

CUHK (SZ)
Course Outline

1. Course Identity

A. Course as listed in CUHK (SZ)

The information in this block should be exactly as approved by CUHK Senate. In case there are any differences, please explain in the table below.

Course code	PHM2010
Course title (English)	Pharmaceutical Physical Chemistry
Course title (Chinese)	药学物理化学
Units	2
Language of Instruction	English
Description (English)	The aim of the course is to provide students with a systematic understanding of the principles of pharmaceutical physical chemistry, through discussing different states of matter, various types of pharmaceutical solutions of non-electrolytes, strong electrolytes and their colligative properties. The course also studies thermodynamics, dynamic equilibria and catalysis, topics that provide students with basic knowledge necessary for chemistry, pharmacokinetics and pharmaceuticals study.
Description (Chinese)	本课程的目的是通过讨论物质的不同状态、非电解质、强电解质的各种药物溶液及其依数性质，使学生系统地了解药物物理化学的原理。该课程还研究热力学、动态平衡和催化，这些主题为学生提供化学、药代动力学和药剂学研究所需的基本知识。

B. Corresponding course in CUHK

Please give details of the *closest* corresponding course in CUHK (as approved by CUHK Senate and listed in course list). If the course in SZ maps to more than one course in CUHK, please make multiple copies of the block below.

Course code	PHAR1110**
Course title (English)	Fundamentals of Pharmaceutical Chemistry
Course title (Chinese)	
Units	2
Description (English)	
Description (Chinese)	

2. Prerequisites / Co-requisites

Students need to take as prerequisites.

(* Because course codes may not yet be stable, please provide both course code and course title.)

A. Prerequisites

General Biology, General Chemistry

3. Learning Outcomes

Upon completing this course, the students are expected to have the following learning outcomes:

Regarding the KNOWLEDGE aspect, the students are expected to be able to describe and integrate the most important concepts, principles and knowledge in physical chemistry and physical pharmacy.

Regarding the SKILLS aspect, the students are expected to gradually develop the basic skills that would enable them to apply the learned concepts, principles and knowledge in understanding and explaining real cases and situations in dosageform design and drug formulation.

Regarding developing and/or enhancing the GENERIC SKILLS AND VALUES of the students, this course is expected to do and accomplish the following:

have acquired the ability to seek, compile, present and critically examine information in relation to physical chemical property.

4. Course Syllabus

UNIT 1: Basic concept of physical chemistry

- I. Introduction to physical chemistry: Importance of physical chemistry in pharmaceutical sciences.
- II. State of Matters: the perfect gases and real gases, change of state (physical transitions), intermolecular interactions
- III. The first law of thermodynamics: Work, Heat, and energy, thermochemistry
- IV. The second and third laws of thermodynamics: entropy, the Helmholtz energy, Gibbs energy, and standard molar Gibbs energy

UNIT 2: Physical pharmacy

- I. Simple Mixtures: Partial molar quantities, chemical potentials of liquids, liquid mixtures, colligative properties.
- II. Surface and interfacial phenomena: Surface tension and surface free energy.
- III. Physicochemical properties and drug action.
- IV. Micromeritics-Introduction to fundamental and derived properties, methods to determine particle size, shape and surface area, density and bulkiness, flow properties compaction

UNIT 3: Drug action and stability:

- I. Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order.
- II. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems.
- III. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

4. Assessment Scheme

Component/ method	% weight
Assignments	20
Quizzes	20
Mid-term exam	30
Final exam	30

5. Grade Descriptor

A	Demonstrates the ability to synthesize and apply the principles or subject matter learnt in the course, to novel situations and/or in novel ways, in a manner that would surpass the normal expectation at this level, and typical of standards that may be common at higher levels of study or research. Has the ability to express the synthesis of ideas or application in a clear and cogent manner.
A-	Demonstrates the ability to state and apply the principles or subject matter learnt in the course to familiar and standard situations in a manner that is logical and comprehensive. Has the ability to express the knowledge or application with clarity.
B	Demonstrates the ability to state and partially apply the principles or subject matter learnt in the course to most (but not all) familiar and standard situations in a manner that is usually logically persuasive. Has the ability to express the knowledge or application in a satisfactory and unambiguous way.
C	Demonstrates the ability to state and apply the principles or subject matter learnt in the course to most (but not all) familiar and standard situations in a manner that is not incorrect but is somewhat fragmented. Has the ability to express the separate pieces of knowledge in an unambiguous way.
D	Demonstrates the ability to state and sometimes apply the principles or subject matter learnt in the course to some simple and familiar situations in a manner that is broadly correct in its essentials Has the ability to state the knowledge or application in simple terms.
F	Unsatisfactory performance on a number of learning outcomes, OR failure to meet specified assessment requirements.

6. Feedback for Evaluation

Formal course and teaching evaluation by students after finishing all the lectures;
Informal feedback to instructor and/or teaching assistant(s) through face-to-face talking, phone calls, emails, etc

7. Reading

A. Required

E book: Physical Chemistry: Thermodynamics, Structure, and Change Tenth Edition, Peter Atkins (Author), Julio de Paula (Author)
ISBN-13: 978-1429290197
Publisher : W. H. Freeman; Tenth edition (January 17, 2014)

E book: Theory and Practice of Physical Pharmacy, Gaurav Jain (Author), Roop Krishen Khar (Author), Farhan J. Ahmad (Author)
ASIN : B0087A2PM6
Publisher : Elsevier India (June 23, 2011)

Physicochemical Principles of Pharmacy, Edition 5th, Prof Alexander T. Florence (Author), David Attwood (Author) SBN-10 9780853699842
ISBN-13 978-0853699842
Publisher Pharmaceutical Press

PPT handout prepared by the lecturers

B. Recommended

None

8. Course Components

Activity	Hours/week
Lectures	2 x 1 hours/week

9. Indicative Teaching Plan

Week	Content/topic/activity
1	Introduction to Physical Chemistry: Importance of Physical Chemistry in Pharmaceutical Sciences.
2	State of Matters: the Perfect Gases and Real gases, Change of State

	(physical transitions), Intermolecular Interactions
3	The First Law of Thermodynamics: Work, Heat, and energy, Thermochemistry
4	The Second and Third laws of thermodynamics: entropy, helmholtz energy, Gibbs energy, and standard molar Gibbs energy
5	Chemical equilibrium: The equilibrium constant, chemical potentials of liquids;
6	Rates of chemical reactions. Rate laws
7	Arrhenius equation, Reaction mechanisms
8	Midterm Exam
9	Buffered and Isotonic Solution
10	Metrimertics
11	Rheology of pharmaceutical systems
12	Surface Tension
13	Drug Release and Dissolution
14	Drug Diffusion

10. Implementation plan (2022–23)

23 students for lecture (x 2); 23 students for tutorials (x 10)

11. Approval

Has the course title been included in the programme submission approved by CUHK Senate? Are there any differences?

Have the details (as in this document) been approved at School or other level in CUHK (SZ)?

12. Any other information

13. Version date

Version number	1
As of (date)	8/5/2023