

Chemistry 4620, Physical Chemistry II - Spring 2016
Mondays & Wednesdays, 2:15-3:30 pm @432NE

- Reaction Kinetics
- Introduction to Quantum Mechanics (Postulates and Math Concepts)
- Solutions of Schrodinger Equations relevant for chemistry.

Lecture textbook: Ira Levine, Physical Chemistry, 6th edition.

It is advisable to get the solutions manual also.

Instructor: Professor Andrzej Jarzecki, 228NE.

tel: 718-951-5000 ext. 2822

e-mail: prof.jarzecki@gmail.com

Office hours: Tuesdays 11:30-1:00 pm or by appointment set by email or phone.

Physical chemistry requires a LOT OF WORK, so make sure you do not have too heavy school schedule and/or job time commitment.

Drop Dates: Thursday February 18 is the last day to DROP a course without a grade.

Monday April 18 is the last day to apply for non penalty withdrawal (*i.e.*, W grade).

Course will cover:

Reaction Kinetics Chapter 16

Quantum Mechanics Chapter 17

Atomic Structure Chapter 18

Molecular Electronic Structure, parts of Chapter 19

Molecular Spectroscopy, parts of Chapter 20

Expect additional material on selected topics through out the semester!!!

Lecture Tests: 3 midterm exams (100 points each)

2 quizzes or homework assignments (30 points each)

Final exam, cumulative (200 pts)

Homework assignments are more time consuming than in Physical Chemistry 1.

The **560 points** earned from the lecture component counts for ~74% of your final grade.

Additional **200 points** (~26%) comes from your laboratory component of the course.

Minimum average to pass the course (D-) is 50.5% (**283 points**)

Exam absences: If you are absent from an exam and have no medical note, your missing grade will be calculated as $[(3/4)X + (1/4)Y] - 3$ pts, where X and Y are the grades on exams (including the final) closest in time to the missing exam and $X < Y$. **If you miss two exams without a doctor's note, both exams will be counted as 0.**

WEEK 1:

- (1) *Feb 1, Mon* – quick review of rates of reactions, rate law from general chemistry
- (2) *Feb 3, Wed* – integrated forms of the rate law for zeroth-, first-order reactions,

WEEK 2:

- (3) *Feb 8, Mon* – second-order reactions, concept of half-life
- (4) *Feb 10, Wed* – third-order reactions, half-time, determination of a reaction order

WEEK 3:

- (5) *Feb 17, Wed* – parallel and sequential reactions, rate-determining steps, steady-state approximation.
- (6) *Feb 22, Mon* – reverse rates and equilibrium reactions

WEEK 4:

- (7) ***Feb 24, Wed*** – ***Quiz or graded homework assignment*** on kinetics (30 pts)
- (8) *Feb 29, Mon* – mechanism of reactions and rate expressions, methods to measure very fast reactions, relaxation time

WEEK 5:

- (9) *March 2, Wed* – methods to measure very fast reaction (cont.),
- (10) ***March 7, Mon*** – **First Midterm Exam**: (Chapter 16: Kinetics) – 100 pts

WEEK 6:

- (11) *March 9, Wed* – introduction to concepts of quantum mechanics
- (12) *March 14, Mon* – basic mathematics for quantum mechanics

WEEK 7:

Simple exact solutions of the Schrodinger Equation:

- (13) *March 16, Wed* – a quantum particle in the box
- (14) *March 21, Mon* – quantum oscillations; a particle in the harmonic potential.

WEEK 8:

- (15) *March 28, Mon* – methods for approximate solutions: variational method
- (16) *March 30, Wed* – methods for approximate solutions: perturbation theory

WEEK 9:

Other important examples for the exact solutions:

- (17) *April 4, Mon* – quantum rotations: solutions for rotations in 2-dimensions
- (18) ***April 6, Wed*** – **Exam 2** (Chapter 17: Quantum Mechanics) – 100 pts

WEEK 10:

Hydrogen Atom:

- (19) *April 11, Mon* – solutions rotations in 3-dimensions
- (20) *April 13, Wed* – Hydrogen Atom: radius-solution

WEEK 11:

- (21) ***April 18, Mon*** – Hydrogen atom: full solution and quantum numbers.
Quiz or homework assignment (30 pts)
- (22) *April 20, Wed* – concept of spin, multi-electron atoms, beyond H atom.

WEEK 12:

- (23) *May 2, Mon* – understanding a chemical bonding

(24) *May 4, Wed – Exam 3* (Chapter 18: Atomic Structure) – 100 pts

WEEK 13:

(25) *May 9, Mon* – Born's approximation for electrons in molecules, understanding molecules,

(26) *May 11, Wed* – rotational spectroscopy

WEEK 14:

(27) *May 16, Mon* – vibrational spectroscopy

(28) *May 18, Wed* – electronic spectroscopy

FINAL EXAM: *May 25, 1:00-3:00 pm*