**Professional Education Unit**
Biology and Chemistry

**Chemistry 112-001: Principles of Chemistry II (face to face)**

**9 a.m.MWF, 130 Lappin Hall**


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**Course Description:** *Prerequisite: MATH 152 or 174 with grade "C" or better, or ACT math score of 22 or higher, and grade of "C" or better in CHEM 111*. Continuation of CHEM 111. An introduction to chemical equilibria, thermodynamics, and kinetics, electro-chemistry, and coordination compounds, with laboratory. The descriptive chemistry of selected groups of elements is introduced.

**Lab is co-requisite, you must pass laboratory and lecture independently to pass CHEM 112.**

**A score of 60 or below, missing two lab periods, not turning in two lab reports leads to a failing grade for CHEM112L. A score of 55 or below in lecture will lead to a failing grade for CHEM 112.**

**Required Field Experience Hours:** 0

***"Community Engagement: A Light to and from the Mountains"***

*The Professional Education Unit at Morehead State University delivers rigorous, high quality programs that prepare professionals informed by best national and international scholarship, plus research, literature, and experiences specific to Appalachia- preparing professionals to improve the schools, quality of life, and the communities in which they live and serve. This statement is not only the strategic mission for the College, but it also incorporates the conceptual framework that guides all our activities.*

**Conceptual Framework Outcomes (CFOs):**

The Unit and the faculty within individual programs assess the degree to which its graduates:

1) Master the content knowledge, professional and the twenty – first century skills need to make an optimal contribution to "whole" student learning in education settings.

2) Are competent in the collection and use of data to inform decision – making and to demonstrate accountability for student learning.

3) Demonstrate professional dispositions

4) Are culturally competent and understand the regions from which they have come utilizing knowledge and experiences to effectively "bridge the gaps" (economic, achievement, and geographic) ensuring optimal learning for all students.

5) Engage in authentic field experiences in collaboration with committed school – based partners and are empowered to improve the quality of education throughout this region and beyond.

**Student Learning Outcomes (SLOs):** By the end of this course, the candidate will be able to:

1) Name and identify elementary hydrocarbons.

2) Differentiate between the effects of colligative properties.

3) Find and predict equilibrium concentrations for chemical reactions.

4) To identify reaction types and predict the products given the initial reactants.

5) Identify acids and bases and use pH to be able to calculate equilibrium and complete concentrations.

6) Understand enthalpy, entropy and free energy and use these thermodynamic properties to predict if a reaction is spontaneous.

7) Identify reaction orders and understand factors that influence reaction rates.

8) Differentiate nuclear fission and fusion and know the characteristics of types of radioactivity in real-life applications.

