

**PHR 342C**  
**Fall 2009**  
**Physical and Chemical Principles of Drugs**  
**Course Syllabus**

---

**Instructor:** Dr. Maria Croyle

**Office:** PHR 4.214D

**Office hours:** M T 3-6 PM  
F 2-4 PM and by appointment

**Telephone:** 471-1972

**e-mail:** macroyle@mail.utexas.edu

**Teaching Assistants**

Jin Huk Choi

Martin Donovan

Bo Lang

Helene Lirola

Shayna McGill

**Class Time and Location**

M	9-11 AM	PHR 2.110	unique number: 61395
F	9-10 AM	PHR 2.110	

**Textbooks for the Course**

**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:

\*\*Sinko, P.J. Martin's Physical Pharmacy, 5<sup>th</sup> edition, Lippincott Williams & Wilkins, 2006 ISBN 0-7817-5027-X

Florence, A. T. Physicochemical Principles of Pharmacy, 4<sup>th</sup> edition, Pharmaceutical Press, 2006 ISBN: 0-85-369608-X

Whitten, K. W., Davis, R. E., Peck, L. and Stanley, G. C. Chemistry. 9<sup>th</sup> edition, Brooks Cole, 2009 ISBN 978-0-49-539163-0

Atkins, P. and de Paula, J. Elements of Physical Chemistry 5<sup>th</sup> edition, Oxford University Press, 2009 ISBN 978-0-19-922672-6

Hammes, G.G. Physical Chemistry for the Biological Sciences, John Wiley & Sons, 2007 ISBN 978-0-470-12202-0

**Note:** Most of 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.

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Required Materials**

The content of this course will require students to assess data and perform calculations. Thus, all students **must** have a **Texas Instruments TI-30XA calculator**. This is a reasonably priced calculator capable of performing all mathematical functions needed for this and other courses in Pharmaceutics. **You must have this calculator for admittance to each exam. Students arriving to an exam with calculators other than that specified above will be turned away.**

**Computer Use**

All students 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 concurrently enrolled in PHR 142P Physical and Chemical Principles of Drugs Laboratory.

**The Blackboard Learning System**

Handouts and Take Home Messages will be handed out at the beginning of each class period. A copy of these materials will also be posted on the Blackboard site for this course. Old exams and corresponding answer keys will also be posted on this site. You can access Blackboard by clicking on the UT Direct heading on the UT homepage. This will bring you to a login page that will ask you for your UTEID and password. Once you have successfully logged on, all you need to do is click on the Blackboard heading to view the page for this course. **It is important that you know how to use Blackboard.** Although all your exams will be returned to you, the score that we have recorded for you for each exam will also be posted through e-Gradebook. You can access your scores only through the Blackboard system. Any questions about using either of these systems can be discussed with Dr. Croyle or any of the teaching assistants.

**Echo360 Lecture Capture System – An Experiment!**

This classroom is outfitted with the new Echo360 Lecture Capture System. As a result, this class is taking part in an experiment this semester. As part of this experiment, audio and projected material presented in class will be recorded and made available to you via Blackboard. To access this material, you will need to log into Blackboard and click on the link for this class. Along the left hand side of the Blackboard page for this class, you will see a link labeled 'Class Capture'. Click on this link to show all recordings available to you.

To watch a recording, simply click on the link for that recording, re-enter your UTEID information and select the version you want to watch (use High Speed if you have a fast internet connection and Low Speed if you have a slower connection). **Please remember that this is a trial of the lecture capturing system**, so there is a chance that an issue might come up that could prevent material from being made available in a timely fashion.

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Class Format**

**For the Monday session:**

**9 AM sharp**

Beginning of lecture - I review the previous lecture material for the first 10 minutes and offer time for questions. It is to your best advantage to arrive on time for class as it is **very likely** that some information discussed during this time will show up on the midterm exams.

**10 AM** - 10 minute break

**10:10 AM** - Continuation of lecture

**10:50 AM** - Adjournment

The Friday lecture will be run in a similar manner except for the break at the end of the first hour.

