PHR 342C
Fall 2003
Physical and Chemical Principles of Drugs
Course Syllabus

Instructor

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Teaching Assistants

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Class Time and Location

M	9-11 AM	PHR 2.110	unique number: 61015
F	9-10 AM	PHR 2.110	

Required Texts

There are no required textbooks for this course. However, if a student would like additional information relative to the subjects covered in lecture, they are referred to the following texts:

Amiji, M. and Sandmann, B. J. Applied Physical Pharmacy. 1st edition McGraw Hill, 2003
ISBN: 0-0713-5076-4

Martin, A. Physical Pharmacy, 4th edition. Williams & Wilkins Press, 1993
ISBN 0-8121-1438-8

General Chemistry. 6th edition, Harcourt College Publishers, 2000
ISBN 0-0302-1214-6

Analytical Chemistry 7th edition, Harcourt College Publishers, 1997
ISBN 0-0300-5938-0

Note: The textbooks listed here are in either the Life Science or Chemistry libraries on campus. Any general chemistry book or physical chemistry book will provide suitable information on subjects covered in this course.

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Suggested Materials

The content of this course will require students to assess data and to perform calculations. All students should have a calculator that can perform basic functions as well as logarithmic transformations.

Computer Use

All students in the Fall 2003 entering class are required to have access to computers. Although you are not required to use a computer during this course, it may be useful for some of the laboratory assignments.

Course Prerequisites

Prior to enrolling in the course, students are to be in the first professional year of the pharmacy curriculum and have successfully completed the prerequisite mathematics and chemistry courses including algebra, calculus, and general chemistry and will be held responsible for understanding the concepts presented in these previous courses. In addition, students must also be enrolled in PHR 142P Physical and Chemical Principles of Drugs Laboratory.

Examination Dates

The exams for both PHR 342C and PHR142P will be given concurrently.

October 9, 2003	Exam I	7:00-9:00 PM	WEL 1.308
November 6, 2001	Exam II	7:00-9:00 PM	WEL 1.308
December 3, 2001	Exam III	7:00-9:00 PM	WCH 1.120
December 12, 2001	Final Exam	9:00 AM - Noon	TBA

Scholastic Dishonesty

In cases where scholastic dishonesty has been determined, sections 11-502 and 11-802 of the Institutional Rules on Student Services and Activities will be enforced. These rules are found in The University of Texas at Austin General Information Catalog.

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Course Grading

Four examinations will be given: three mid-term exams and one final exam. The exams will be given concurrently with the exams for PHR 142P. Each of the exams will be of equal value and will count as 25% of the course grade. The final exam will be comprehensive and also count as 25% of the course grade.

Grades will be based on the calculated semester average according to the following formula:

Semester average = (Exam I)(0.25) + (Exam II)(0.25) + (Exam III)(0.25) +
(Final Exam)(0.25)

Grade assignment is as follows:
"A" if semester average is $\geq$ 90%
"B" if semester average is $\geq$ 80%
"C" if semester average is $\geq$ 70%
"D" if semester average is $\geq$ 60%
"F" if semester average is $<$ 60%

Reexaminations of the final exam will be considered according to the guidelines in Academic Policies and Procedures section of The University of Texas at Austin General Information Catalog.

Examination Policies

Examinations will begin promptly at their scheduled times. Students who complete the exam early will be required to remain in the exam room during, at least, the first half of the exam period. After the first half of the exam period is over, students who have completed the exam may leave the room after turning in their exam. Students who arrive at the examination room after the scheduled exam time will not be given additional time to complete the exam. Students who arrive at the examination room after the first half of the scheduled examination period is over, will not be allowed to take the exam and will receive a score of '0' for that exam.

Midterm exams will be graded and returned to the students. The final exam will be comprehensive and will not be returned to the students. Students will need to present their identification cards in order to review the graded final exam. No exceptions will be made.

If a student believes that an error has been made in grading an exam question, the student will be required to provide a ***written justification*** to the course instructor within **one week** of the exam return date. This will allow the error to be corrected in a timely manner. **After the one week period for corrections NO CHANGES will be made to exam grades.**

When a student is unable to take an exam at the appointed time (due to illness) the student **must** make special arrangements with the course coordinator **prior** to the time when the exam is scheduled. Any unexcused absence will result in a score of '0' for that exam.

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Course Description

Many significant advances made in the pharmaceutical sciences in recent years are in large part attributable to the accelerated development of knowledge of the molecular structure and physicochemical properties of drugs. The correlation of this knowledge with that of the nature of biological reactions of drugs is paramount to the practice of modern pharmacy in retail, clinical, and industrial settings. This course will review certain topics presented in various general and physical chemistry courses taken in the pre-pharmacy curriculum and address how these topics influence the safety, effectiveness and reliability of medicinal products. This knowledge will assist the pharmacy student in the critical evaluation and preparation of dosage forms prior to dispensing them to a patient and will form a basis for understanding concepts in biopharmaceutics and pharmacokinetics introduced later in the curriculum.

