

**SPRING 2023**

**CHEM 1406**

## **INTRODUCTORY CHEMISTRY**

- **INSTRUCTOR:** TRACY DAWSON; [tracy.dawson@plainviewisd.org](mailto:tracy.dawson@plainviewisd.org); PCHS Room 103/SPC ROOM 120; 806-293-6005.
- **OFFICE HOURS:** TUESDAY-THURSDAY 4:00-4:30 AT PCHS ROOM 103; MONDAY/FRIDAY BY APPOINTMENT ONLY.
- **TEXT:** No textbook. Laboratory Manual - Jesse Yeh, 2<sup>nd</sup> ed. printed copy
- **REQUIRED MATERIALS.** A laboratory manual. A scientific calculator; not a graphing calculator. You may not use your cell phone as a calculator during exams.

**COURSE DESCRIPTION and PURPOSE.** This course is introductory to the principles and applications of inorganic chemistry, organic chemistry and biochemistry. The course fulfills the requirements for a one semester chemistry course for allied health professionals. It also fulfills the basic chemistry requirement for anatomy and physiology. (THIS COURSE WILL NOT SUBSTITUTE FOR CHEM 1411).

**COURSE OBJECTIVES.** CHEM 1406 provides (1) basic chemical knowledge for people living in a world of advancing technology, (2) understanding of the basic chemical nature of our world, and (3) a laboratory experience designed to enhance their appreciation of science and of the role of the clinical laboratory in the hospital.

**CLASS ATTENDANCE AND PARTICIPATION.** Lecture and laboratory attendance is mandatory. If you miss 5 classes throughout the semester you may be dropped from the course. If you miss 3 consecutive classes for any reason you may be dropped from the course. Class participation, in and of itself, is not a grade requirement. I encourage you to ask questions during class. You are expected to take notes and to be attentive to instruction.

**CHEATING AND CLASSROOM ETIQUETTE.** Cheating will not be tolerated and students will receive a zero for each occurrence. Turn your cell phone off before you enter the classroom for lecture. Once the lecture starts I require that there be no extemporaneous talking or distractions. You may use only provided materials on exams and you may NOT access another URL. On quizzes you may use your notes, worksheets, other class materials, but you may NOT access any other URL.

### **Diversity Statement**

**In this class, the teacher will establish and support an environment that values and nurtures individual and group differences and encourages engagement and interaction. Understanding and respecting multiple experiences and perspectives will serve to challenge and stimulate all of us to learn about others, about the larger world and about ourselves. By promoting diversity**

and intellectual exchange, we will not only mirror society as it is, but also model society as it should and can be.

### **Disabilities Statement**

Students with disabilities, including but not limited to physical, psychiatric, or learning disabilities, who wish to request accommodations in this class should notify the Disability Services Office early in the semester so that the appropriate arrangements may be made. In accordance with federal law, a student requesting accommodations must provide acceptable documentation of his/her disability to the Disability Services Office. For more information, call or visit the Disability Services Office at Levelland (Student Health & Wellness Office) 806-716-2577, Lubbock Centers (located at the Lubbock Downtown Center) 806-716-4675, or Plainview Center (Main Office) 806-716-4302 or 806-296-9611.

### **Non-Discrimination Statement**

South Plains College does not discriminate on the basis of race, color, national origin, sex, disability or age in its programs and activities. The following person has been designated to handle inquiries regarding the non-discrimination policies: Vice President for Student Affairs, South Plains College, 1401 College Avenue, Box 5, Levelland, TX 79336. Phone number 806-716-2360.

### **Title IX Pregnancy Accommodations Statement**

If you are pregnant, or have given birth within six months, Under Title IX you have a right to reasonable accommodations to help continue your education. To activate accommodations you must submit a Title IX pregnancy accommodations request, along with specific medical documentation, to the Health and Wellness Center. Once approved, notification will be sent to the student and instructors. It is the student's responsibility to work with the instructor to arrange accommodations. Contact the Health and Wellness Center at 806-716-2529 or email [dburleson@southplainscollege.edu](mailto:dburleson@southplainscollege.edu) for assistance.