**NCATE/ EPSB Accreditation Alignment of CFOs and SLOs:**

| **Program:** | **Secondary Chemistry Education** | | **Principles of Chemistry II** | | |
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| **Aligned with →**<br><br>**Assessment ↓ (point values)** | **Kentucky Teacher Standards (KYS)** | **Kentucky Program of Studies-Science (POS)** | **Education Professional Standards Board (EPSB)** | **National Science Teachers Association (NSTA)** | **National Council for Accreditation of Teacher Education (NCATE)** |
| Test 1, 100 pts<br>CFO: 1<br>SLO: 1, 2, 3, 4 | 1 | SC-H-STM-S-9 | 1 | 1.C.3a.1<br>1.C.3a.6 | 1 |
| Test 2, 100 pts<br>CFO: 1<br>SLO: 3, 5 | 1 | SC-HS-1.1.6 | 1 | 1.C.3a.6<br>1.C.3a.7<br>1.C.3a.8 | 1 |
| Test 3, 100 pts<br>CFO: 1<br>SLO: 4, 6, | 1 | SC-HS-1.1.8<br>SC-H-STM-U-7<br>SC-H-STM-U-8<br>SC-H-ET-S-1<br>SC-H-ET-S-9<br>SC-H-ET-U-2<br>SC-HS-4.6.11 | 1 | 1.C.3a.4<br>1.C.3a.5<br>1.C.3a.6<br>1.C.3a.8 | 1 |
| Test 4, 100 pts<br>CFO: 1<br>SLO: 7, 8 | 1 | SC-HS-4.6.11<br>SC-HS-ET-S-1 | 1 | 1.C.3a.4<br>1.C.3a.6 | 1 |
| Final Exam, 100pts<br>CFO: 1<br>SLO: 1, 2, 3, 4, 5, 6, 7, 8 | 1 | | 1 | | 1 |
| Chemiluminescence: Oxidation of Luminol, 100pts<br>CFO: 1<br>SLO: | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.6<br>1.C.3a.8 | 1 |
| Organic Structural Formulas and Naming, 100pts<br>CFO: 1<br>SLO: 1 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.1 | 1 |
| Intermolecular Forces and Boiling Points, 100pts<br>CFO: 1<br>SLO: 2 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15<br>SC-HS-1.1.5 | 1 | | 1 |
| Net Ionic Equations, 100pts<br>CFO: 1<br>SLO: 4 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.6<br>1.C.3a.8 | 1 |

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| Acid/Base Lab Practical, 100pts<br>CFO: 1<br>SLO: 5 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.6<br>1.C.3a.8 | 1 |
| LeChatelier's Principle, 100pts<br>CFO: 1<br>SLO: 3 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.6 | 1 |
| Copper in a Penny by Inductively Coupled Plasma, 200pts<br>CFO: 1<br>SLO: | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.6<br>1.C.3a.8 | 1 |
| Thermodynamics and Copper(II) to en Bonding, 100pts<br>CFO: 1<br>SLO:6 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.4<br>1.C.3a.6<br>1.C.3a.7<br>1.C.3a.8 | 1 |
| Titration of an Unknown iron(II) Solution, A Lab Practical, 100pts<br>CFO: 1<br>SLO:4 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.6<br>1.C.3a.8<br>1.C.3a.5 | 1 |
| Redox Reactions, 100pts<br>CFO: 1<br>SLO: 4 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.6<br>1.C.3a.8<br>1.C.3a.5 | 1 |
| Rate Law for Bleaching of Crystal Violet by NaOH, 200pts<br>CFO: 1<br>SLO:7 | 1 | SC-HS-1.1.6<br>SC-H-STM-U-9<br>SC-H-STM-S-15 | 1 | 1.C.3a.6<br>1.C.3a.8<br>1.C.3a.4 | 1 |
| Radiochemistry, 100pts<br>CFO: 1<br>SLO:8 | 1 | SC-H-STM-U-9<br>SC-H-STM-S-15<br>SC-H-ET-U-1 | 1 | | 1 |

