cu, Zn))	
	22-Sep	CH 02 Periodicity + Atomic Electronic Structure + Orbitals -- 24 questions/problems	
<b>9</b>	23-Sep	3.4 Ionic Radii	
		2.14 Electron Configurations and Periodic Properties: Atomic Radii	
		3.5 Removing an Electron from an Atom: Ionization Energy (like "oxidation")	
		3.6 Higher Ionization Energies	
		3.7 Adding an Electron to an Atom: Electron Affinity (like "reduction")	
<b>10 -- 9</b>	25-Sep	Exam.01 - Ch. 0, 1, 2 and 3.1/3.2 (name elements and their ionic compounds...atomic numbers 1-36)	
		Periodic Table and some conversion -- you need to memorize the "top basic ten conversions"	

<b>Recitation</b>	26-Sep	More nomenclature practice (ions, atoms, "molecules", compounds) -- Who are you?	
<b>11</b>	30-Sep	3.8 The Octet Rule (Guideline) for Main-Group Atoms (s and p block elements) -- duet concept also Expanded Octet "Rule" -- "octadecoctet" guidelines (especially for transition metal ions, P, S, Cl) Apps of the octet guideline and relationship to chemical stability (Is "NO" stable? "CO" stable?) 4.4 electronegativity (ionization energy, electron affinity, dissociation energy, polarity...Pauling's Scale)	
<b>12</b>	2-Oct	3.9 Ionic Bonds and the Formation of Ionic Solids 3.10 Lattice Energies in Ionic Solids -- one application of IE, EA, $D_{\text{diss}}$ , etc. for $\text{NaCl}_{(\text{s})}$ 3.11 Some Chemistry of the Group 1A Elements: Alkali metals 3.12 Some Chemistry of the Group 2A Elements: Alkaline <u>earth</u> metals Special families include pnictogens (5A) and chalcogens (6A) 3.13 Some Chemistry of the Group 7A Elements: Halogens 3.14 Some Chemistry of the Group 8A Elements: Noble or Inert Gases (when small monatomic)	
<b>Recitation</b>	3-Oct	Naming of Ionic Compounds (easy common household compounds vs " $\text{NH}_4\text{NaHPO}_4$ ") Start printing net ionic balanced notated chemical equations (math apps / chemical communication)	
<b>13</b>	7-Oct	4.1 Comparing Ionic and Molecular Compounds (but not alloys or metallic compounds) 4.2 Covalent Bond Formation 4.3 Strengths of Covalent Bonds 4.4 Polar Covalent Bonds: Electronegativity (C N O F and Si P S Cl) -- stability application 4.5 Naming Molecular Compounds 4.6 Electron-Dot Structures 4.7 Electron-Dot Structures of Compounds Containing only H and 2nd-Row Elements 4.8 Electron-Dot Structures of Compounds Containing Elements Below the 2nd Row	
<b>14</b>	9-Oct	4.9 Electron-Dot Structures and Resonance (and stability: more resonance, then more stable) 4.10 Formal Charges (and clues about stability; not ionic charge nor oxidation number charge) 5.1 Molecular Shapes: The VSEPR Model (challenge: molecular geometry versus orbital geometry) 5.2 Valence Bond Theory 5.3 Hybridization and $\text{sp}^3$ Hybrid Orbitals 5.4 Other Kind of Hybrid Orbitals ( $\text{sp}^3\text{d}$ and $\text{sp}^3\text{d}^2$ ) -- could we say $\text{s}^1\text{p}^3\text{d}^2$ for 6 sigma ( $6\sigma$ )?	
<b>Recitation</b>	10-Oct	Lewis Dot Structures (2D) and VSPER (3D) -- Who is the most stable? How can we predict?	
	14-Oct	Is this really a Monday schedule? YES...Tuesday becomes Monday this week only...majority rules...	

<b>15</b>	16-Oct	6.1 Chemical Symbols on Different Levels	
		6.2 Balancing Chemical Equations (molecular balance versus net ionic equation balance; distractions!)	
		6.3 Stoichiometry: The Arithmetic of Chemical Reactions (conservation of mass not moles)	
		6.4 Yields of Chemical Reactions	
		6.5 Reactions with Limiting Amounts of Reactants -- ALE to be collected -- collaborative or individual	
<b>Recitation</b>	17-Oct	Balancing equations and stoichiometry (always an exam Qs: 7 parts possible...)	