**METHOD OF EVALUATION.** Grades will be assigned on the following basis: 100-89 A, 88-78 B, 77-66 C, 65-53 D, 52-0 F.

Students will be evaluated by means of weekly quizzes, lecture exams and performance in the laboratory. Typically, weekly quizzes will be given on Mondays and lab exercises will be conducted Wednesday of each week. There will be five forty-five minute exams and a final exam. Each hour exam will cover  $\sim\frac{1}{6}$  th of the class material. The final will be semi-comprehensive covering the final  $\sim\frac{1}{6}$  th of class material and include questions from material presented earlier in the semester. Each hour exam will make up 10% of your grade; the final will make up 25% of your grade. The remaining 25% of your grade will be determined from your performance on the weekly quizzes and your performance in the laboratory. There will be no make-up opportunities for quizzes or labs. Lowest quiz and two lowest labs and one lowest exam will be dropped. If you find that you cannot sit an exam for a valid reason (as determined by me) you must let me know as soon as possible before the exam. If you do not sit the exam without having first contacted me, you will be scored a zero for that exam with no opportunity for make-up. It is imperative that you keep up with the material throughout the course of the semester. Up to five points can be added to your exam score through completion of the review for the exam.

### Semester Overview

Week of:	Projected coverage of material (+/-) * covered in the Fall 2022	
January 17th	*Chapter 1	Measurements
21 <sup>st</sup> MLK	*Chapter 2	Atoms and Elements
28 <sup>th</sup>	*Chapter 3	Periodic Table and Trends
February 4 <sup>th</sup>		
11 <sup>th</sup>	*Chapter 4	Compounds and their bonds (tested in Spring)
18 <sup>th</sup>		
January 17th	Chapter 5	Chemical Reactions
	Chapter 6	Energy
18th	Chapter 7	Gases
25 <sup>th</sup>	Chapter 8	Solutions and Solution Concentration
April 1 <sup>st</sup> Easter	Chapter 9	Acids and Bases
8 <sup>th</sup>	Chapter 10	Organic Chemistry (Selected Topics)
15 <sup>th</sup>		
22 <sup>nd</sup>		
29 <sup>th</sup>		
May 6 <sup>th</sup>	Finals week	

### Exam Schedule

EXAM 1.	January 23rd Chapter 4	Semi-cumulative Final: May 8th&9th
EXAM 2.	February 13th Chapter 5	
EXAM 3.	March 6th Chapter 6	
EXAM 4.	April 3rd Chapter 7	
EXAM 5.	April 24th Chapter 8	

# CHEM1406 Schedule

Week 1	Date	Topic
Week 1	January 17	Go over the syllabus /lab notebook/Blackboard, etc.
	January 18	Lab #1 Safety - draw, label, specify purpose of safety equipment in lab.
	January 19	Review for Exam
	January 20	ACT Prep
Week 2	January 23	Exam 1 -Cmpd&Bonds NO RETAKES
	January 24	Slides 1-20 Physical/Chemical Changes/ Balancing Chem Rxn.
	January 25	Lab #2 Experiment 14 Chemical Reactions
	January 26	Slides 21-36 Types of Chemical Reaction w/o Redox
	January 27	Slides 37-43 - Redox
Week 3	January 30	Quiz #1
	January 31	Slides 44-53 mol/ Avogadro
	February 1	Lab #3 Chemical Reactions: Evidence of Change Lab
	February 2	Slides 54-60 conversion g to mol and vice versa
	February 3	ACT prep
Week 4	February 6	Quiz #2
	February 7	Slides 61-65 mole ratio
	February 8	Lab #4 Exp. 7 Determining The Mole Ratio in a Chem. Rxn.
	February 9	Slides 66-71 mass calculations
	February 10	Review for Exam
Week 5	February 13	Exam 2 - Chemical Reactions/Quantities
	February 14	Slides 1-18 Energy and calculations
	February 15	Lab #5 Endothermic Vs. Exothermic Reaction Lab
	February 16	Slides 19-31 Intermolecular Forces
	February 17	ACT prep
Week 6	February 20	Quiz #3 ONLINE HOLIDAY
	February 21	Slides 32-42 Changes of state; Heat of fusion and vaporization

	February 22	Lab #6 Which is Hotter? Lab
	February 23	Slides 43-50 Energy in chemical reactions
	February 24	Slides 51-55 Rate of Reaction
Week 7	February 27	Quiz #4
	February 28	Slides 56-71 Chemical Equilibrium
	March 1	Lab #7 Experiment 4 - Heat of Fusion for Ice
	March 2	Review for Exam
	March 3	ACT prep
Week 8	March 6	Exam 3-Energy
	March 7	Slides 1-17 Boyle's Law
	March 8	Lab #8 Mini Gas Labs Investigation
	March 9	Slides 18-25 Charles' Law
	March 10	Slides 26-30 Gay-Lussac's Law
Week 9	March 13-17	Spring Break
Week 10	March 20	Quiz #5
	March 21	Slides 31-33 Combined Gas Law
	March 22	Slides 35-36 Avogadro's Law
	March 23	Lab #9 Exp. 8 Boyle's Law: Pressure-Volume Relationship in Gas
	March 24	ACT prep
Week 11	March 27	Quiz #6
	March 28	Slides 37-48 Ideal Gas Law/ Molar mass of a gas
	March 29	Lab #10 Introduction to the Gas Laws using PhET simulations
	March 30	Slides 49-60 Partial Pressure of gases
	March 31	Review for Exam
Week 12	April 3	Exam 4 - Gases
	April 4	Slides 1-19 Water, Solutions, Electrolytes vs. Non Electrolytes
	April 5	Lab #11 Experiment 10 Solutions (Electrolytes/Non Electrolytes)
	April 6	Slides 26-33 Saturated and Unsaturated solutions
	April 7	Easter Break SPC

