

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	有机化学 I Organic Chemistry I
2.	授课院系 Originating Department	化学系 Department of Chemistry
3.	课程编号 Course Code	CH203
4.	课程学分 Credit Value	4
5.	课程类别 Course Type	专业基础课 Major Foundational Courses
6.	授课学期 Semester	秋季 Fall
7.	授课语言 Teaching Language	中英双语 English & Chinese
8.	授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	李鹏飞, 助理教授, 化学系, li.pf@sustech.edu.cn 汪君, 助理教授, 化学系, wang.j@sustech.edu.cn 何川, 副教授, 化学系, hec@sustech.edu.cn 徐晨, 助理教授, 化学系, xuc@sustech.edu.cn Pengfei Li, Assistant Professor, Department of Chemistry, li.pf@sustech.edu.cn ; Jun Wang, Assistant Professor, Department of Chemistry, wang.j@sustech.edu.cn ; Chuan He, Associate Professor, Department of Chemistry, hec@sustech.edu.cn ; Chen Xu, Assistant Professor, Department of Chemistry, xuc@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	穆怀雪, 化学系, muhx@mail.sustech.edu.cn Huaixue Mu, Department of Chemistry, muhx@mail.sustech.edu.cn
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
学时数 Credit Hours	64	0	0	0	64

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	化学原理 A (CH101A)
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	有机化学 II (CH206)
14. 其它要求修读本课程的学系 Cross-listing Dept.	

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

为学生提供基础理论知识以便于学生理解有机分子的结构及反应活性，用实际例子去阐明有机化学在众多学科的重要性。本课程作为基础有机化学课程的第一部分，随后将要开展 CH206 有机化学 II。

To provide students with the basic principles to understand the structure and reactivity of organic molecules, with examples illustrating the role of organic chemistry in daily life and industry. This course serves as the first part of the complete program on fundamental organic chemistry, to be followed up by CH206 Organic Chemistry II.

16. 预达学习成果 Learning Outcomes

预期学习效果:

- 1 能够理解有机化学的基本概念，并能够有效的运用其中的专业名词;
- 2 能够形象地画出正确表示化学分子的三维立体结构式;
- 3 能够认识、区分并命名手性异构体和非对映异构体
- 4 能够理解官能团地反应活性;
- 5 能够掌握反应机理并用以掌握地机理知识应用于解决化学问题;
- 6 能够应用已知的反应去合成目标分子.

On successful completion of this course, students should be able to:

- 1 understand basic concepts and employ the vocabulary of organic chemistry;
- 2 visualize and draw three-dimensional, stereochemically correct representations of organic molecules;
- 3 recognize, discriminate and name chiral stereoisomers and diastereomers;
- 4 understand the reactivity of the functional groups;
- 5 understand reaction mechanisms and apply mechanistic knowledge to solve chemistry problems;
- 6 apply reactions to the synthesis of target molecules.

17. 课程内容及教学日历 (如授课语言以英文为主, 则课程内容介绍可以用英文; 如团队教学或模块教学, 教学日历须注明主讲人)
Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

Chapter 1 Introduction and Review

The origins of organic chemistry; Principles of atomic structure; Bond formation: the Octet rule; Lewis structure; Multiple bonding; Electronegativity and bond polarity; Formal charges; Ionic structure; Resonance; Structural formulas; Molecular formulas and empirical formulas; Arrhenius acids and bases; Lewis acids and bases. 2 credit hours

第一章 绪论

有机化学的起源；原子结构理论；键的形成；八隅体规则；路易斯结构；多重键；电负性和键极性；形式电荷；离子结构；共振；分子结构；分子式和实验式；阿伦尼乌斯酸碱；路易斯酸碱。2 个学时

Chapter 2 Structure and Properties of Organic Molecules

Wave properties of electrons in orbitals; Molecular orbitals; Pi bonding; Hybridization and molecular shapes; Drawing three-dimensional molecules; General rules of hybridization and geometry; Bond rotation; Isomerism; Polarity of bonds and molecules; Intermolecular forces; Polarity effects on solubilities. 2 credit hours

第二章 有机分子的结构及性质

轨道电子的波性质；分子轨道；Pi 键；杂化轨道和分子构型；化分子的三维结构；杂化轨道和几何结构理论；键的旋转；同分异构体；分子和键的极性；分子间作用力；相似相溶原理。2 个学时

