

## 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 <b>Course Title</b>	物理化学实验 <b>Physical Chemistry Laboratory</b>			
2.	授课院系 <b>Originating Department</b>	化学系 Department of Chemistry			
3.	课程编号 <b>Course Code</b>	CH303			
4.	课程学分 <b>Credit Value</b>	2			
5.	课程类别 <b>Course Type</b>	专业基础课 Major Foundational Courses			
6.	授课学期 <b>Semester</b>	秋季 Fall			
7.	授课语言 <b>Teaching Language</b>	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） <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	汤小菊 第一教学楼 532 88018730 tangxj@sustech.edu.cn 颜瑗琿 第一教学楼 533 88018733 yanah@sustech.edu.cn 何绮婷 第一教学楼 537 88018741 heqt@sustech.edu.cn Tang Xiaoju Lecture Hall 1, Room-532, 88018730, tangxj@sustech.edu.cn Yan Aihui Lecture Hall 1, Room-533, 88018733, yanah@sustech.edu.cn He Qiting Lecture Hall 1, Room-537, 88018741, heqt@sustech.edu.cn			
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	无 NA			
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>				
11.	授课方式 <b>Delivery Method</b>	讲授 <b>Lectures</b>	习题/辅导/讨论 <b>Tutorials</b>	实验/实习 <b>Lab/Practical</b>	其它(请具体注明) <b>Other (Please specify)</b>
	学时数 <b>Credit Hours</b>			64	64

12. 先修课程、其它学习要求 <b>Pre-requisites or Other Academic Requirements</b>	物理化学 I (CH301)
13. 后续课程、其它学习规划 <b>Courses for which this course is a pre-requisite</b>	无 NA
14. 其它要求修读本课程的学系 <b>Cross-listing Dept.</b>	This course should be taken by students with contemplating in Chemistry, Chemical Engineering, and Materials Science and Engineering, etc.

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

物理化学实验课程的教学目标是使学生加深对热力学、电化学、反应动力学、表面化学和结构化学的基本原理的理解；掌握热化学测量技术、电化学测量技术、真空技术、界面技术、物质结构分析技术等基本原理和实验操作技术。

This experimental course is intended to demonstrate the established principles of physical chemistry including thermochemistry, phase equilibrium, electrochemistry, surface property, chemical kinetics and molecular structure. It provides experience with the kind of experimental measurements that can yield new results.

#### 16. 预达学习成果 Learning Outcomes

通过课程的学习，学生应该：（1）理解各种温度、压力、电压和真空测量仪器的原理和操作；（2）加深理解物理化学理论课程的基本原理；（3）提高实验技术和问题解决能力；（4）提高数据处理、误差分析等实验结果的归纳总结能力；（5）提高团队合作能力；（6）提高查阅文献来设计探究型实验的能力。

After completing the course, students should be able to: (1) understand the principle and performance of various temperature, pressure, voltage, and vacuum measurement instruments; (2) enhance understanding of the fundamental concepts of physical chemistry presented in the lecture component. (3) develop experimental skills and problem-solving skills; (4) write laboratory reports, perform error propagation analysis, and properly report the final results; (5) work as part of a team in performing experiments; (6) access and utilize chemical information technology for proper experimental design and interpretation.

#### 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.)**

实验一、绪论（4学时）：实验内容、评分标准、实验安全

Introduction to experiments, grade rulers and safety

实验二、燃烧热的测定（4学时）：学习氧弹式量热计的原理和技术；测量苯甲酸和萘的燃烧热

Heat of Combustion: to learn the principle and experimental technique of a bomb calorimeter; to measure the heats of combustion of naphthalene and benzoic acid.

实验三、纯液体的饱和蒸汽压的测量（5学时）：学习真空原理和技术；测量乙醇的饱和蒸汽压和平均摩尔汽化热

Saturated Vapor Pressure of Pure Liquid: to learn the experimental technique for low vacuum operation; to determine the saturated vapor pressure of ethanol at different temperatures using vacuum gauge; to gain the average molar enthalpy of vaporization of ethanol.

实验四、凝固点降低法测相对分子量（4学时）：学习凝固点的测量技术；凝固点降低法测定蔗糖的摩尔质量，绘出溶液的冷却曲线

Molar Mass from Depression of Freezing Point: to learn the experimental technique for freezing point measurement; to determine the molar mass of sucrose by plotting the cooling curve of a dilute sucrose solution and measuring the depressing of freezing point.

