UTAH STATE UNIVERSITY

PHYSICAL CHEMISTRY 3060

SYLLABUS

FALL SEMESTER 2021

Instructor: Alexander I. Boldyrev

Office: ML 369

Email: a.i.boldyrev@usu.edu

Class times:	W330	MWF	9:30-10:20	
Office hours:		ML369	MW	11:00-noon

I will be happy to make appointments with anyone who has unavoidable conflicts at these times. The best way to contact me outside office hours is by email.

September 3 – last day to add without instructor's signature; Instructor's signature required to add a class September 4 – 20; LAST DAY TO DROP CLASSES (without notation on transcript) September 20; LAST DAY TO WITHDRAW FROM CLASSES ("W" on transcript) November 1; LAST DAY TO CHANGE TO P/D+/D/F OPTION November 1.

The final exam will be given at 9:30-11:20 am in W330, on Wednesday, December 15.

There are no classes on September 6, October 15, and November 24-26.

In accordance with the Americans with Disabilities Act, reasonable accommodation will be provided for all persons with disabilities in order to ensure equal participation in this course.

Text: Physical Chemistry (6-th edition) by Ira N. Levine.

I will make reading assignments from the text. You are responsible for studying all the material in these assignments even if it isn't covered in lectures.

Important information regarding Math Prerequisites:

Physical chemistry is a course in chemistry not mathematics; however, weak math skills can cause considerable difficulties for students. The mathematical tools needed for physical chemistry are not very advanced, but it is vitally important that the student is able to use them well. In particular, multivariable calculus is used extensively in the course, so **if you have not completed Math 2210 (old Math 320) or an equivalent course, you MAY NOT register for Chem 3060 WITHOUT PERMISSION OF THE INSTRUCTOR**. In the interest of fairness, grading cannot take into account math weaknesses.

Learning Objectives for Physical Chemistry

Divisional level learning objectives in physical chemistry are as follows. After completing the course students will be able to:

1. Apply the basic concepts of calculus to concepts in chemistry.
2. Discuss the Three Laws of Thermodynamics and their development.
3. Use the Maxwell equations and other thermodynamic relations to compute thermodynamic quantities from thermodynamic data tables.
4. Be able to derive relationships between thermodynamic quantities.
5. Interpret phase diagrams and discuss phase equilibria in terms of chemical potentials.
6. Explain the origin of K_{eq} and its relation to fugacity and activity and apply these concepts to ideal and real solutions of electrolytes and non-electrolytes and to colligative properties.
7. Apply the principles of electrochemistry to conductance, voltaic, and electrolytic systems.
8. Provide a physical basis for Debye-Huckel theory.

9. List the methods for arriving at a plausible mechanism and/or rate law based on kinetic information.
10. Manipulate the gas laws to describe real and ideal gas behavior.
11. Apply the steady-state hypothesis to obtain rate equations.
12. Explain the basic principles of photochemical and radiation-chemical reactions.

Course content: The following topics will be covered:

Thermodynamics
The First Law of Thermodynamics
The Second Law of Thermodynamics
Material Equilibrium
Standard Thermodynamic Functions of Reactions
Reaction Equilibrium in Ideal Gas Mixtures
One-Component Phase Equilibrium
Real Gases
Solutions
Nonideal Solutions
Reaction Equilibrium in Nonideal Systems
Multicomponent Phase Equilibrium
Surface Chemistry
Electrochemical Systems
Kinetic Theory of Gases
Transport Processes
Reaction Kinetics

Homeworks: Homework assignments will be given at every lecture. I encourage you to work out every assignment before the next lecture. Homework will not be graded, but on every lecture, there will be a short quiz, which may contain one modified problem from the previous homework.

Quizzes: There will be approximately 30 short quizzes during lecture time (about 5 minutes). Every quiz will yield 5 points maximum. I will grade quizzes, but I will **not** count them towards your grade. However, if you do well on quizzes you will get overall higher score. For example, if you get 80% or more on quizzes I will rise your grade for example from B to B+.

Exams: There will be three one-hour exams given during the regular class period. These will cover only chemical thermodynamics, each will yield 100 points maximum. The final exam will be comprehensive, covering material from the entire course. It will yield 100 points maximum.

The first midterm exam will be given at the scheduled time on September 22.

The second midterm exam will be given at the scheduled time on October 27.

The third midterm exam will be given at the scheduled time on November 17.

The final exam will be given at 9:30-11:20 am in W330, on Wednesday, December 15 and WILL NOT be given early to accommodate travel arrangements, so plan accordingly.

All exams are closed book. A typical exam will consist of 100 points worth of questions that ask you to define important terms or state important principles introduced since the last exam.
THERE WILL BE <u>NO</u> MAKE-UP EXAMS. Arrangements to compensate for a missing exam may be requested only with verifiable medical certification.

Grading: The course grading is based on 400 total points.

I. Exams - 400 total points (100 + 100 + +100 + 100)

Final grades: Final grades are computed by setting the dividing line between **B-** and **C+** at either 80% of the possible total points or the class average for total points, whichever is lower. The other grades are than assigned in proportion.

Obtaining help: I discourage the use of solution manuals or workbooks because they will fool you into thinking you know how to work the problems when you don't. The same applies to the answers given in the back of the text. **Too much reliance** on these makes it easy to fall into the **dangerous habit** of mindlessly plugging numbers into formulas until you obtain the given answer. This **does not constitute understanding** and will lead to **disaster** on exams where you will not know the answer you are supposed to obtain!

Collaborating on the problem sets is not forbidden and a certain amount can be helpful, **but you must learn to work the problems on your own, or you won't be able to pass the exams**.

I am more than willing to assist you with the problems; this is largely what my office hours are for. I only ask that you observe a few ground rules:

1. I won't give out help over the telephone or the Internet.

2. When you come to see me, please be prepared with specific questions. ("I don't understand" is not a question.) There are only two questions (and all variations thereof) that I won't answer, "How do you work this?" and "Is this right?" Otherwise, any question is permissible, including questions having nothing to do with the problem sets. For example, you may wish to ask about unclear points in the lectures or reading assignments.

3. If you have a question about a problem, bring a calculator and any partial work you have completed on the problem as well.

Covid-19

1. Wearing a cloth face mask are not required but recommended.
2. Stay home when you’re sick - even if your symptoms are mild.