**Chemistry 122: Chemical Principles II**

**Block 4, 2018-19**

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**Office hours for Prof. Strong:** I’m usually in my office when we’re not in class, and I’ll announce office hours each day. Please stop by my office, talk to me after class, or email me to set up a time. I’ll be in the classroom each morning at 8:45 to answer questions, and I can usually stay after class as well. Also, I check email frequently, and I’m happy to answer questions via email. If you are stuck on a problem, asking a question can save you a lot of time and frustration!

**Course Description, Objectives, and Meeting Times**

**Learning Objectives (Educational Priorities and Outcomes):**

1. Use introductory concepts in intermolecular forces, colligative properties, kinetics, chemical equilibria (including acid/base and solubility equilibria), thermodynamics, and electrochemistry to solve problems and explain observations (Knowledge, Inquiry, Reasoning)
2. Demonstrate accurate and precise lab technique, draw conclusions from data, and consider the error associated with results (Inquiry, Reasoning, Ethical Behavior)
3. Work effectively with others in the classroom and lab; communicate lab results clearly, both in writing and verbally (Communication, Ethical Behavior)

This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, and communication.

**Class schedule:** Class will meet from 9:00 to 11:00 am and from 12:30 or 1:00 to 3:00 pm every day; see the schedule on the last page. If you have questions about the problem set assignment, come early: we will work on those questions from 8:45 to 9:00. Afternoons will be a mix of lab, class, and problem sessions; please see the attached schedule for more details. Prof. Jeff Cardon will teach the lab portion of the course; he will distribute more specific information regarding the lab.

**Course Materials, Assignments, and Grading**

**Text:** *Chemistry*, by Gilbert, Kirss, Foster, and Davies, 4th edition.

**Additional required materials:**  Lab goggles (UVEX stealth S3960C), a bound lab notebook (composition book), and a scientific calculator.

**Skills, assignments, and lab activities:** This course is organized around a set of specific skills (or competencies), related assignments, and lab activities.

* Skills: You will have the opportunity to demonstrate your mastery of 30 skills over the course of the block. Each skill will be discussed in class, practiced through problem sets and in-class group work (see below), and assessed through a skill quiz; passing each quiz requires answering 80% of the questions correctly. You will have multiple chances to pass each skill, except for the two skills that will be assessed only on the final exam. Each skill is designated as Essential (19), Additional (7), or Integrated (4); see the list below. Daily quizzes will assess the Essential skills, while the Additional and Integrated skills will be assessed on the exams.
* Problem sets: These will be posted on Moodle and due two days after they are assigned, at 9:00 am. For example, work Monday’s problem set on Monday, ask questions about it (if necessary) on Tuesday, finish it up on Tuesday, and turn it in on Wednesday at the beginning of class. **It is essential that you work the assigned problem set each night.** I will collect your problem sets and check to see that they are complete, but I will not correct them. Answers for many of the questions are in the back of your textbook; I will post the answers to the remaining problems on Moodle. You are responsible for checking to be sure that your answers are correct.
* Lab experiments (9): You will demonstrate your understanding of each lab activity by completing a worksheet, formal lab report, and/or lab notebook entry. Full participation in all lab activities will comprise a tenth lab component.
* Chemistry news mini-presentation: Find a recent article (online or print) about a new development in chemistry and share it with the class. This assignment will give you a chance to explore something that interests you and practice communicating about chemistry. In approximately four slides, your presentation should (1) provide the title, author(s), and source of the article, (2) explain what the article is about, (3) describe why you found the article interesting, and (4) explain how the news is connected in some way to CHE 122. (If you find an article that interests you but have trouble connecting it to our class, talk to me; I can help you find a connection.) Please time your mini-presentation so that it is about 5 minutes long. I’ll give a sample presentation on the first Tuesday. Possible sources of articles and a sign-up sheet will be posted on Moodle.
* Group participation: We will spend part of each class session solving problems and applying concepts in groups. These activities will give you a chance to share problem-solving strategies and practice communicating about science.
* Study log and reflections: Create a Google sheet and share it with your instructor. Each day, add an entry with your reflections about your progress for the day. Include the amount of time you spent working on chemistry outside of class and comment on the concepts or problems that gave you the most difficulty that day, study strategies that are working or not working for you, progress toward mastering particular skills, and/or other reflections.