实验五、离子迁移数的测定（5学时）：学习库仑计和恒电流仪的使用；测定  $\text{CuSO}_4$  溶液中  $\text{Cu}^{2+}$  的迁移数

Ion Transport Number: to learn the technique of coulometer and constant current meter; to determine the transport number of  $\text{Cu}^{2+}$  in aqueous solution of  $\text{CuSO}_4$ .

实验六、原电池电动势的测定（5学时）：学习电位差计的原理和技术；熟悉有关电动势和电极电势的基本计算

Electromotive Force of Galvanic Cells: to learn the principle and technique of a potentiometer; to calculate the electromotive force and electrode potential.

实验七、双液系的气液平衡相图（5学时）：学习阿贝折射仪的原理和技术；使用阿贝折射仪测定二组分的组成；学习沸点仪的原理和技术；绘制水-正丙醇体系的气液平衡相图

Phase Diagram of a Binary Liquid-Vapor System: to learn the method for determining the boiling point of a binary liquid system; to learn the method for determining the composition of binary liquid system by refractometry; to draw the phase diagram of the water-propanol liquid-vapor system.

实验八、镍的阳极极化曲线（4学时）：学习 CHI 电化学工作站的原理和技术；采用线性电位扫描法测定镍在硫酸中的钝化行为

Passivation Behavior of Ni in Sulfuric Acid Solution: to learn the principle and technique of CHI electrochemical analyzer; to measure the passivation behavior of Ni in sulfuric acid solution by linear sweep voltammetry.

实验九、最大泡压法测定溶液的表面张力（4学时）：学习最大泡压法测定液体表面张力的原理和技术；测定不同浓度正丁醇水溶液的表面张力；计算表面吸附量和正丁醇分子的横截面积

Surface Tension of Solutions: to learn the principle and technique of the maximum bubble pressure method; to determine the surface tension of different solutions of n-butanol at varying concentrations; to calculate the surface adsorption capacity and the cross-section of n-butanol molecule.

实验十、络合物磁化率的研究（4学时）：学习 Evans 磁天平测定物质磁化率的原理和技术；测定络合物的磁化率；推算未成对电子数；判断配建类型

Determination of Magnetic Susceptibility of Complex Compounds: to learn the principle and technique of magnetic susceptibility measurement using and Evans balance; to determine the magnetic susceptibility of complex compounds; to deduce the number of unpaired electrons and to estimate the coordination pattern.

实验十一、蔗糖水解速率常数的测定和反应条件的研究（4学时）：学习旋光仪的原理和技术；了解旋光度和浓度的关系；测定蔗糖在酸催化条件下的水解反应速率常数

Rate Constant for the Conversion of Sucrose by a Polarimetric Method: to learn the principle and technique of polarimeter; to know the relationship between the reactant concentration and optical rotation; to determine the rate constant for the conversion of sucrose.

实验十二、化学振荡反应的研究（5学时）：了解BZ振荡反应的基本原理；通过测定电位-时间曲线求得振荡反应的表现活化能

The Oscillating Reaction: to know the mechanism of the oscillating reaction; to determine the apparent activation energy of the oscillating reaction via measuring the open circuit potential-time curve.

实验十三、分光光度法测定蔗糖酶的米氏常数（5学时）：学习旋光仪的原理和技术；了解底物浓度与酶反应速率之间的关系；测定蔗糖酶的米氏常数和最大反应速率

The Michaelis Constant for Sucrase by a Spectrophotometric Method: to learn the principle and technique of spectrophotometer; to know the relationship between substrate concentration and reaction rate of enzyme; to determine the Michaelis constant and maximum reaction rate of sucrose.

实验十四、陈述（6学时）

Presentation

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

Experimental Physical Chemistry, Gao Zi, Higher Education Press

《物理化学实验》庄继华等, 第三版, 高等教育出版社

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		5		
课堂表现 Class Performance		35		
小测验 Quiz		10		
课程项目 Projects				
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				

期末报告 <b>Final Presentation</b>	10		陈述 Presentation
其它（可根据需要 改写以上评估方 式） <b>Others (The above may be modified as necessary)</b>	40		实验报告 Lab Report

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