Chapter 3 Structure and Stereochemistry of alkanes

Nomenclature of alkanes; Physical properties of alkanes; Uses and sources of alkanes; Reactions of alkanes; Structure and conformations of alkanes; Cycloalkanes; Cyclohexane conformations; Conformations of monosubstituted cyclohexanes; Conformations of disubstituted cyclohexanes. 4 credit hours

第三章 烷烃的结构和立体化学

烷烃的命名；烷烃的物理性质；烷烃的应用及来源；烷烃的反应；烷烃的结构与构象；环烷烃；环己烷的构象；单取代环己烷的构象；双取代环己烷的构象。4 个学时

Chapter 4 The Study of Chemical Reactions

Chlorination of methane; The free-radical chain reaction; Equilibrium constants and free energy; Enthalpy and entropy; Bond-dissociation enthalpies; Enthalpy changes in chlorination; Kinetics and the rate equation; Activation energy and the temperature dependence of rates; Transition states; Rates of multistep reactions; Temperature dependence of halogenation; Selectivity in halogenation; The Hammond postulate; Radical inhibitors; Reactive intermediates. 4 credit hours

第四章 化学反应的研究

氯代甲烷；自由基反应；平衡常数和自由能；焓和熵；焓变；氯代反应中的焓变；动力学和速率方程；活化能与反应速率的温度依赖；过渡态；多步反应速率；卤代反应的温度依赖；卤代反应的选择性；Hammond 假设；自由基抑制剂；活性中间体。4 个学时

Chapter 5 Stereochemistry

Chirality; (R) and (S) nomenclature of asymmetric carbon atoms; Optical activity; Racemic mixtures; Enantiomeric excess and optical purity; Chirality of conformationally mobile systems; Chiral compounds without asymmetric atoms; Fischer projections; Diastereomers; Stereochemistry of molecules with two or more asymmetric carbons; Meso compounds; Absolute and relative configuration; Physical properties of diastereomers; Resolution of enantiomers. 4 credit hours

第五章 立体化学

手性；不对称碳原子的(R、(S)命名；光学活性；外消旋混合物；对映体过量和光学纯度；手性构象的移动系统；没有不对称碳原子的手性化合物；费舍尔投影式；非对映异构体；含两个或更多不对称碳原子分子的立体化学；内消旋化合物；绝对构型和相对构型；非对映异构体的物理性质；对映异构体的拆分。4 个学时

Chapter 6 Alkyl Halides: Nucleophilic Substitution and Elimination

Nomenclature of alkyl halides; Common uses of alkyl halides; Structure of alkyl halides; Physical properties of alkyl halides; Preparation of alkyl halides; Reactions of alkyl halides: substitution and elimination; Second-order nucleophilic substitution: The SN2 reaction; Generality of the SN2 reaction; Factors Affecting SN2 reactions: strength of the nucleophile; Reactivity of the substrate in SN2 reactions; Stereochemistry of the SN2 reaction; First-order nucleophilic substitution: the SN1 reaction; Stereochemistry of the SN1 reaction; Rearrangements in SN1 reactions; Comparison of SN1 and SN2 reactions; First-Order elimination: the E1 reaction; Positional orientation of elimination: Zaitsev's Rule; Second-order elimination: the E2 reaction; Stereochemistry of the E2 reaction; Comparison of E1 and E2 elimination mechanisms. 8 credit hours

第六章 卤代烃：亲核取代与消除

卤代烃的命名；卤代烃的日常用途；卤代烃的结构；卤代烃的物理性质；卤代烃的制备；卤代烃的反应；取代反应与消除反应；二阶亲核取代；SN2 反应：常见的 SN2 反应；影响 SN2 反应的因素；亲核试剂的强度；SN1：SN1 反应的立体化学；SN1 反应中的重排现象；比较 SN1 和 SN2 反应；一阶消除反应：E1 反应：发生消除反应的位置；扎伊采夫规则；二阶消除反应；E2 反应的立体化学；比较 E1 反应和 E2 反应。8 个学时

Chapter 7 Structure and Synthesis of Alkenes

Nomenclature of alkenes; The orbital description of the alkene double bond; Elements of unsaturation; Commercial importance of alkenes; Stability of alkenes; Physical properties of alkenes; Alkene synthesis by elimination of alkyl halides; Alkene synthesis by dehydration of alcohols; Alkene synthesis by high-temperature industrial methods. 4 credit hours