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| 1 | ES1 | Predict and describe the attractive forces between molecules |
| 2 | ES2 | Explain the effect of intermolecular forces on the physical properties (boiling point, melting point, vapor pressure, solubility) of substances |
| 3 | ES3 | Describe the forces between particles in molecular, ionic, metallic, and covalent network solids and relate the forces to their physical properties |
| 4 | ES4 | Express the concentration of a solution in molality |
| 5 | ES5 | Calculate the freezing and boiling point of a solution of a nonvolatile solute |
| 6 | ES6 | Derive a rate law from initial reaction rate data |
| 7 | ES7 | Explain the concept of activation energy and calculate the activation energy of a reaction |
| 8 | ES8 | Link mechanisms to rate laws and identify catalysts and catalysis |
| 9 | ES9 | Write equilibrium constant expressions for reversible reactions including those involving heterogeneous equilibria |
| 10 | ES10 | Predict how a reaction at equilibrium responds to changes in conditions |
| 11 | ES11 | Calculate the concentrations or partial pressures of reactants and products in a reaction mixture at equilibrium from their starting values and the value of K |
| 12 | ES12 | Calculate, interpret, and interconvert pH and [H+] values for strong acids and bases |
| 13 | ES13 | Calculate the pH values of solutions of weak acids and bases |
| 14 | ES14 | Explain how buffers control pH and calculate the pH of a buffer mixture |
| 15 | ES15 | Relate the solubility of an ionic compound to its solubility product |
| 16 | ES16 | Use standard molar entropies and standard free energies of formation to calculate the standard entropy change and standard free energy change for a reaction |
| 17 | ES17 | Calculate free energy changes in chemical reactions |
| 18 | ES18 | Combine the appropriate half reactions and standard reduction potentials to write redox reactions and calculate standard cell potentials |
| 19 | ES19 | Use the Nernst equation to calculate a cell potential |
| 20 | AS1 | Predict the direction of solvent flow in osmosis and calculate osmotic pressure |
| 21 | AS2 | Use integrated rate laws and half-life equations |
| 22 | AS3 | Calculate the value of an equilibrium constant or a reaction quotient and use it to predict the direction of a reversible chemical reaction |
| 23 | AS4 | Predict whether a salt is acidic, basic, or neutral |
| 24 | AS5 | Predict the signs of entropy changes for chemical reactions and physical processes |
| 25 | AS6 | Draw cell diagrams and describe the components of electrochemical cells and their roles in interconverting chemical and electrical energy |
| 26 | AS7 | Relate the standard cell potential for a reaction to the equilibrium constant and the standard free energy change for the reaction |
| 27 | IS1 | Solve an integrated problem applying ES1-ES7 and AS1-AS2 (part of Exam #1) |
| 28 | IS2 | Solve an integrated problem applying ES8-ES13 and AS3-AS4 (part of Exam #2) |
| 29 | IS3 | Solve an integrated problem applying ES14-ES19 and AS5-AS6 (part of Final) |
| 30 | IS4 | Solve an integrated problem applying ES14-ES19 and AS5-AS6 (part of Final) |
| 31 | L1 | Alum synthesis |
| 32 | L2 | Properties of Solids |
| 33 | L3 | Kinetics – Decomposition of hydrogen peroxide |
| 34 | L4 | Alum Analysis Part 1 |
| 35 | L5 | Titrations: Identifying Unknowns |
| 36 | L6 | Salts |
| 37 | L7 | Alum Analysis Part 2 |
| 38 | L8 | Alum Project |
| 39 | L9 | Electrochemical Series |
| 40 | L10 | Lab participation |
| 41 | GP | Group participation in class (Days 1-17) |
| 42 | SL | Study log and reflections (Days 1-17) |
| 43 | PS1 | Problem sets 1a and 1b |
| 44 | PS2 | Problem sets 2a and 2b |
| 45 | PS3 | Problem sets 3a, 3b, and 3c |
| 46 | PS4 | Problem sets 4a and 4b |
| 47 | PS5 | Problem sets 5a, 5b, and 5c |
| 48 | PS6 | Problem sets 6a and 6b |
| 49 | PS7 | Problem sets 7a and 7b |
| 50 | NP | Chemistry news mini-presentation |

Your letter grade will be determined by the total number of skills you master and assignments you complete, as shown below. These cutoffs may be adjusted down, but they will not be raised.