**To get the most out of this course**

- a. Class attendance is expected.
- b. Be on time.
- c. If you arrive early, sit up front.
- d. **Be quiet** when entering the lecture room if class has already started. Your colleagues will thank you later for not distracting them from hearing what is going on.
- e. Review your notes (or Take Home Messages at the least) prior to class and come prepared with questions if something is not clear.

**Course Grading**

Four examinations will be given: three mid-term exams and one final exam. 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:

$$\text{Semester average} = (\text{Exam I})(0.25) + (\text{Exam II})(0.25) + (\text{Exam III})(0.25) + (\text{Final Exam})(0.25)$$

Grade assignment will be as follows:

“A” Range:	A+ if semester average is 100-97%	A = 96-93%	A- = 92-90%
“B” Range:	B+ if semester average is 89-87%	B = 86-83%	B- = 82-80%
“C” Range:	C+ if semester average is 79-77%	C = 76-73%	C- = 72-70%
“D” Range:	D+ if semester average is 69-67%	D = 66-65%	
“F”	if semester average is 64% and below		

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Examination Dates**

Exams for PHR 342C will be given on the following dates at the following times:

<b>October 8, 2009</b>	<b>Exam I</b>	<b>7:00-9:00 PM</b>	<b>WEL 1.308</b>
<b>November 12, 2009</b>	<b>Exam II</b>	<b>7:00-9:00 PM</b>	<b>WEL 1.308</b>
<b>December 3, 2009</b>	<b>Exam III</b>	<b>7:00-9:00 PM</b>	<b>FAC 21</b>
<b>Final Exam</b>	<b>TBA</b>		

**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 exam has been handed out will not be given additional time to complete the exam. Students who arrive at the examination room after the first half hour of the scheduled exam 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 promptly returned to students. The final exam will be comprehensive and will not be returned. Students will need to present their identification cards in order to review the graded final exam. No exceptions will be made.

*No allowances will be made for an exam being missed, other than by written statement from a physician in the case of personal illness.* If an exam is to be missed, the instructor must be notified **prior** to the time when the exam is scheduled. If permission is granted by telephone at the last minute (e.g. due to sudden illness) the student must confirm the request in writing as soon as possible (see College Policy on Rescheduling an Exam below) and provide the instructor with a **written medical excuse** for the absence. In this event, the student will be required to take a make up exam as quickly as possible. This exam may be of the format selected by the instructor which may not be the same format given during the examination time (i.e. oral, essay, etc.). Any unexcused absence will result in a score of 'zero' for that exam.

**Posting Class Scores**

Students can access their exam scores via e-Gradebook and/or the Blackboard page for this course. This can be accessed by logging on to UT Direct using your UTEID.

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Academic Dishonesty**

The “**Statement on Scholastic Dishonesty of the College of Pharmacy**” reads as such: “Pharmacy practitioners enjoy a special trust and authority based upon the profession’s commitment to a code of ethical behavior in its management of patient affairs. The inculcation of a sense of responsible professional behavior is a critical component of professional education, and high standards of ethical conduct are expected of pharmacy students. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including failure of the course involved and dismissal from the College and/or the University. **Since dishonesty harms the individual, fellow students, and the integrity of the University and the College of Pharmacy, policies of scholastic dishonesty will be strictly enforced in this class.**”

Students are expected to work independently on all examinations and on all laboratory quizzes and problem sets (unless specifically instructed otherwise). Any student caught cheating will be given a “zero” on the assignment **at a minimum**. Any student suspected of dishonesty will be reported to the Dean of the College of Pharmacy and to the Dean of Students, as per University regulations. Students are expected to have read and understood the current issue of the General Information Catalog published by the Registrar’s Office for information about procedures and what constitutes academic dishonesty. Students are also expected to be familiar and abide by the College Honors Code, and will be expected to sign the Honors Statement at the end of each examination. **If a student turns in an exam without signing this statement, they will not receive a grade until they meet with Dr. Croyle to discuss this issue.**

**The Honors Statement**

I have neither participated in nor witnessed any acts of academic dishonesty pertaining to this exam.

