

Course Overview

This course satisfies the Pure and Applied Sciences Pillar (UC Credit) Level 1. This course is an introductory course in chemistry designed specifically for non-science majors. The course is intended to develop critical thinking to help students understand how chemistry is relevant to their daily lives. The course reflects a variety of current societal and technological issues and the chemical principles embedded in them. Air pollution, global warming, acid rain, energy (fossil fuels, nuclear, alternatives), and properties/purity of water are examples of such issues.

Instructor Biography

Professor Lattman has been teaching at SMU for more than 30 years. In addition to teaching students majoring in chemistry, he has taught non-science majors since he first arrived at SMU. His experience includes teaching Chem 1301 during the summer for the past 10 years, as well as in May Term 2013 and 2014. Professor Lattman was recognized by SMU students as a HOPE (Honoring our Professors' Excellence) honoree in 2002, 2003, 2007, 2008, and 2015. He also received the Distinguished HOPE Faculty Award in 2012 and has been honored as a Camille and Henry Dreyfus Scholar. In 2014, Professor Lattman received the Altshuler Distinguished Teaching Professor Award. Professor Lattman conducts research in the areas of inorganic chemistry and catalysis.

Benefits of taking this course during May Term

- Students will be able to focus exclusively on this course.
- Numerous breaks will be scheduled for problem sessions and review.
- Small class size allows for individualized faculty-student interactions.
- Students will be free from taking Chem 1301 during the fall and spring or summer, making it possible to substitute other courses to fulfill requirements and interests.

UC/GEC "tags" and Student Learning Outcomes (SLO's)

This course satisfies the Pure and Applied Sciences Pillar (UC Credit) Level 1. This course is an introductory course in chemistry designed specifically for non-science majors.

General Education Learning Outcomes:

- Students will be able to use both qualitative and quantitative methods to understand chemistry.
- Students will be able to describe how the concepts and findings in chemistry are relevant to our daily lives and shape our world.

Student Learning Outcomes:

- Students will be able to apply chemical principles with their application to the real world.
- Students will be able to acquaint themselves with scientific methods and scientific understanding, so that they will be able to read about science and technology with some degree of critical judgment.
- Students will be able to use chemical knowledge and critical thinking ability to better assess the risks and benefits in choices that they, as informed citizens, will be making.
- In the laboratory, experiments are designed to illustrate the chemical principles presented in lecture with broader societal implications. Hands-on experience with experimentation and data collection will help students describe the scientific method and the role that science plays in addressing societal issues. All experiments include a set of questions that will allow students summarize and consolidate what they have learned and/or to extend the results to new situations.

Class Meeting 9:00 am to 1:00 pm **Fondren Science** **Room TBD (lecture)** **Room 25 (lab)**

Instructor: M. Lattman, Room 310 Fondren Science (FS) (Tel. 214-768-2467, mlattman@smu.edu)

Office Hours: M W 1:00 - 2:00 pm (or by appointment)

Text: Middlecamp, Keller, Anderson, Bentley, Cann, Ellis *Chemistry in Context: Applying Chemistry to Society*, 7th ed., McGraw-Hill, 2012.

Calculator: An inexpensive calculator will be needed. One that does logarithms (“logs”) is helpful.

| Date | Topic | Lab | Exams |
|--------|---|--|------------|
| May 14 | Introduction - Chemistry for a Sustainable Future The Air We Breathe | | |
| May 15 | Protecting the Ozone Layer | What's in a Breath? O ₂ and CO ₂ . | |
| May 18 | The Chemistry of Global Climate Change | | Exam 1 |
| May 19 | Energy from Combustion | Molecular Shapes | |
| May 20 | Water for Life | | |
| May 21 | Neutralizing the Threat of Acid Rain | Chemical Moles | |
| May 22 | The Fires of Nuclear Fission | | Exam 2 |
| May 25 | HOLIDAY | | |
| May 26 | The World of Polymers and Plastics | Acids and Bases | |
| May 27 | Manipulating Molecules and Designing Drugs | | |
| May 28 | Nutrition | | |
| May 29 | — | Fats in Foods | Final Exam |

Lectures meet for 4 hours (with breaks/problem sessions) unless a lab or lecture exam is scheduled on the same day.

When a lab is scheduled, lecture and lab meet for 2 hours each.

Exams 1 and 2 are 1-hour long; lecture meets for 3 hours on these days.

The final exam is scheduled for 2 hours and the final lab is 2 hours.

| | | |
|----------------|--|------|
| Grading | Two one-hour lecture exams (Exams 1 and 2) | 40% |
| | Final Exam (2 hours, comprehensive) | 40% |
| | Lab | 20% |
| | Total | 100% |

Missed Exams

If you miss an exam for a **WRITTEN, EXCUSED** reason, a make-up will be given.

