

# Chemistry 336 – Physical Chemistry

## Spring 2017

### Dr. Erin D. Speetzen

---

#### Contact Information

Office: B135 (Science Building)  
Phone: 715-346-3258 (office)  
E-mail: [espeetze@uwsp.edu](mailto:espeetze@uwsp.edu)

The best way to reach me is via my university email.

#### Meeting Times

*Lecture:* Tuesday, Thursday and Friday 9 – 9:50 am Room A112 (Science)

#### Office Hours:

Monday 3-4 pm, Tuesday 11 am – 12 pm, Wednesday 2 – 3 pm, and Thursday 11 am – 12 pm or by appointment.

#### Prerequisite

Completion of CHEM 335 with a grade of “D” or higher.

#### Required Materials

##### Textbook

Physical Chemistry Ball, D.W., Thomson Brooks/Cole, 2003. This book is available for rental at the University Bookstore.

##### Scientific Calculator

#### Course Description

Chemistry 336 is the second semester of the physical chemistry sequence. This course will focus on the development and application of quantum mechanics to describe atomic and molecular properties. This course will involve the use of physics, mathematics and chemistry to form the foundation to understand problems from all areas of chemistry (analytical, organic, inorganic, biological, etc.).

We will cover primarily chapters 9 – 15 of the textbook.

#### Course Learning Outcomes

- Explain the historical development of quantum mechanics.
- Apply quantum mechanics to exactly solvable systems and use those solutions to understand chemical systems.
- Apply quantum mechanics to chemical systems that are not exactly solvable by using various approximation methods.
- Use Group Theory and Symmetry to assign vibrations of polyatomic molecules.
- Analyze spectra of molecules using quantum mechanical models and obtain molecular constants.
- Understand how modern quantum chemistry programs solve chemical problems and use modern quantum chemistry programs to perform calculations on simple molecules.
- Use Statistical Thermodynamics to understand thermodynamic variables from a molecular standpoint.
- Use Mathematica and Excel to perform calculations and display meaningful results.

## Grading

Your grade in this course will come from the following components

3 Midterm Exams @ 100 pts each	300 pts
Final Exam 150 pts	150 pts
Homework 10 @ 15 pts each	150 pts
Total	600 pts

Your final grade in the course will be determined using the following scale (please note that the instructor reserves the right to lower these cut-offs, but will never raise them).

A ≥ 90%
A- ≥ 88%
B+ ≥ 86%
B ≥ 77%
B- ≥ 75%
C+ ≥ 73%
C ≥ 63%
C- ≥ 61%
D+ ≥ 59%
D ≥ 50%
F < 50%

Midterm Exams – Three exams will be given during the semester. The exams will be administered during the normal class times on: 2/21, 3/28, and 4/25. All exams are cumulative. If your percentage grade on the final exam is higher than your lowest regular exam percentage, then your percentage grade on the final will replace your lowest exam score percentage.

Final Exam – A two-hour cumulative final exam will be given on **Monday May 15<sup>th</sup> from 8:00 – 10:00 a.m.**

Homework – Over the course the semester 12 homework sets will be posted corresponding to one per week, excluding exam weeks. Each homework set will be worth 15 points and will be due on Tuesdays. Of the homework sets you submit I will drop your two lowest scores. Homework will be collected at the start of class and the solutions will be posted immediately after class. **No late homework will be accepted for any reason.** No help will be given on homework after 5:00 p.m. on Mondays.

You are encouraged to discuss problem sets with your peers and with me, however, all work submitted must be your own. Discussion of a problem means that you are talking about the big picture ideas needed for solving the problem. All details of the solutions should be your own.

### Attendance, Absences and Make-Ups

***Make-up exams will not be allowed, except under special circumstances with documentation. I consider the following special circumstances (please talk to me if you have other special circumstances that you feel deserve consideration):***

- UWSP athletic event (I require **written** authorization from your coach)
- Armed forces related training or drills (I require **written** authorization from a supervising officer)
- Medical emergency (I require **written** authorization from a physician)
- Death in the family (I require documentation of some type; an obituary or service folder is acceptable)

### Rights and Responsibilities

UWSP values a safe, honest, respectful, and inviting learning environment. In order to ensure that each student has the opportunity to succeed, we have developed a set of expectations for all students and instructors. This set of expectations is known as the *Rights and Responsibilities* documents, and it is intended to help establish a positive living and learning environment at UWSP.