Printed Name \_\_\_\_\_

Signed Name \_\_\_\_\_

**Post-Exam Remarks and Reconsideration Requests**

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 ADDITIONAL CHANGES will be made to exam grades. For some helpful hints about submitting re-grade requests, please see the section titled “Excerpt from an Essay on Submitting Grade Reconsideration Requests” on the last two pages of this document.**

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Final Exam Re-Examination Policy**

The re-examination policy for this course will follow the General Information Catalog (GIC) policy for the University, which reads as follows: "*Only a student who has a grade average of at least a C on all class work and lab work submitted before the final exam **may request** a temporary delay of the final course grade because he or she failed the final examination, which is the examination given during the final exam period as printed in the official examination schedule.*"

*" If the petition is denied by the instructor, the student's final course grade will remain as originally determined. If the petition is granted by the instructor, the grade on the reexamination will be **substituted** for the grade on the original exam in determining the student's final course grade, provided the student earns at least a C on the reexamination. **If the grade on the reexamination is less than a C, a final course grade of F must be recorded.**"*

If a re-examination of the final must be given, the student must meet with the course instructor and take the exam prior to the start of the following semester.

**Students with Disabilities**

The University of Texas at Austin provides, upon request, appropriate academic accommodations for qualified students with disabilities. All University rules concerning accommodations must be followed, including the student arranging for special accommodations *prior* to *each* examination. In the absence of such *pre-arrangement*, the student will be expected to take the exam with the rest of the class at the regularly scheduled exam time. For more information, contact the Office of the Dean of Students at 471-6529, 471-4641, TTY.

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Course Objectives:**

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.

This course is designed to review certain concepts presented in various general and physical chemistry courses taken in the pre-pharmacy curriculum and address how these influence the safety, effectiveness and reliability of medicinal products.

After completing this course students should be able to:

- \* **understand the rationale and theory** used to describe and monitor biological (drug absorption) and physical (drug solubility, drug degradation) processes routinely encountered in pharmaceutical practice.
- \* **critically evaluate given data sets** to identify parameters that dictate how safe, effective and reliable a given medicinal preparation will be and how these could be altered to improve drug efficacy in given situations.
- \* **accurately and adeptly perform calculations** based upon general chemical principles to predict how medicinal preparations will perform in the body as well as in a given dosage form on the pharmacy shelf.
- \* **appreciate** that this knowledge will not only form a basis for understanding concepts introduced later in the curriculum but is critical for the evaluation and preparation of any dosage form prior to dispensing them to a patient.
- \* **effectively interface with practitioners and basic scientists** involved in formulation development and preparation of both novel and traditional medicinal preparations.

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**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

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

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

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Lecture Schedule**

<b><u>Date</u></b>	<b><u>Lecture #</u></b>	<b><u>Topic</u></b>
8/28		Introduction to Physical Pharmacy
8/31	1	Introduction to Thermodynamics and The First Law
9/4	2	Thermodynamics: The First and Second Laws – Relevance to Pharmacy
9/7		<b>No lecture – Happy Labor Day!</b>
9/11	3	Gibbs Free Energy, Spontaneity & Chemical Equilibrium
9/14	4	Chemical Equilibrium: Volume and Temperature Effects
9/18	5	Chemical Equilibrium: Intermolecular Interactions
9/21	6	Colligative Properties of Solutions: Raoult's Law
9/25	7	Colligative Properties of Solutions: Vapor Pressure Lowering, Boiling Point Elevation and Freezing Point Depression
9/28	8	Colligative Properties: Osmotic Pressure and Role of Tonicity in the Preparation of Pharmaceutical Solutions
10/2		<b>Exam Review with TAs</b>
10/5		<b>No lecture – Dr. Croyle in Singapore</b>
<b>Exam #1</b>	<b>10/8</b>	<b>7:00-9:00 PM      WEL 1.308</b>
10/9		<b>No lecture – Dr. Croyle in Singapore</b>
10/12	9	Chemical Equilibrium and Partition Coefficients: Role in Drug Solubility and Drug Action
10/16	10	Chemical Equilibrium and Drug Complexation