The make-up may be written or oral, or a combination of the two.

If you miss the exam for an **UNexcused** reason, a zero will be entered.

Course Objectives: This course is an introductory course in chemistry specifically designed for non-science majors. The course is intended to develop critical thinking to help students understand how chemistry is relevant to their daily lives. The course reflects a variety of current societal and technological issues and the chemical principles embedded in them. Air pollution, global warming, energy, acid rain, and properties/purity of water are examples of such issues.

General Education Learning Outcomes:

- Students will be able to use both qualitative and quantitative methods to understand chemistry.
- Students will be able to describe how the concepts and findings in chemistry are relevant to our daily lives and shape our world.

Student Learning Outcomes:

- Students will be able to apply chemical principles with their application to the real world.
- Students will be able to acquaint themselves with scientific methods and scientific understanding, so that they will be able to read about science and technology with some degree of critical judgment.
- Students will be able to use chemical knowledge and critical thinking ability to better assess the risks and benefits in choices that they, as informed citizens, will be making.
- In the laboratory, experiments are designed to illustrate the chemical principles presented in lecture with broader societal implications. Hands-on experience with experimentation and data collection will help students describe the scientific method and the role that science plays in addressing societal issues. All experiments include a set of questions that will allow students summarize and consolidate what they have learned and/or to extend the results to new situations.

Disability Accommodations: Students needing academic accommodations for a disability must first contact Ms. Rebecca Marin, Coordinator, Services for Students with Disabilities (214-768-4557) to verify the disability and establish eligibility for accommodations. They should then schedule an appointment with the professor to make appropriate arrangements. (See University Policy No. 2.4.)

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity will be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

Homework

In addition to the assignments below, other problems and exercises may be assigned throughout the semester. The homework will not be collected or graded. However, doing the homework is necessary to do well in this course.

End of chapter questions.

- 1: 1, 3, 4, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17a, 18, 20, 21, 22, 25, 29, 30, 31, 37, 38, 45
- 2: 1, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18 (calculate the frequency associated with each wavelength; also calculate the energy of a photon associated with each wavelength), 19, 25, 26, 36, 40, 41, 42, 52
- 3: 3, 4, 8, 9, 12, 13, 14, 16, 17, 21, 23 (note average value), 24, 25, 36, 38, 39, 54.
Also do problems on handout: Extra homework on grams, moles, and atoms.
- 4: 1, 4, 5, 6, 13, 14, 17, 18, 19, 24, 25, 27, 29, 32, 33, 35 (also show specifically the effect of a catalyst on the energy of activation using the green line on Fig 4.20 as a reference), 37, 40(a, b, e), 45, 50
- 5: 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 27, 35, 36, 37, 38, 50, 52
- 6: 7, 9, 10, 12, 13 (for a, calculate $[H^+]$; for c and d, calculate pH), 14 (for d-g, calculate pH), 15, 16, 18, 20, 21, 22, 28, 29, 36
- 7: 2, 3, 4, 12, 13, 14, 15, 17, 18, 21, 22, 43
- 9: 1, 2, 3, 9, 10, 11, 12, 33, 40
- 10: 10, 12, 23, 24, 31 (In the question 31 structures, each dash not connected to two carbons is a hydrogen atom)
- 11: 5, 6, 7, 9, 10, 11, 13, 15, 16, 17, 22, 27, 33, 34, 35, 40, 46

Your Turn, Consider This, Skeptical Chemist questions.

All are Your Turn questions except where otherwise indicated: Consider This (CT), Skeptical Chemist (SC)

1.5 (SC), 1.6, 1.7, 1.8, 1.10, 1.11, 1.13, 1.15, 1.18, 1.20, 1.25, 1.29

2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11(CT), 2.12, 2.13, 2.15(CT), 2.16, 2.23

3.4(CT), 3.6 (SC), 3.8, 3.9, 3.10, 3.11, 3.12, 3.14, 3.15, 3.16, 3.17

4.4, 4.8, 4.9, 4.13a, 4.16, 4.18, 4.20 (do problem on a per gram, not per gallon, basis)

5.12, 5.13, 5.3, 5.4(CT), 5.5, 5.6(CT), 5.14, 5.15, 5.16, 5.17, 5.18, 5.19(CT), 5.21

6.2, 6.3(CT), 6.4, 6.5, 6.6, 6.7, 6.13, 6.14

7.6, 7.12, 7.13, 7.18, 7.26

10.6, 10.7, 10.16. 10.17 (a, c only)

Specific Topics/Details

Day **May**
Thu **14** **4-Hour Lecture**

Introduction - Chemistry for a Sustainable Future

The Choices We Make Today

The Sustainable Practices We Need for Tomorrow

Your Ecological Footprint

Our Responsibilities as Citizens and Chemists

The Air We Breathe

What's in a Breath?

