PITTSBURG STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES
DEPARTMENT OF Chemistry
Chem 215-01: General Chemistry I
Spring 2019
Course Intended for Partial Fulfillment of the Pitt State Pathway Curriculum

LECTURE: 8:00-8:50 AM MWF; 102 Yates
INSTRUCTOR and EMAIL: Dr. K. Siam: ksiam@pittstate.edu
OFFICE: 307 Yates Hall Room 301
OFFICE HOURS: MWF 10:00 AM-12:00 PM or By Appointment

PITT STATE PATHWAY

Mission Statement

The Pitt State Pathway curriculum serves as the heart of the university education by fostering interdisciplinary competencies that typify the educated person. It is designed to facilitate the development of key proficiencies including communication and information literacy. The Pitt State Pathway curriculum provides a transformational experience that challenges students to think creatively and critically, and to immerse themselves in the productive examination of humans in their global setting. By encouraging the development of skills that promote life-long learning, the Pitt State Pathway fosters a sense of personal responsibility, an appreciation of diversity, and an understanding of interconnectedness in our truly global society.

Pitt State Pathway Pillars to Be Covered in This Course

QUANTITATIVE/ANALYTIC METHODS AND SCIENTIFIC LITERACY

1. To *apply* methods of scientific inquiry and problem solving;
2. To ***apply*** a set of formal tools (e.g., logical or statistical inference, probability, or mathematical analysis) to draw valid conclusions.

Objective 1: Understanding of Matter, Measurements, Atomic Composition and Chemical Compound Nomenclature.

Learning Outcome:

1. Students will be able to classify matter as a pure substance or a mixture and will be able to distinguish between physical and chemical properties, physical and chemical changes. They will be able to identify SI units of measurements for the various physical properties and carry out unit conversions using dimensional analysis. Students will also be able to assess the level of precision and accuracy in a given set of measurements and use significant figures to express precision in calculations. Students will also able to address questions relating to the composition of atoms and carry out calculations involving the

determination of the number of protons, electrons and neutrons in a given isotope and be able to use isotopic masses and natural abundance to calculate the average atomic masses.

2. Students will be able to name ionic, covalent compounds as well as binary and oxoacids from a given chemical formula and write the chemical formulas of those compounds from a given name.

Objective 2: An understanding of the quantitative concepts associated with calculating amounts of elements and compounds

Learning Outcome:

1. Students will be able to calculate molar masses of compounds, and use the molar masses and Avogadro's number to conduct mass to mole to number of formula unit or atom conversions. Students will be able to calculate the mass percent of an atom in a given compounds and will be able to use atomic mass percent to determine empirical and molecular formulas of compounds.

Objective 3: Understand different types of chemical reactions and understand properties of aqueous solutions.

Learning Outcome:

1. Students will be able to balance chemical equations and to use these equations to carry out simple stoichiometric and limiting reactant calculations to determine theoretical and percent yield of a given product.

2. Students will able to identify precipitation reactions, acid base reactions, oxidation reduction reactions and combustion reactions. They will be able to write molecular, total ionic and net ionic equations for those reactions. Students will also be able to balance redox reactions in aqueous solutions using the half-reaction method.

3. Using the concept of equivalence point in an acid base reaction, students will be able to carry out stoichiometric calculations involving acid-base titration.

4. Students will be able to calculate molarities of aqueous solutions. They will be able to identify electrolytes and nonelectrolytes and will be able to calculate molarities of ions in an aqueous solution of an electrolyte.

Objective 4: Understand properties of gases.

Learning Outcome:

1. Students will be able to carry out quantitative calculations using Boyles Law, Charles' Law, Avogadro's Law, Dalton's Law, and the Ideal Gas Law. They will be able to calculate the molar mass of a gas and its density given from a given set of physical properties. They will be able to carry out stoichiometric calculations of reactions involving gases.

2. Students will be able to identify the postulates of the kinetic and molecular theory of gases and carry out calculations of the root mean square velocity of gases as well as use Graham's law to calculate ratios of effusion or diffusion of two gases.

Objective 5: Understand the basics of thermochemistry.

Learning Outcome:

1. Students will be able to carry out calculations involving exchange of heat between different parts of the system in a coffee-cup calorimeter. They will be able to carry out calculations involving the first law of thermodynamics.