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| **Letter Grade** | **Skills passed plus assignments completed** |
| A | 45 |
| A- | 44 |
| B+ | 42 |
| B | 40 |
| B- | 39 |
| C+ | 37 |
| C | 35 |
| C- | 34 |
| D+ | 32 |
| D | 30 |
| D- | 29 |
| F | 28 or fewer |

**Math support:** Jessica Johanningmeier, the Quantitative Reasoning Consultant, is available to help with math review, quantitative problem solving, data presentation, and other math-related issues. Jessica will provide a math review session that is specifically designed for our class during the first week of the block. The Quantitative Reasoning Studio is located just to the left as you enter the library’s main entrance (3rd floor).

**Class Policies**

**Academic Honesty expectations:** Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College’s requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Catalogue, under the heading “Academic Honesty."

I encourage you to work together as you study the material and work the problems. Examples of inappropriate cooperation would be copying from another student's problem set or lab report, or sharing information during a test. Please be aware that these actions constitute academic dishonesty and will be handled in accordance with the policies in the student handbook.

**Accommodations for learning disabilities:** Cornell College makes reasonable accommodations for persons with disabilities.  Students should notify the Coordinator of Academic Support and Advising and their course instructor of any disability related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format.  For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see <http://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml>.

Brooke Paulsen, the Coordinator of Academic Support and Advising, can be reached at bpaulsen@cornellcollege, 319-895-4382, or in room 309 of Cole Library.

**Health issues:** For your safety and the safety of those who will be working with you in the lab, please inform me and the lab instructor if you have a health issue that may be exacerbated by exposure to chemicals. Examples would be severe asthma, severe allergies, seizure disorder, or pregnancy. We will keep this information confidential and work with you to minimize your risk.

**Other policies:** I turn off my cell phone when I come to class, and I expect you to do the same. It is not appropriate to text, go online, etc. during class or lab.

A student who wishes to drop the course on the 15th day must have completed all the work for the course and must have attended class faithfully.

**Notes on the reading assignments**

The following notes are provided to help you focus your reading time on the most important sections of the text. **It is essential that you work through the Sample Exercises and Concept Tests within each chapter** rather than simply reading them. If you have trouble working a Sample Exercise, take as many hints as you need from the solution to help you through it. Then, work the Practice Exercise that follows. For difficult problems, some students find it helpful to go back and re-work the Sample Exercise with the solution covered. Answers to the Practice Exercises and Concept Tests are in the back of the book.

**Chapter 10:** Sections 1-7, but less emphasis on section 7; we will not use the Clausius-Clapeyron equation.  Sample exercises 1-5, 7.

**Chapter 11**: Section 1, section 2 (concepts, not equations); section 3 (not Born-Haber cycle); sections 5 and 6.  Sample exercises 8-18.

**Chapter 12**: Section 1; we will briefly discuss sections 2, and 7.  Sample exercise 3.

**Chapter 14:**  All sections, but less emphasis on sections 1 and 6.  Sample exercises 1, 2, 4, 6, 7, 12, 13.

**Chapter 15**:  Sections 1, 2, 4-8.  Sample exercises 1-3, 5-15, 16ab.

**Chapter 16**:  Sections 1-3, 5-8, 10; in Section 4, we will discuss the concepts but not the calculations.  Section 9 will be mentioned in class but mostly covered in lab.  Sample exercises 1-5, 7-10, 12, 13, 15-17.

**Chapter 18**:  Sections 1-7; in section 8, the concept but not the equation.  Sample exercises 1-7, 9, 10.

**Chapter 19**:  Sections 1-6 and 8; in section 7, 9, and 10, the concepts but not the equations.  Sample exercises 2-6, 9.