<b>16</b>	21-Oct	6.6 Percent Composition and Empirical Formulas	
		6.7 Determining Empirical Formulas (and Molecular Formulas)	
		6.8 Concentrations of Reactants in Solution: Molarity ( $M \cdot V = M \cdot V$ but be careful)	
		6.9 Diluting Concentrated Solutions ( $M_o \cdot V_o = M_f \cdot V_f$ )	
		6.10 Reaction Stoichiometry in Solutions	
		6.11 Finding the Concentration of a Solution: Titration (and apps of $n_b \cdot M_a \cdot V_a = n_a \cdot M_b \cdot V_b$ )	
<b>17</b>	23-Oct	7.1 Electrolytes in Aqueous Solution (who are weak and who are strong...some periodic trends? Yes!)	
		7.2 Some Ways That Chemical Reactions Occur	
		7.3 Aqueous Reactions + (harder) Net Ionic Equations -- ALE collected -- collaborative or individual	
<b>Recitation</b>	24-Oct	Percent Composition / Percent Reaction / Percent Completion / Stoichiometry practice More practice with reaction stoichiometry as in titration with monoprotic and diprotic or triprotic species	
<b>18 -- 8</b>	28-Oct	Exam.02 - Chapters 3.3 thru 6.5 (but consult Exam Study Guide questions, exercises, WE, MC, etc.)	
<b>19</b>	30-Oct	7.4 Precipitation Reactions and Solubility Guidelines (challenge and periodicity patterns)	
		7.5 Acids, Bases, and Neutralization Reactions (periodicity patterns and $n_b \cdot M_a \cdot V_a = n_a \cdot M_b \cdot V_b$ )	
		7.6 Oxidation-Reduction (Redox: LEO and GER) Reactions (and OAR and RAO)	
		Demonstration if time permits and maybe you will be treated or tricked?!	
<b>Recitation</b>	31-Oct	Reaction products, nomenclature, balancing equations (AMCE!) -- could be scary -- T & T	
<b>20</b>	4-Nov	7.7 Identifying Redox Reactions	
		7.8 The Activity Series of the Elements (and diagonal relationship)	
		7.9 Balancing Redox Reactions: The Half-Reaction Method (challenge!!!)	
		7.10 Redox Stoichiometry (could try the formula $nOAR \cdot M \cdot V = nROA \cdot M \cdot V$ )	
		7.11 Some Applications of Redox Reactions	

		0.8 Derived Units: Measuring Energy (joules or J, W or watts of power, BTU, calorie, Calorie, KE, PE)	
<b>21</b>	6-Nov	8.1 Energy and Its Conservation (for chemical reactions, nuclear reactions $\Delta E_{BE} = \Delta m \cdot c^2$ )	
		8.2 Internal Energy and State Functions ( $\Delta E = q + w$ , but heat flow and work are not state functions)	
		8.3 Expansion Work (one math example...but engineers may be disappointed...)	
		8.4 Internal Energy and Enthalpy (When does $\Delta E$ equal $\Delta H$ ?)	
<b>Recitation</b>	7-Nov	Balancing redox reactions(AMCE and V: expect challenges)-- acid media versus basic media...	
<b>22</b>	11-Nov	8.5 Calorimetry and Heat Capacity (constant pressure only ... $q_p = \Delta H_{rxn} = m \cdot s \cdot \Delta T$ is one option)	
		8.6 The Thermodynamic Standard State (1 atm, 1 molarity, 1 liter, 298 K, 1 mole, etc.)	
		8.7 Enthalpies of Physical and Chemical Change ( $q_p = m \cdot {}_D H_{phase\ change}$ )	
		8.8 Hess's Law (The possibilities... Type I, Type II and Type III) -- ice in your coffee...final temperature?	
		8.9 Standard Heats of Formation ( $\Delta H^0_{f, phase}$ ) and Hess' Law Type II and Type III	
<b>23</b>	13-Nov	8.10 Bond Dissociation Energies (one example comparison to enthalpy calculations...)	