**Assignment Descriptions:**

| **Program:** | **Secondary Chemistry Education** **Principles of Chemistry II** |
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| **Assessment (point value)** | **Description** |
| Test 1, 100pts | 1 hour open response, over<br><br>Elemental carbon and Hydrocarbons, Hydrocarbon nomenclature, Functional groups; polymers; review IMF, Solutions, LABOR DAY, Solution Concentrations, Vapor pressure; colligative properties, Reaction Types I, Reaction Types II, Intro to More Equilibrium; Le Chatelier's Principle, Equilibrium Constants and Their Use; Finding Equil. Composition |
| Test 2, 100pts | 1 hour open response, over<br><br>Predicting Direction of Reaction; Getting New K's from other K's and Reaction Equations, common Ion Effect; Will a Precipitate Form?; Ka* Kb = Kw ; Acid-base reactions with a strong reactant; finding the K value, Logs and pH; pH of solutions of acids and bases (no mixing), pH when solutions are mixed; buffers and pH; solubility and pH, Complex Ions and Crystal Field Theory; Uses of Complex Ions |
| Test 3, 100pts | 1 hour open response, over<br><br>Ligands and Solubility; 2nd Law of Thermodynamics, spontaneity, entropy and its increase/decrease; calculating $\Delta S$, The 2nd law of thermo and Gibbs energy; Signs of $\Delta H^o$, $\Delta S^o$, $\Delta G^o$; Calculating $\Delta G^o$ , Gibbs "Free" energy; Oxidation-reduction Reactions, Balancing redox equations; start electrochemical cells; Relative strengths of "agents"; predicting redox reactions; E and kinetics;Nernst equation, Concentration cells, voltage and K; LCP and changes in E; Electrolysis |
| Test 4, 100pts | 1 hour open response, over<br><br>Rate of reaction; rate law; initial rate method, Integrated rate laws; half-lives, Temperature and rate constant, collision theory, Mechanisms, Nuclear chemistry; types of radioactivity and nuclear reactions; kinetics, THANKSGIVING, Nuclear Power, Introduction to Polymers |
| Final exam, 100pts | Final exam is comprehensive from the material from tests 1-4 listed above, multiple choice |
| Lab Reports, ~25-100pts each | Data acquisition, appropriate data analysis, and evidence based conclusion |
| Homework, ~10-80pts each | Practice problem solving for example: finding and equilibrium constant. |
| Quizzes, ~5-15pts each | Reading comprehension quizzes, vocabulary and conceptual understanding |

## Grading Scale:

**Overall course grades are assigned as:**
>85% = A, 75 – 84% = B, 65 – 74% = C , 55 – 64% = D, <55% = E

**Homework**: You will be using the WebAssign program online. The semester cost is ~$20 (credit/debit card)

**Quizzes** are unannounced. There may be as many as two per week or less. The quizzes will cover any previous material from lecture or readings. The quizzes can only be taken at the beginning of class anyone late to class will not be allowed to take the quiz.

**Test,** you absolutely must show up for exams at the scheduled time. **There are no makeup exams**.
The final exam is the Comprehensive, Std. ACS second semester.

**Grade Evaluation:**
quizzes-homework 20 %, lab 25 %, hour exams 40 %, final exam 15 %

## Required Textbooks:
The text is "Chemistry: A Molecular Approach, *Nivaldo Jose Tro"* ISBN(9780131000650) get it.

You will also need a lab manual, lab note book, goggles, and apron for laboratory, the manual and apron can be picked up from the SAACS club in LA 426, Cash or Check (hours and cost will be posted outside the door).

The lab manual must be purchased from the ACS Affiliates (Lappin 426) before your lab section meets. Safety glasses or goggles and a lab apron are required.

## Course Evaluation:

Criterion referenced

## Attendance Policy:

You must be present in order to participate there are no make-up opportunities for quizzes, tests, homework assignments and lab reports.

## Academic Honesty:

Cheating, fabrication, plagiarism or helping others to commit these acts will not be tolerated. Academic dishonesty will result in severe disciplinary action including, but not limited to, failure of the student assessment item or course, and/ or dismissal from MSU. If you are not sure what constitutes academic dishonesty, read the Eagle: Student Handbook or ask your instructor. An example of plagiarism is copying information from the internet when appropriate credit is not given. The policy is located at
http://morehead-st.edu/units/studentlife/handbook/academicdishonesty.html

**Americans with Disabilities Act (ADA):**

In compliance with the ADA, all students with a documented disability are entitled to reasonable accommodations and services to support their academic success and safety. Though a request for services may be made at any time, they are best applied when requested at or before the start of the semester. To receive accommodations and services the student should immediately contact the Disability Services Coordinator at: 204-E ADUC, 606-783-5188, or e.day@moreheadstate.edu