Week 13	April 10	Quiz #7
	April 11	Slides 34-36 Solubility rules
	April 12	Lab #12 Kool-Aid Concentration Lab Activity
	April 13	Slides 57- 63 Molarity
	April 14	ACT Prep
Week 14	April 17	Quiz #8
	April 18	Slides 64-70 Molarity conversion factor
	April 19	Lab #13 Exp. 11 Household Acids and Bases
	April 20	Slides 70-77;88-90
	April 21	Review for Exam
Week 15	April 24	Exam 5 - Solutions and Solution Concentration
	April 25	Slides 1-19 Acids/Bases pH scale
	April 26	Lab #14 Experiment 12 Titration of Household Items
	April 27	Slides 20-25 Brønsted-Lowry-Lowry A/B; Conjugate A/B Last Day to Drop
	April 28	ACT prep
Week 16	May 1	Quiz #9
	May 2	Slides 26-41 Strength of A/B; Buffers
	May 3	Lab #15 Experiment 13 Organic Models
	May 4	Slides 6-12 Organic compounds, Alkanes, Allene's, Structural formulas
	May 5	Slides 17- 29 Branched chain alkanes; Alkyl groups; Haloalkanes
Week 17	May 8-11	Finals Week - Acid/Bases and Organic Chemistry
		Semicumulative Final Exam NO EXEMPTIONS

## Student Learning Outcomes/Competencies

### Measurements

- \*Write the names and abbreviations for the units used in measurements of length, volume, and mass; write a number in scientific notation.
- \*Determine the number of significant figures in measured numbers.
- \*Adjust calculated answers to the correct number of significant figures.
- \*Use the numerical values of prefixes to write a metric equality.
- \*Write a conversion factor for two units that describe the same quantity.
- \*Use conversion factors to change from one unit to another.

- \*Calculate the density or specific gravity of a substance, and use the density or specific gravity to calculate the mass or volume of a substance.

### **Energy and Matter**

- Identify energy as potential or kinetic.
- \*Given a temperature, calculate a corresponding temperature on another scale.
- Use specific heat to calculate heat loss or gain, temperature change, or mass of a sample.
- Identify the physical state of a substance as a solid, liquid, or gas.
- Describe the changes of state between solids, liquids, and gases; calculate the energy involved.

### **Atoms and Elements**

- Classify matter as pure substances or mixtures.
- \*Given the name of an element, write its correct symbol; from the symbol, write the correct name.
- \*the periodic table to identify the group and the period of an element and decide whether it is a metal, nonmetal, or metalloid.
- \*Describe the electrical charge and location in an atom for a proton, a neutron, and an electron.
- \*Given the atomic number and the mass number of an atom, state the number of protons, neutrons, and electrons.
- \*Give the number of protons, electrons, and neutrons in the isotopes of an element and to know how to calculate the average atomic masses of the elements.
- \*Given the name or symbol of one of the first 20 elements in the periodic table, write the electron arrangement and use it to explain the periodic law.
- \*Use the electron arrangement of elements to explain periodic trends.

### **Compounds and Their Bonds**

- \*Using the octet rule, write the symbols of the simple ions for the representative elements.
- \*Using charge balance, write the correct formula for an ionic compound.
- \*Given the formula of an ionic compound, write the correct name; given the name of an ionic compound, write the correct formula.
- \*Write the name and formula of a compound containing a polyatomic ion.
- \*Given the formula of a covalent compound, write its correct name; given the name of a covalent compound, write its formula.
- Given the formulas of an acid, write its correct name; given the name of an acid, write its formula.
- \*Use electronegativity to determine the polarity of a bond.
- \*Predict the three-dimensional structure of a molecule and classify it as polar or nonpolar.

