CHEM 1301 Chemistry for the Liberal Arts May Term 2017

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 more than10 years, as well as in May Term 2013 through 2015. 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 to summarize and consolidate what they have learned and/or to extend the results to new situations.

CHEM 1301 Chemistry for the Liberal Arts May Term 2017

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, Mury, Anderson, Bentley, Cann, Ellis, Roberts *Chemistry in Context: Applying Chemistry to Society*, 8th ed., McGraw-Hill, 2015. ISBN 978-0-07-352297-5.

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

Date	Topic	Lab	Exams
May 18	Introduction - Chemistry for a Sustainable Future The Air We Breathe		
May 19	Protecting the Ozone Layer	What's in a Breath? O_2 and CO_2.	
May 22	The Chemistry of Global Climate Change		Exam 1
May 23	Energy from Combustion	Molecular Shapes	
May 24	Water for Life		
May 25	Neutralizing the Threat of Acid Rain	Chemical Moles	
May 26	The Fires of Nuclear Fission		Exam 2
May 30	The World of Polymers and Plastics	Acids and Bases	
May 31	Manipulating Molecules and Designing Drugs		
June 1	Nutrition		
June 2	—	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.
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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 register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit http://www.smu.edu/Provost/ALEC/DASS to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

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 should 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, 1, 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 **Date**

Thu **May 18** **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 **May 19** **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 May 22 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 May 23 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 May 24 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 May 25 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 NOx
Acid Deposition and Its Effects on Materials
Acid Deposition, Haze, and Human Health
Damage to Lakes and Streams

Lab 3. Chemical Moles

Fri May 26 **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)

Tue May 30 **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 May 31 **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 June 1 **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 June 2 **2-Hour Final Exam** **2-Hour Lab**

Final Exam

Lab 5. Fats in Foods