2. Students will be able to write formation reactions and understand the definition of heat of formation. They will be able to calculate enthalpies of reactions from standard enthalpy of formations and using Hess's law. Students will be able to distinguish between an exothermic reaction and an endothermic reactions and be able to perform stoichiometric calculations involving thermochemical reactions.

Objective 6: Basic understanding of electromagnetic radiation, the quantization of the energy levels of the atom, and the shapes and properties of atoms and molecules.

Learning Outcome:

1. Students will be able to carry out calculations involving the energy of a photon, its wavelength and its frequency. Using the Bohr model, students will be able to carry out energy calculations involving transitions of a hydrogen atom electron.

2. Students will be to determine the various quantum numbers associated with a given principle energy level. Using the Aufbau principle along with the Pauli exclusion principle and Hund's rule, students will be able to write the ground state electron configurations of the main group elements and their ions.

3. Using trends in the periodic table, students will be able to rank atoms in order of increasing atomic size, electronegativity, electron affinity and ionization energy.

Students will be able to draw Lewis structures for simple molecules and using the Valance Shell Electron Pair Repulsion Theory, they will be able to predict to predict molecular shapes of these molecules. Students will be able to use the molecular shapes of molecules to predict whether these molecules are polar or nonpolar.

Pitt State Companion Element to Be Covered in This Course
Scientific Inquiry

The scientific method is the systematic approach to understanding the foundations of science and the experimental nature to guide such an inquiry. Students will apply the skills both qualitative and quantitative to explain observations made while performing experiments or given experimental data to interpret.

Competency in this element means:

- Interpreting data, charts, observations;
- Analyzing data from multiple sources;
- Communicating scientific results orally or in writing.

Methods of Assessment:

Homework, Quizzes, In-Class Activities and Exams

Learning Outcomes:

1. Students will be able to classify matter as a pure substance or a mixture and will be able to distinguish between physical and chemical properties, physical and chemical changes. They will be able to identify SI units of measurements for the various physical properties and carry out unit conversions using dimensional analysis. Students will also be able to assess the level of precision and accuracy in a given set of measurements and use significant figures to express precision in calculations. Students will also able to address questions relating to the composition of atoms and carry out calculations involving the determination of the number of protons, electrons and neutrons in a given isotope and be able to use isotopic masses and natural abundance to calculate the average atomic masses.

2. Students will be able to name ionic, covalent compounds as well as binary and oxoacids from a given chemical formula and write the chemical formulas of those compounds from a given name.

3. Students will be able to calculate molar masses of compounds, and use the molar masses and Avogadro's number to conduct mass to mole to number of formula unit or atom conversions. Students will be able to calculate the mass percent of an atom in a given compounds and will be able to use atomic mass percent to determine empirical and molecular formulas of compounds.

4. Students will be able to balance chemical equations and to use these equations to carry out simple stoichiometric and limiting reactant calculations to determine theoretical and percent yield of a given product.

5. Students will able to identify precipitation reactions, acid base reactions, oxidation reduction reactions and combustion reactions. They will be able to write molecular, total ionic and net ionic equations for those reactions. Students will also be able to balance redox reactions in aqueous solutions using the half-reaction method.

6. Using the concept of equivalence point in an acid base reaction, students will be able to carry out stoichiometric calculations involving acid-base titration.

7. Students will be able to calculate molarities of aqueous solutions. They will be able to identify electrolytes and nonelectrolytes and will be able to calculate molarities of ions in an aqueous solution of an electrolyte.

8. Students will be able to carry out quantitative calculations using Boyles Law, Charles' Law, Avogadro's Law, Dalton's Law, and the Ideal Gas Law. They will be able to

calculate the molar mass of a gas and its density given from a given set of physical properties. They will be able to carry out stoichiometric calculations of reactions involving gases.

9. Students will be able to identify the postulates of the kinetic and molecular theory of gases and carry out calculations of the root mean square velocity of gases as well as use Graham's law to calculate ratios of effusion or diffusion of two gases.

10. Students will be able to carry out calculations involving exchange of heat between different parts of the system in a coffee-cup calorimeter. They will be able to carry out calculations involving the first law of thermodynamics.