**Campus Safety Statement:**

Emergency response information will be discussed in class. Students should familiarize themselves with the nearest exit routes in the event evacuation becomes necessary. You should notify your instructor at the beginning of the semester if you have special needs or will require assistance during an emergency evacuation. Students should familiarize themselves with emergency response protocols at http://www.moreheadstate.edu/emergency

**COURSE CALENDER** Chemistry 112 F 2011

| | Date | Topics | Vocabulary--learn definitions before class date listed.<br><br>For terms separated by "vs", learn the definition of both terms and also explain the difference between them. | Reading Pages (read before class); N means in lab manual notes |
|---|---|---|---|---|
| M | 8/22 | Quick and dirty review | Important topics from 111 | |
| W | 24 | Elemental carbon and Hydrocarbons | Allotrope, activated carbon, fullerene, nanotube; structural isomers, optical isomers, chiral, skeleton formula, structure, condensed structure; alkane, alkene, alkyne | 999-top 1002; 902-911 |
| F | 26 | Hydrocarbon nomenclature | Know generic formulas of alkane, alkene, alkyne and know table 20.5; saturated hydrocarbon, unsaturated hydrocarbon, aromatic compounds; cis & trans isomers | 912-918, 920-921, 924-925, 927 |
| M | 29 | Functional groups; polymers; review IMF | Functional group, carboxylic acid, alcohol, ester, ether, amine, amide, ketone, aldehyde (know table given in class for functional groups); polymer; hydrogen-bonding, dipole-dipole attractions, dispersion forces, ion-dipole | 927-928, 934-936, 938-940, 465-477 |
| W | 31 | Solutions | Solution, solute, solvent, solubility, entropy, miscible, enthalpy of hydration, dynamic equilibrium, saturated, unsaturated, supersaturated, recrystallization, Henry's Law, concentrated; colloid | 520-535, 557-559 |
| M | 9/5 | LABOR DAY | | |
| W | 9/7 | Solution Concentrations | Molarity, molality; parts by mass, parts by volume (ppt, ppm, ppb); mole fraction | 535-540 |
| F | 9 | Vapor pressure; colligative properties | Raoult's Law, colligative property, vapor pressure of solution, freezing point depression, boiling point elevation, osmosis, osmotic pressure | 540-545, 548-556 |
| M | 12 | Reaction Types I | Precipitate, precipitation, solubility rules, net ionic equation; acids, bases, and neutrals (recognize) | N1-N12 |
| W | 14 | Reaction Types II | Reactions of Acids and Bases; Complex Ions | N12-N13 |

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| M | 19 | Intro to More Equilibrium; Le Chatelier's Principle | Intensive property, Le Chatelier's Principle, "equilibrium shifts right", "equilibrium shifts left" | N17-N19; 646-652 |
| W | 21 | Equilibrium Constants and Their Use; Finding Equil. Composition | Law of Mass Action, equilibrium constant, position of equilibrium; know the approximate K values for: reaction essentially complete, well to the right, very little reaction, essentially no reaction; be able to explain when it is OK to "neglect x" | N20-26 |
| F | 23 | **Exam 1** | | |
| M | 26 | Predicting Direction of Reaction; Getting New K's from other K's and Reaction Equations | Reaction Quotient (how is this different from K?); Acidity Constants, Basicity Constants, Solubility Product Constant (how are these three different than just K?) | N26-N29 |
| W | 28 | Common Ion Effect; Will a Precipitate Form?; $K_a * K_b = K_w$; Acid-base reactions with a strong reactant; finding the K value | Common Ion Effect; conjugate acid-base pair; $K_w$ | N30-N34; N37-38; N40-42; N:44-47 (up to pH) |
| M | 10/3 | Logs and pH; pH of solutions of acids and bases (no mixing) | pH | N47-N51; text 679-685, 687-690 |
| W | 5 | pH when solutions are mixed; buffers and pH; solubility and pH | Buffer; Henderson-Hasselbach equation | N51-57 |
| F | 7 | Complex Ions and Crystal Field Theory; Uses of Complex Ions | Complex ion, ligand, lewis base, coordination compound, formation constant, counterion, coordination number, monodentate, bidentate, polydentate; crystal-field splitting, strong-field ligand, weak-field ligand, complementary color, diamagnetic, paramagnetic; understand the meaning of the order of the spectrochemical series list | Text, pp. 759-763, 1050-1053, 1056-1059, 1067-1072; 1073-1077 |
| M | 10 | Catch-up and Review | | |
| W | 12 | **Exam 2** | | |
| | | Oct. 13-14 FALL BREAK | | |