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Lecture Schedule**

10/19	11	Drug Complexation and Solubility
10/23	12	Principles of Drug Solubility – The Common Ion Effect
10/26	13	Principles of Acid Base Chemistry
10/30		Solubility and Acid Base Equilibria
11/2		Self Study – Acid Base Chemistry in Daily Pharmacy Practice
11/6	14	Acid Base Equilibria and pH
11/9	15	Buffered Solutions and the Henderson Hasselbalch Equation
<b>Exam #2</b>	<b>11/12</b>	<b>7:00-9:00 PM</b> <b>FAC 21</b>
11/13	16	pH and Drug Solubility
11/16	17	pH and Drug Absorption
11/20	18	Introduction to Chemical Kinetics:Rate laws
11/23	19	Introduction to Chemical Kinetics:Order of Reaction
11/27		<b>No lecture – Happy Thanksgiving!</b>
11/30	20	Chemical Kinetics – The Effect of Temperature and pH on Drug Degradation
<b>Exam #3</b>	<b>12/3</b>	<b>7:00-9:00 PM</b> <b>FAC 21</b>
12/4	21	Design of Formal Stability Studies in the Pharmacy

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

***Excerpt from An Essay on Submitting Grade Reconsideration Requests***

**by Prof. Patrick J. Davis, Associate Dean 5/18/03**

**Definition:** You are *requesting* that a faculty member *reconsider* your answer to a specific question(s) based upon additional documentation or explanation. Therefore, these are neither *challenges* nor *contesting* of the question; they are *reconsideration requests!*

**The Approach:** Since these are *requests for a re-grade*, not *challenges*, it would be in your best interests to start your request professionally and with courtesy, for example:

- “I am submitting question #3 for reconsideration based upon...Thanks you for your consideration.” -or-
- “I am writing to ask that you reconsider my answer for question #3 based upon...”

**but not-**

- “I thought this was a dumb question!” -or-
- “I am contesting question #3. I felt that this question was not testing our knowledge of the material but our ability to memorize odd facts. I studied extremely hard for this exam and felt like I knew the material, but I did not memorize how many amino acids were in each hormone.” [anonymous quote, 2003]

**NOTE - When designing your request, is important to provide documentation to support your case.** This documentation many include statements from textbooks, handouts, packets or current scientific publications. **A student's lecture notes are not authoritative documentation.**

**Other things to be considered when drafting re-grade requests:**

**1. Rarely will you be successful in using old exams as your justification.**

- “This question was very similar to question #17 from the 1999 exam, and the answer was ‘D’ (which is what I put).” [anonymous quote, 2003]

It could be that the question on the previous exam was thrown out because of poor statistics, and so the old exam copy you have has a ‘wrong’ answer for which all students were given credit. That doesn’t make it correct. This is one reason why I will post previous exams in an ‘unanswered’ form (for you to use for self-evaluation) and then post the keys separately.

In relying on old exams, you should also understand that the information may have changed!

**PHR 342C**  
**Fall 2009**  
**Course Syllabus**

---

**Other things to be considered when drafting re-grade requests (continued)**

**2. You may want to have a colleague read your statement for feedback before you submit it for faculty consideration. Examples:**

- *“In lecture, you said that side-effects included agranulocytosis, thrombocytopenia, hypoprothrombinemia, and aplastic anemia. But on the test you said blood dyscrasias so I marked it false! You never once mentioned blood dyscrasias!”* [anonymous quote, 2003]
  
- *“You said ‘drug of choice’ in the question, but you didn’t ask which one is primarily the best, so I thought any drug on the list used for treatment was appropriate.”*[anonymous quote , 2003]

**3. Never, never, never use as your justification “I need the points”.**

The decision on a reconsideration request belongs to the faculty member authoring the question, but all Course Coordinators caution their faculty to *not* consider this “justification” *in any way* in their deliberations. This is *never* an appropriate justification for awarding points, and it simply isn’t fair to the other students to make it a basis for awarding points. Should a student 1point from a “C” be given the points for a “B” *just because they asked for them*, while another student with the same score be assigned (and accept) a “C”? What is that faculty member to do when the second student finds out the first was awarded the points just for asking?

**4. Just because you can find an article supporting your position doesn’t *automatically* mean that it is correct or that you should be given credit.**

Part of the faculty member’s responsibility to is to stay current with their field, which involves reading, reviewing, and distilling the often-time copious & conflicting material relevant to their field to create their learning environment and define the content they present to you in class. The faculty member will make their decision on the article/text you cite in the context of their full knowledge of the field and what they present to you in class.