11. Students will be able to write formation reactions and understand the definition of heat of formation. They will be able to calculate enthalpies of reactions from standard enthalpy of formations and using Hess's law. Students will be able to distinguish between an exothermic reaction and an endothermic reactions and be able to perform stoichiometric calculations involving thermochemical reactions.

12. Students will be able to carry out calculations involving the energy of a photon, its wavelength and its frequency. Using the Bohr model, students will be able to carry out energy calculations involving transitions of a hydrogen atom electron.

13. Students will be to determine the various quantum numbers associated with a given principle energy level. Using the Aufbau principle along with the Pauli exclusion principle and Hund's rule, students will be able to write the ground state electron configurations of the main group elements and their ions.

14. Using trends in the periodic table, students will be able to rank atoms in order of increasing atomic size, electronegativity, electron affinity and ionization energy.

TEXT: "Chemistry" by Nivaldo J. Tro, Fourth Edition **with the Modified MasteringChemistry Card**. The best way to buy the text is as the loose-leaf form in a package with the Modified Mastering Card from the PSU bookstore. To save money you can buy the ebook package with the Modified Mastering Card from the PSU bookstore.

ONLINE HOMEWORK: Homework will be carried out and graded through CANVAS using the "Modified MasteringChemistry Card" You are required to buy this resource and use it for the first homework due during the second week of class. The homework will be accessed through **My Lab & Mastering** on CANVAS.

COURSE DESCRIPTION: CHEM 215 is an introduction to calculations, atomic structure, atomic periodicity, molecular bonding, chemical reactions, and gases. An introductory course for students planning a science major.

PREREQUISITES: Students must have a score of at least 20 on the math portion of the ACT or they must have passed either CHEM 105 or MATH 113. CHEM 216 General Chemistry Laboratory is a corequisite (or prerequisite) although it is a separate course. If you drop CHEM 215 any time during the semester, you are required to drop the CHEM 216 lab and vice versa.

CANVAS: Power Point slides used in class will be available on "CANVAS". The syllabus, test keys, quiz keys, test grades and quiz grades will be posted on CANVAS. Grade averages calculated by CANVAS are only approximate—official averages will be determined at the end of the course.

GRADES: Grades will be based on 4 hour exams, quizzes, a final exam, attendance, and homework problems. Quizzes should be expected on the day homework assignments are due. The quizzes are designed to see how well you understood the homework assignment.

4 Hour Exams .....45 %
Quizzes.....15 %
Homework.....15 %
Attendance ..... 5 %
Final Exam.....20 %

Your final course grade will be based on the following scale:

85 to 100 percent.....A
70 to 84.9 percent.....B
55 to 69.9 percent.....C
40 to 54.9 percent.....D

ATTENDANCE: Your attendance will be recorded at various times and this attendance record will be used to determine 5% of your grade. Absences will be considered excused only for documented illness or exceptional circumstances which generally must be reported prior to the absence. Absences for university sponsored events must be reported as early in the semester as possible. Absences will be considered unexcused if there appears to be any delay in reporting the reason for the absence. Make-up exams may be given for excused absences. No make-up quizzes will be offered but the quiz average may be adjusted for an excused absence.

ACADEMIC HONESTY: Academic dishonesty on any exam, quiz, or assignment will result in an "F" for the exam, quiz, or assignment. A second offense will result in a grade of "F" or "XF" for the course. In all cases, proper due process consistent with the "Code of Students' Rights and Responsibilities" will be followed.

The PSU Academic Honesty and Integrity policy is found online at

http://catalog.pittstate.edu/contentm/blueprints/blueprint_display.php?bp_listing_id=162&blueprint_id=124&sid=1&menu_id=7980

SYLLABUS SUPPLEMENT: The PSU Spring 2018 syllabus supplement may be found online at:

https://www.pittstate.edu/registrar/_files/documents/syllabus-supplement-spring-2019-updated-10-5-18-.pdf

CALCULATORS and CELL PHONES: Everyone should have a basic scientific calculator that carries out basic math, trig, and log operations but has limited memory (about $10). This calculator can be used on all quizzes and exams. The use of advanced calculators (or computers) with graphing or alphabet capabilities should not be used on quizzes or exams. Calculators cannot be shared during a quiz or exam unless approval is obtained from the instructor. Cell phones may not be used during a quiz or test—you may be asked to leave your cell phone in the front of the room during a test. No smart watches or any other electronic device for communication, photography, data storage, etc. are allowed during any quiz or test.