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| M | 17 | Ligands and Solubility; 2nd Law of Thermodynamics, spontaneity, entropy and its increase/decrease; calculating $\Delta S$. | 2nd Law of Thermodynamics; spontaneous reaction (will do this one in class), enthalpy, endothermic, exothermic, entropy | N60-61; 774-785, 793-797 |
| W | 19 | The 2nd law of thermo and Gibbs energy; Signs of $\Delta H^o$, $\Delta S^o$, $\Delta G^o$; Calculating $\Delta G^o$ | Surroundings, system, universe; standard Gibbs Free Energy | 785-792, 797-802 |
| F | 21 | Gibbs "Free" energy; | Standard conditions, nonstandard Gibbs Energy, $\Delta G^o$ and K; T and K | 803-809 |
| M | 24 | Oxidation-reduction Reactions | Oxidation, reduction, redox, oxidizing agent, reducing agent; oxidation numbers | N66-68 |
| W | 26 | Balancing redox equations; start electrochemical cells; | Half-reaction, potential, voltage, electrochemical cell, standard cell potential | N68-71<br>N72-75 |
| M | 31 | Relative strengths of "agents"; predicting redox reactions; E and kinetics;Nernst equation | **LAST DAY TO DROP/ADD IS Nov. 1** | N75-82 |
| W | 11/2 | Concentration cells, voltage and K; LCP and changes in E; Electrolysis | Electrolysis; galvanic cell, electrolytic cell | Text 839-842, N82-N83(stop at section G); N85 (summary); N87-88 |
| F | 4 | Catch-up and Review | | |
| M | 7 | **Exam 3** | | |
| W | 9 | Rate of reaction; rate law; initial rate method | Reaction rate, average reaction rate, instantaneous reaction rate, rate law, rate constant, order of reaction, method of initial rates | Text 569-579 |
| M | 14 | Integrated rate laws; half-lives | Integrated rate laws (how do they look different than rate law we did before, what variables are in the equation?); half-life | 580-587 |

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| W | 16 | Temperature and rate constant, collision theory | Arrhenius equation, transition state, collision theory; reaction diagrams | 587-594 |
| F | 18 | Mechanisms | Mechanism, rate determining step, elementary step, catalyst, enzyme | 594-604; N97-100, #3 on N101 and #5 on N101; |
| M | 21 | Nuclear chemistry; types of radioactivity and nuclear reactions; kinetics | Radioactive, mass number, alpha particles, beta particles, gamma rays, positron emission, electron capture, half-life | Text 864-874, 875-879 |
| | | **Nov. 23-25 THANKSGIVING** | | |
| M | 28 | Nuclear Power | Fission, fusion, mass defect, chain reaction, critical mass | 883-890 |
| W | 30 | Introduction to Polymers | monomer, polymer, crystalline, amorphous, cross-linking, condensation reactions; addition reactions; ester, alcohol, amine, amide, protein, starch, cellulose | |
| F | 12/2 | **Exam 4** | | |
| M | 5 | Intro Biochemistry-lipids | Lipids, fats, oils, fatty acid, saturated, monounsaturated, polyunsaturated, triglyceride, phospholipid, lipid bilayer, steroid | 955-961, |
| W | 7 | | | |
| **Dec. 13, 8 am Final Exam** | | | **ACS Standardized** | |