### **Academic Misconduct**

The definition of academic misconduct can be found starting on page 11 of the document found at:

<http://www.uwsp.edu/dos/Documents/CommunityRights.pdf>

Students found to have engaged in academic misconduct on problem sets will receive a score of zero on the assignment for the first offense and an F in the course for the second offense. Students found to have engaged in academic misconduct on an exam may receive a grade of F for the course.

### **Disability Services**

The Americans with Disabilities Act (ADA) is a federal law requiring educational institutions to provide reasonable accommodations for students with disabilities..

If you have a disability and require classroom or exam accommodation, please register with the Disabilities Services offer and then contact me.

In order to receive accommodations you must have documentation of your disability on file with the Office of Disability Services. In addition, you must provide me with an Accommodations Request Form (available at the website). You must have me sign the form and return it to the Office of Disability Services.

### **Suggestions for Course Success**

1. **Read the textbook and work through problems and derivations.**
2. **Attend, participate and take notes at all lectures.**
  - a. Don't be afraid to answer questions or ask questions during class.
  - b. When taking notes it is best to try and capture the key points instead of writing down word for word what we discuss. You can always go back later and fill in more detail.
3. **Re-Read the section(s)** of the book after lecture and fill in your notes with additional details.
4. **Do Lots of Problems.**
  - a. I encourage you to work together to solve problems, but make sure you are competent enough to solve problems from start to finish by yourself.
5. **Work on physical chemistry a little bit every day.** Material in CHEM 336 can be challenging, it is in your best interest to continually work on this course and allow concepts to develop and solidify over time. It is best to start the problem sets early and give your brain time to digest the material.
6. **Utilize helpful resources.**
  - a. Form study groups.
  - b. Come to my office hours.
  - c. If my office door is open, feel free to stop and ask questions. If you need to set-up a time to meet outside of my office hours, email me and we will find a time that works. Talking through physical chemistry problems can help develop intuition and allows you to see the big picture question and not get overly bogged down in the mathematics. Quantum mechanics can be a difficult concept to grasp. I'm always willing to talk through problems and help you grapple with the material.
  - d. I'm here to facilitate your learning in this course. Success requires that you take personal responsibility to make sure you understand the material and seek resources to help you learn.

**Tentative Course Schedule**

The instructor reserves the right to change this schedule as needed. Any changes will be announced in advance via an in-class announcement.

<b>Week</b>	<b>Chapter(s)</b>	<b>Exam</b>
<b>1</b> (1/23)	<b>9</b> (Pre-Quantum Mechanics)	
<b>2</b> (1/30)	<b>10</b> (Introduction to Quantum Mechanics)	
<b>3</b> (2/6)	<b>10</b> (Introduction to Quantum Mechanics)	
<b>4</b> (2/13)	<b>10</b> (Introduction to Quantum Mechanics)	
<b>5</b> (2/20)	<b>11</b> (Q.M.: Model Systems and the Hydrogen Atom)	<b>Feb 21st</b>
<b>6</b> (2/27)	<b>11</b> (Q.M.: Model Systems and the Hydrogen Atom)	
<b>7</b> (3/7)	<b>12</b> (Atoms and Molecules)	
<b>8</b> (3/13)	<b>12</b> (Atoms and Molecules)	
(3/20)	<b>SPRING BREAK</b>	
<b>9</b> (3/27)	<b>13</b> (Symmetry in Quantum Mechanics)	<b>Mar 28th</b>
<b>10</b> (4/3)	<b>13</b> (Symmetry in Quantum Mechanics))	
<b>11</b> (4/10)	<b>14</b> (Rovibrational Spectroscopy)	
<b>12</b> (4/17)	<b>14</b> (Rovibrational Spectroscopy)	
<b>13</b> (4/24)	<b>15</b> (Electronic Spectroscopy and Structure)	<b>Apr 25th</b>
<b>14</b> (5/1)	<b>15</b> (Electronic Spectroscopy and Structure)	
<b>15</b> (5/8)	Special Topics	
<b>5/15</b>	<b>FINAL EXAM (8:00 – 10:00 a.m.)</b>	<b>May 15th</b>