TENTATIVE SCHEDULE:

Week	Dates	Chapter/Exam	
1	Jan 14--18	1	
2	Jan 23--25	2	
3	Jan 28--Feb 1	2	
4	Feb 4--8	3	
	Feb 8	**Exam 1**	**(Friday)**
5	Feb 11--15	3	
6	Feb 18--22	4	
7	Feb 25—Mar 1	4	
8	Mar 4--8	5	
	Mar 8	**Exam 2**	**(Friday)**
9	Mar 11--14	**Spring Break**	
10	Mar 18—22	5	
11	Mar 25--29	5,6	
12	April 1--5	6	
	April 5	**Exam 3**	**(Friday)**
13	Apr 8--12	6	
14	Apr 15--19	7	
15	April 22--26	8	
	Apr 26	**Exam 4**	**(Friday)**
16	Apr 29—May 3	9,10	

Final Exam (Wednesday, May 8, 8:00 to 9:50)*

*Do not make travel plans that interfere with this date. Everyone is expected to take the exam at the scheduled time.

CHEM 215: Course Objectives and Expected Learning Outcomes

Objective 1: Understanding of Matter, Measurements, Atomic Composition and Chemical Compound Nomenclature.

Learning Outcome:

4. Students will be able to classify matter as a pure substance or a mixture and will be able to distinguish between physical and chemical properties, physical and chemical changes. They will be able to identify SI units of measurements for the various physical properties and carry out unit conversions using dimensional analysis. Students will also be able to assess the level of precision and accuracy in a given set of measurements and use significant figures to express precision in calculations. Students will also able to address questions relating to the composition of atoms and carry out calculations involving the determination of the number of protons, electrons and neutrons in a given isotope and be able to use isotopic masses and natural abundance to calculate the average atomic masses.

5. Students will be able to name ionic, covalent compounds as well as binary and oxoacids from a given chemical formula and write the chemical formulas of those compounds from a given name.

Objective 2: An understanding of the quantitative concepts associated with calculating amounts of elements and compounds

Learning Outcome:

6. Students will be able to calculate molar masses of compounds, and use the molar masses and Avogadro's number to conduct mass to mole to number of formula unit or atom conversions. Students will be able to calculate the mass percent of an atom in a given compounds and will be able to use atomic mass percent to determine empirical and molecular formulas of compounds.

Objective 3: Understand different types of chemical reactions and understand properties of aqueous solutions.

Learning Outcome:

8. Students will be able to balance chemical equations and to use these equations to carry out simple stoichiometric and limiting reactant calculations to determine theoretical and percent yield of a given product.

9. Students will able to identify precipitation reactions, acid base reactions, oxidation reduction reactions and combustion reactions. They will be able to write molecular, total ionic and net ionic equations for those reactions. Students will also be able to balance redox reactions in aqueous solutions using the half-reaction method.

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Objective 4: Understand properties of gases.

Learning Outcome:

10. Students will be able to carry out quantitative calculations using Boyles Law, Charles' Law, Avogadro's Law, Dalton's Law, and the Ideal Gas Law. They will be able to calculate the molar mass of a gas and its density given from a given set of physical properties. They will be able to carry out stoichiometric calculations of reactions involving gases.

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Learning Outcome:

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Objective 6: Basic understanding of electromagnetic radiation, the quantization of the energy levels of the atom, and the shapes and properties of atoms and molecules.

Learning Outcome:

15. Students will be able to carry out calculations involving the energy of a photon, its wavelength and its frequency. Using the Bohr model, students will be able to carry out energy calculations involving transitions of a hydrogen atom electron.

16. Students will be to determine the various quantum numbers associated with a given principle energy level. Using the Aufbau principle along with the Pauli exclusion principle and Hund's rule, students will be able to write the ground state electron configurations of the main group elements and their ions.

17. Using trends in the periodic table, students will be able to rank atoms in order of increasing atomic size, electronegativity, electron affinity and ionization energy.

18. Students will be able to draw Lewis structures for simple molecules and using the Valance Shell Electron Pair Repulsion Theory, they will be able to predict to predict molecular shapes of these molecules. Students will be able to use the molecular shapes of molecules to predict whether these molecules are polar or nonpolar.