### **Chemical Reactions and Quantities**

- Identify a change in a substance as a chemical or a physical change.
- Write a balanced chemical equation from the formulas of the reactants and products for a reaction.
- Identify a reaction as a combination, decomposition, replacement, or combustion reaction.
- Define the terms *oxidation* and *reduction*.

- Use Avogadro's number to determine the number of particles in a given number of moles.
- Determine the molar mass of a substance and use molar mass to convert between grams and moles.
- Given a quantity in moles of reactant or product, calculate the moles of another substance in the reaction.
- Given the mass in grams of a substance in a reaction, calculate the mass in grams of another substance in the reaction.
- Describe endothermic and exothermic reactions and factors that affect the rate of a reaction.

### Gases

- Describe the kinetic theory of gases and the properties of gases.
- Describe the units of measurement used for pressure and change from one unit to another.
- Use the pressure-volume relationship (Boyle's law) to determine the new pressure or volume of a certain amount of gas at a constant temperature.
- Use the temperature-volume relationship (Charles' law) to determine the new temperature or volume of a certain amount of gas at a constant pressure.
- Use the temperature-pressure relationship (Gay-Lussac's law) to determine the new temperature or pressure of a certain amount of gas at a constant volume.
- Describe the relationship between the amount of a gas and its volume and use this relationship in calculations concerning gases in chemical reactions conducted at STP.
- Use partial pressures to calculate the total pressure of a mixture of gases.

### Solutions

- Identify the solute and solvent in a solution. Describe the formation of a solution.
- Identify solutes as electrolytes or nonelectrolytes.
- Define *solubility*; distinguish between an unsaturated and a saturated solution.
- Calculate the percent concentration of a solute in a solution; use percent concentration to calculate the amount of solute or solution.
- Calculate the molarity of a solution; use molarity to calculate the moles of solute or the volume needed to prepare a solution.
- Describe the dilution of a solution.
- Given the volume and molarity of a solution, calculate the amount of another reactant or product in the reaction.
- Identify a mixture as a solution, a colloid, or a suspension. Describe osmosis and dialysis.

### Acids and Bases

- Describe and name acids and bases.
- Identify conjugate acid-base pairs for Brønsted-Lowry acids and bases.
- Write equations for the dissociation of strong and weak acids and bases.
- Use the ion product of water to calculate the  $[\text{H}_3\text{O}^+]$  and  $[\text{OH}^-]$  in an aqueous solution.
- Calculate pH from  $[\text{H}_3\text{O}^+]$ ; given the pH, calculate  $[\text{H}_3\text{O}^+]$  and  $[\text{OH}^-]$  of a solution.
- Write balanced equations for reactions of acids and bases.
- Describe the role of buffers in maintaining the pH of a solution.

### Organic Chemistry

- Identify properties characteristic of organic or inorganic compounds.
- Write the IUPAC names and structural formulas for alkanes, alkenes, and alkynes.

- Write the IUPAC names for alkanes with substituents.
- Identify the properties of alkanes and write a balanced equation for combustion.
- Write the structural formulas and names for cis-trans isomers of alkenes.
- Identify and name alcohols and ethers; classify alcohols as primary, secondary, or tertiary.
- Describe some properties of alcohols, phenols, and ethers.
- Identify compounds with the carbonyl group as aldehydes and ketones.
- Compare the boiling points and solubility of aldehydes, ketones, alkanes and alcohols.
- Identify chiral and achiral carbon atoms in an organic molecule.
- Describe the boiling points, solubility, and ionization of carboxylic acids in water.
- Describe some properties of amines.
- Classify a monosaccharide as an aldose or ketose and indicate the number of carbon atoms.
- Draw the D or L configurations of glucose, galactose and fructose.
- Draw and identify the cyclic structures of monosaccharides.
- Describe the monosaccharide units and linkages in disaccharides.
- Describe the structural features of amylose, amylopectin, glycogen, and cellulose.
- Describe the classes of lipids.
- Write structures of fatty acids and identify as saturated or unsaturated.
- Describe the characteristics of glycerophospholipids.
- Describe the structures of steroids.
- Describe the composition and function of the lipid bilayer in cell membranes.
- Classify proteins by their functions in the cells.
- Draw the structure for an amino acid. Write the zwitterion of an amino acid.
- Draw the structure of a dipeptide. Identify the structural levels of a protein.
- Describe how enzymes function as catalysts and give their names.
- Describe the role of an enzyme in an enzyme-catalyzed reaction.
- Describe the effect of temperature, pH, concentration of a substrate, and inhibitors on enzyme activity.

\*these topics covered in the Fall semester 2022