		8.11 Fossil Fuels, Fuel Efficiency, and Heats of Combustion	
		8.12 An Introduction to Entropy (nonmathematical since CHMG142 covers entropy; conceptual!)	
		8.13 An Introduction to Free Energy (nonmathematical since CHMG 142 covers "energy available")	
<b>Recitation</b>	14-Nov	Calorimetry (typically at constant pressure; related directly to a complex CHMG 145 lab experiment!)	
		November 14 (Friday) -- Last day to drop from classes with a grade of "W"	
<b>24</b>	18-Nov	9.1 Gases and Gas Pressure	
		9.6 The Kinetic-Molecular Theory of Gases	
		9.2 The Gas Laws	
		9.3 The Ideal Gas Law (vs a real gas law model since air occupies space, less free volume to roam)	
		9.4 Stoichiometric Relationships with Gases -- ALE to be collected -- collaborative or individual	
<b>25</b>	20-Nov	9.5 Mixtures of Gases: Partial Pressure	
		9.7 Graham's Law: Diffusion and Effusion of Gases	
		9.8 The Behavior of Real Gases -- ALE to be collected -- collaborative or individual	
<b>Recitation</b>	21-Nov	Gas Laws (and relationship to a CHMG 145 laboratory experiment: Domodel correctly or Die?)	
<b>26</b>	25-Nov	10.1 Polar Covalent Bonds and Dipole Moments	
		10.2 Intermolecular Forces -- real gases "feel" neighbors	
		10.3 Some Properties of Liquids	
		10.4 Phase Changes (water and maybe carbon dioxide if time permits)	



		Tentative top questions for comprehensive final examinations that is only 2 hours long (45 minutes longer...)	
		1. unit conversions and dimensional analysis (ignoring significant figure guidelines; use 3-4 sigfig)	
		2. nomenclature (elements, atoms, ionic compounds and molecular compounds) -- most common	
		3. concentration (density, fraction percent, molarity, molality, mole fraction,pph, ppm, ppb)	
		Calculate the molarity, molality, and mole fractions for a solution that is 39.1% HCl...solution density of 1.19 g/cm <sup>3</sup> .	
		4. limiting reagent challenge problem (molar mass, moles of each component, who controls, final amount of a product)	
		5. electronic configuration of elements and ions (Aufbau Principle, Pauli Exclusion Principle and Hund's Rule (+reshuffle)	
		6. Lewis dot structure (2D) and formal charge calculation (check for stability)	
		7. VSEPR (3D) and links to hybridization, molecule stability, polarity and solubility (challenge problem)	
		8. Gas Law computations (using ideal gas law and real gas law to compare how nonideal)	
		9. Henry's Law computation as related to the solubility of an ideal gas in a solvent (CO <sub>2</sub> in water) at various temperatures	
		10. Colligative property short Qs (boiling point, freezing point, vapor pressure of water, osmotic pressure ... 0.9 <u>m</u> NaCl <sub>(aq)</sub> )	
		11. Compare phase diagram of water to carbon dioxide...	
		12. Calculate the heat flow for an ice cube placed on your tongue.	
		13. Calculate the number of power bars required to provide energy for a studious student during finals week.	
		14. Balance a variety of chemical equations involving combustion, metathesis, displacement/replacement, synthesis...	
		(such as precipitation, acid-base, oxidation/reduction, or complexation situation in the CHMG 145 laboratory).	
		15. Utilize the periodic table to predict the stability of a proposed compound.	
		16. Predict whether a potential redox reaction should occur (based on The Activity Series of Metals, which would be supplied).	
		17. Be able to utilize the generic formula $M \cdot V = M \cdot V$ for precipitation, acid/base reaction or dilution.	
		Ignore complexation and redox reactions.	
		18. Lots of definitions utilizing "true or false" style or fill-in. (Could be simple or multilayered.) No multiple guess.	
		Typically 40-50% of this final should look quite familiar (base on MC, WE, inclass, or previous exam Qs),	
		Priorities for studying	
		1. Past exams including last years	
		2. Worked Example problems in the text	
		3. Lecture problems	
		4. MasteringChemistry exercises and problems (may be directly related to past exams...)	
		5. Other recommended problems at the end of the chapter that are directly related to lecture coverage...	