Course Outline

1. Introduction
    - 1.1 What is Physical Pharmacy?
    - 1.2 Role of Physical Pharmacy in Daily Pharmaceutical Practice
        - a) Examples of Drug Stability
        - b) Examples of Drug Reliability
        - c) Examples of Drug Safety

2. Thermodynamics
    - 2.1 Basic definitions
    - 2.2 State Functions
    - 2.3 Equilibrium and relation to State Functions
    - 2.4 Effect of temperature on equilibrium
        - a) the van't Hoff equation

3. Intermolecular Interactions
    - 3.1 Modes of Interaction
    - 3.2 Intermolecular Interactions and drug formulation and drug action
    - 3.3 Interactions in pure compounds
        - a) boiling point
        - b) melting point
    - 3.4 Relationship between melting and boiling point
        - a) methods for prediction of melting and boiling point
    - 3.5 Interactions in Solution
        - a) solubility
        - b) partition coefficient
        - c) Raoult's Law
        - d) colligative properties
        - e) adjusting tonicity

4. Equilibria Important to the Pharmaceutical Sciences
    - 4.1 Chemical Reactions
    - 4.2 Complexation
        - a) drug, receptor
        - b) drug, protein
        - c) drug, drug
        - d) complexation and drug stability
    - 4.3 Vapor Pressure
        - a) aerosols and Raoult's Law
    - 4.4 Solubility
        - a) electrolytes
        - b) non-electrolytes
    - 4.5 Partitioning of Non-Electrolytes

5. Acid/Base Equilibria
    - 5.1 Basic definitions
    - 5.2 Solving pH and buffer problems
        - a) pH and buffer problems in physiology
    - 5.3 Effect of pH on solubility of drugs
    - 5.4 Effect of pH on drug partitioning and absorption

6. Chemical Kinetics
    - 6.1 Basic concepts
    - 6.2 Zero order processes
    - 6.3 First order processes
    - 6.4 Pseudo-order processes
    - 6.5 Effect of temperature on rate of a process
    - 6.6 Effect of pH on rate of a process

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Lecture Schedule

Date	Lecture #	Topic
8/29		Introduction to Physical Pharmacy
9/1		**No Class – Happy Labor Day!**
9/5	1	Introduction to Thermodynamics -Processes and Systems
9/8	2	Thermodynamics: The First and Second Laws
9/12	3	Thermodynamics: Gibbs Free Energy and Spontaneous Processes
9/15	4	Gibbs Free Energy and Chemical Equilibrium
9/19	5	Chemical Equilibrium and Intermolecular Interactions
9/22	6	Use of Intermolecular Interactions to Predict Solubility and Relative Boiling and Melting Points of Drugs
9/26	7	Colligative Properties of Solutions: Raoult's Law
9/29	8	Colligative Properties of Solutions: Vapor Pressure Lowering, Boiling Point Elevation and Freezing Point Depression
10/3	9	Colligative Properties: Osmotic Pressure and Role of Tonicity in the Preparation of Pharmaceutical Solutions
Exam #1	**10/9**	**7:00-9:00 PM WEL 1.308**
10/6	10	Chemical Equilibrium and Partition Coefficients – Role in Drug Solubility and Drug Action
10/10	11	Chemical Equilibrium and Drug Complexation
10/13	12	Drug Complexation and Solubility
10/17	13	Principles of Drug Solubility – The Common Ion Effect

10/20	14	Solubility and Acid Base Equilibria	
10/24	15	Acid Base Equilibria and pH	
10/27		**No lecture – AAPS meeting**	
10/31	16	Acid Base Equilibria and Biological Buffers	
11/3	17	Buffered Solutions and the Henderson Hasselbalch Equation	
Exam #2	**11/6**	**7:00-9:00 PM**	**WEL 1.308**
11/7	18	pH and Drug Solubility	
11/10		**No lecture**	
11/14	19	pH and Drug Absorption	
11/17	20	Introduction to Chemical Kinetics	
11/21	21	Chemical Kinetics – Rate Laws and Order of Reaction	
11/24	22	Methods of Data Collection and Analysis to Assess Drug Stability	
11/28		**No lecture – Happy Thanksgiving!**	
12/1	23	The Effect of Temperature on Drug Degradation Processes	
Exam #3	**12/3**	**7:00-9:00 PM**	**WCH 1.120**
12/5	24	The Effect of pH on Drug Degradation Processes	