Air Pollutants and Risk Assessment

Air Quality

Classifying Matter: Pure Substances, Elements, and Compounds

Atoms and Molecules

Names and Formulas: The Vocabulary of Chemistry

Chemical Change: The Role of Oxygen in Burning

Fire and Fuel: Air Quality and Burning Hydrocarbons

Air Pollutants: Direct Sources

Ozone: A Secondary Pollutant

Fri **15** **2-Hour Lecture** **2-Hour Lab**

Protecting the Ozone Layer

Ozone: What and Where Is It?

Atomic Structure and Periodicity

Molecules and Models

Waves of Light

Radiation and Matter

The Oxygen-Ozone Screen

Biological Effects of Ultraviolet Radiation

Stratospheric Ozone Destruction

Chlorofluorocarbons: Properties, Uses, and Interactions with Ozone

The Antarctic Ozone Hole

Responses to Global Concern

Replacements for CFCs

Lab 1. What's in a Breath? Properties of Oxygen and Carbon Dioxide

Mon 18 4-Hour Lecture**The Chemistry of Global Climate Change**

The Greenhouse Effect: Earth's Energy Balance
 Gathering Evidence
 Molecular Shape
 Vibrating Molecules and the Greenhouse Effect
 The Carbon Cycle: Contributions from Nature and Humans
 Quantitative Concepts: Mass
 Quantitative Concepts: Molecules and Moles
 Methane and Other Greenhouse Gases
 How Warm Will the Planet Get?
 The Consequences of Climate Change
 What Can (or Should) We Do About Climate Change?

Exam 1 (1-hour long)**Tue 19 2-Hour Lecture 2-Hour Lab****Energy from Combustion**

Fossil Fuels and Electricity
 Efficiency of Energy Transformation
 The Chemistry of Coal
 Petroleum
 Measuring Energy Changes
 Energy Changes at the Molecular Level
 The Chemistry of Gasoline
 New Uses for an Old Fuel
 Biofuels I—Ethanol
 Biofuels II—Biodiesel, Garbage, and Biogas
 The Future

Lab 2. Molecular Shapes**Wed 20 4-Hour Lecture****Water for Life**

The Unique Properties of Water
 The Role of Hydrogen Bonding
 Water Use
 Water Issues
 Aqueous Solutions
 A Close Look at Solutes
 Names and Formulas of Ionic Compounds
 The Ocean—An Aqueous Solution with Many Ions
 Covalent Compounds and Their Solutions
 Protecting Our Drinking Water: Federal Legislation
 Water Treatment
 Water Solutions for Global Challenges

Thu 21 2-Hour Lecture 2-Hour Lab**Neutralizing the Threat of Acid Rain**

What is an Acid?
 What is a Base?
 Neutralization: Bases are Antacids
 Introducing pH
 Ocean Acidification
 The Challenges of Measuring the pH of Rain
 Sulfur Dioxide and the Combustion of Coal
 Nitrogen Oxides and the Combustion of Gasoline
 The Nitrogen Cycle
 SO₂ and NO_x
 Acid Deposition and Its Effects on Materials
 Acid Deposition, Haze, and Human Health
 Damage to Lakes and Streams

Lab 3. Chemical Moles

| | | | |
|------------|-----------|--|-------------------|
| Fri | 22 | 4-Hour Lecture The Fires of Nuclear Fission Nuclear Power Worldwide How Fission Produces Energy How Nuclear Reactors Produce Electricity What is Radioactivity? Radioactivity and You The Weapons Connection Nuclear Time: The Half-Life Nuclear Waste Issues Risks and Benefits of Nuclear Power A Future for Nuclear Power Exam 2 (1-hour long) | |
| Mon | 25 | SMU HOLIDAY | |
| Tue | 26 | 2-Hour Lecture | 2-Hour Lab |
| | | The World of Polymers and Plastics Polymers: Long, Long Chains Adding Up the Monomers Polyethylene: A Closer Look The “Big Six”: Theme and Variations Condensing the Monomers Polyamides: Natural and Nylon Recycling Lab 4. Acids and Bases | |
| Wed | 27 | 4-Hour Lecture Manipulating Molecules and Designing Drugs A Classic Wonder Drug The Study of Carbon-Containing Molecules Functional Groups How Aspirin Works: Function Follows Form Modern Drug Design Steroids Prescription, Generic, and Over-the-Counter Medicines Herbal Medicine Drugs of Abuse | |
| Thu | 28 | 4-Hour Lecture Nutrition Food and the Planet Fats, Oils, and Your Diet Carbohydrates: Sweet and Starchy Sugars and Sugar Substitutes Proteins Vitamins and Minerals Energy from Food Feeding a Hungry World | |
| Fri | 29 | 2-Hour Final Exam | 2-Hour Lab |
| | | Final Exam Lab 5. Fats in Foods | |