第七章 烯烃的结构与合成

烯烃的命名；烯烃双键的轨道描述；不饱和元素；烯烃的商业用途；烯烃的稳定性；烯烃的物理性质；通过卤代烃的消除反应生成烯烃；醇脱水合成烯烃；高温工业合成烯烃。4 个学时

Chapter 8 Reactions of Alkenes

Reactivity of the carbon-carbon double bond; Electrophilic addition to alkenes; Addition of hydrogen halides to alkenes; Addition of water: hydration of alkenes; Hydration by oxymercuration-demercuration; Alkoxymercuration-demercuration; Hydroboration of alkenes; Addition of halogens to alkenes; Formation of halohydrins; Catalytic hydrogenation of alkenes; Addition of carbenes to alkenes; Epoxidation of alkenes; Acid-catalyzed opening of epoxides; Syn hydroxylation of alkenes; Oxidative cleavage of alkenes; Polymerization of alkenes; Olefin metathesis. 8 credit hours

第八章 烯烃的反应

碳碳双键的活性；烯烃的亲电加成；烯烃的氢卤加成；水的加成；烯烃的水合反应；羟汞化-脱汞水合反应；烷氧汞化-脱汞；烯烃的硼氢化反应；烯烃的卤素加成；卤代醇的形成；烯烃的催化加氢；卡宾加成生成烯烃；烯烃环氧化；酸催化环氧化开环反应；烯烃的氢化；烯烃的氧化断裂；烯烃的聚合；烯烃的置换作用。8 个学时

Chapter 9 Alkynes

Nomenclature of alkynes; Physical properties of alkynes; Commercial importance of alkynes; Electronic structure of alkynes; Acidity of alkynes; Formation of acetylide ions; Synthesis of alkynes from acetylides; Synthesis of alkynes by

elimination reactions; Addition reactions of Alkynes; Oxidation of alkynes. 4 credit hours

第九章 炔烃

炔烃的命名; 炔烃的物理性质; 炔烃的商业价值; 炔烃的电子结构; 炔烃的酸性; 炔基离子的形成; 由乙炔合成炔烃; 合成炔烃的消除反应; 炔烃的加成反应; 炔烃的氧化反应。4 个学时

Chapter 10 Conjugated Systems and Orbital Symmetry

Stabilities of dienes; Molecular orbitals of a conjugated system; Allylic Cations; 1,2- and 1,4-Addition to conjugated dienes; Kinetic versus thermodynamic control in the addition of HBr to 1,3-Butadiene; Allylic radicals; Molecular orbitals of the allylic system; Electronic configurations of the allyl radical, cation, and anion; SN2 Displacement reactions of allylic halides and tosylates; The Diels-Alder reaction; The Diels-Alder as an example of a pericyclic reaction. 6 credit hours

第十章 共轭系统和轨道对称性

双烯类化合物的稳定性; 共轭系统的分子轨道; 炔基阳离子; 双烯化合物的 1,2-和 1,4 加成; HBr 加成到 1,3-Butadiene 的动力学、热力学控制; 炔基自由基; 炔基系统的分子轨道; 炔基自由基、炔基阳离子和炔基阴离子的电子构型; 卤代炔基和甲苯磺酸盐的 SN2 取代反应; Diels-Alder 反应; 以 Diels-Alder 反应为例的周环反应。6 个学时

Chapter 11 Infrared and Ultraviolet Spectroscopy

The electromagnetic spectrum; The Infrared region; Molecular vibrations; IR-active and IR-inactive vibrations; Measurement of the IR spectrum; Infrared spectroscopy of hydrocarbons; Characteristic absorptions of alcohols and amines; Characteristic absorptions of carbonyl compounds; Characteristic absorptions of C-N bonds; Simplified summary of IR stretching frequencies; Reading and interpreting IR spectra; Ultraviolet absorption spectroscopy; Ultraviolet light and electronic transitions; Measurement of the UV-visible spectrum; Interpreting UV-visible spectra. 4 credit hours

第十一章 红外光谱和紫外光谱

电磁波谱; 红外区域; 分子的振动; 红外振动的频率; 红外光谱的测量; 碳氢化合物的红外光谱; 醇和胺类化合物的红外吸收特征; 羰基化合物的红外吸收特征; C-N 键的吸收特征; 简单总结红外伸缩振动频率; 解析 IR 谱图; 紫外吸收色谱; 紫外光和电子的转移; 可见紫外光的测量; 解析紫外可见光谱。4 个学时

Chapter 12 Nuclear Magnetic Resonance Spectroscopy and Mass Spectroscopy

Introduction of nuclear magnetic; Theory of nuclear magnetic resonance; Magnetic shielding by electrons; The NMR spectrometer; The chemical shift; The number of signals; Areas of the peaks; Spin-spin splitting; Carbon-13 NMR spectroscopy; Interpreting carbon NMR spectra; Introduction to Mass spectrometry; Determination of the molecular formula by mass spectrometry; Fragmentation patterns in mass spectrometry. 4 credit hours

第十二章 核磁共振光谱和质谱

核磁的介绍; 核磁共振理论; 电子的磁屏蔽; 核磁共振谱图; 化学位移; 峰个数; 峰面积; 自旋裂分; 碳谱; 解析核磁谱图; 质谱的介绍; 通过质谱确定分子式; 质谱的裂解方式。4 个学时

Chapter 13 Structure and Synthesis of Alcohols

Nomenclature of alcohols; Structure and classification of alcohols; Physical properties of alcohols; Commercially important alcohols; Acidity of alcohols and phenols; Synthesis of alcohols: Introduction and Review; Organometallic reagents for alcohol synthesis; Synthesis of alcohol: addition of organometallic reagents to carbonyl compounds; Side reactions of organometallic reagents: reduction of alkyl halides; Synthesis of 1° and 2° alcohols: reduction of the carbonyl group; Thiols (Mercaptans). 8 credit hours

第十三章 醇的结构与合成

醇的命名；醇的结构及分类；醇的物理性质；醇的商业用途；醇和多酚的酸性；醇的合成；简介；用有机金属试剂合成醇；醇的合成；将有机金属试剂加成到羰基化合物上；有机金属试剂的副反应；卤代烃的还原；合成 1°、2° 醇；去羰基化；硫醇。8 个学时

Chapter 14 Reactions of Alcohols

Oxidation states of alcohols and related functional groups; Oxidation of alcohols; Additional methods for oxidizing alcohols; Alcohols as nucleophiles and electrophiles; formation of tosylates; Reduction of alcohols; Reactions of alcohols with hydrohalic acids; Reactions of alcohols with phosphorus halides; Reactions of alcohols with thionyl chloride; Dehydration reactions of alcohols; Unique reactions of diols; Esterification of alcohols; Esters of inorganic acids; Reactions of alkoxides. 2 credit hours

第十四章 醇的反应

氧化态的醇和相关的官能团；醇的氧化；加成的方法氧化醇；醇作为亲核试剂和亲电试剂；甲苯磺酸盐的生成；醇的减少；醇与氢卤酸的反应；醇与磷卤化合物的反应；醇与亚硫酸基的反应；醇的脱水反应；脱醇的特殊反应；醇的酯化；无机酸的酯；醇盐的反应。2 个学时

18. 教材及其它参考资料 Textbook and Supplementary Readings

现用教材 (textbook): L. G. Wade, Jr 《Organic Chemistry》 (Eighth Edition) Pearson International Edition, ISBN-13: 978-0-321-81139-4, ISBN-10: 0-321-81139-9.

参考教材 (supplementary reading): 邢其毅、裴伟伟、徐瑞秋、裴坚主编。《基础有机化学》(第三版, 上、下册) 高等教育出版社, 2005。

课程评估 ASSESSMENT

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		0		
课堂表现 Class Performance		0		
小测验 Quiz		0		
课程项目 Projects		0		
平时作业 Assignments		10		
期中考试 Mid-Term Test		30		
期末考试 Final Exam		60		
期末报告 Final Presentation		0		

其它（可根据需要
改写以上评估方
式）
Others (The
above may be
modified as
necessary)

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20. 记分方式 GRADING SYSTEM

- A. 十三级等级制 Letter Grading
 B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过
 This Course has been approved by the following person or committee of authority

化学系教学指导委员会
 Teaching committee of the chemistry department

