

PRELIMINARY COURSE OUTLINE FACILITATORS

DECEMBER 30, 2016.

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| ▶ Instructors: | Dr Jeremy Rawson | Dr Philip Dutton |
| Section, Time, Location: | 1, 12:30-13:20, OD 104 2, 13:30-14:20, TC 100 | Course Coordinator and available for tutoring. |
| Office: | Essex Hall, Room 387 A Department of Chemistry (519) 253-3000 ext. 3700 | Essex Hall, Room 232 Faculty of Science (519) 253-3000 ext. 5104 |
| Telephone: | | |
| Email: | jmrawson@uwindsor.ca | dutton@uwindsor.ca |
| Office Hours: | M 2:30 PM – 5:00 PM W 2:30 PM – 5:00 PM | T 2:00 PM - 4:00 PM R 2:30 PM - 4:00 PM |
| Location | Room EH 387 A | Room EH 232 |
| ▶ Support Services: | LABORATORIES | SCIENCE RESOURCE CENTRE |
| Staff: | Nedhal Al-Nidawy Ronan San Juan | Staffed by: Graduate Assistants |
| Office: | Essex Hall, Room 175-0 | Location: Essex Hall 182-1 |
| Telephone: | (519) 253-3000 ext. 3547 | Hours: Mon-Fri 09:00-21:30. |
| Email: | alnidawy@uwindsor.ca | GA Hours: As posted on the door. |

COURSE DESCRIPTION

- ▶ **Course:** 03-59-141-01 OD 104 MWF 12:30 - 13:20
03-59-141-02 TC 100 MWF 13:30 - 14:20
- ▶ **Term:** 2017 Winter
- ▶ **Course Text:** by Nivaldo J. Tro, Travis Fridgen, Lawton Shaw, Chemistry: A Molecular Approach, Second Canadian Edition, Pearson Canada.
- ▶ **Lab Manual:** **See Blackboard for information about the laboratory. (start Jan 16)**
- ▶ **On-Line Homework:** **Mastering Chemistry course code is UWINDSORGENCHEM78305 (same as 140)**

Chemistry is the subject that studies the composition, structure and properties of matter. Such compounds can be either organic, where the chemistry is based around the element carbon (such as drugs, plastics or larger biomolecules) or inorganic, where the emphasis is based on any other element in the periodic table! Chemistry is the central science and pervades a network of interdisciplinary fields such as biochemistry, chemical technology, medicinal and environmental chemistries, nuclear chemistry and materials science amongst others. Chemistry also looks at the transformations which matter undergoes and it is these processes which are central to the themes developed in General Chemistry II

The course builds upon basic concepts of structural chemistry developed in 59-140 and a strong grounding and knowledge of 59-140 is a pre-requisite for 59-141. A firm grasp of basic mathematical concepts including solving quadratic equations, knowledge of logarithms and basic calculus will also be necessary.

The course is structured around Chapters 13-18 of the course text in which we examine how and why chemical reactions occur. In Chapter 13 we examine how quickly chemical reactions occur, and how catalysts and enzymes make reactions occur more quickly. In Chapter 14 we examine chemical equilibria, i.e. reactions which can occur in both directions. A sound mathematical understanding of Chapters 13 and 14 allows us to answer important questions such as "Which way will a chemical reaction go?" and "How quickly will it get there?" Chapters 15 and 16 build on the fundamentals of Chapter 14 to examine the strengths of acids and bases and why it's OK to put vinegar on your fries but not hydrochloric acid! In Chapter 17 we examine the energetic reasons why reactions proceed in a particular direction in more detail (known as thermodynamics) and build up fundamental mathematical relationships between the energy change associated with a reaction and the position of equilibrium. We conclude our study of solution chemistry with a study of those chemical reactions in which molecules or ions gain or lose electrons (oxidation and reduction reactions) and examine applications in important industrial techniques such as battery design, electrolysis and electroplating.

TIMETABLE & LOCATIONS

► Examinations

- Midterm 1:** Mon, Feb 6, 2017, in class (falls after lecture 12) Covers Chapters 13 and 14
Midterm 2: Mon, Mar 13, 2017, in class, (falls after lecture 22) Covers Chapters 15 and 16
Final: Wed, Apr 19, 2017, 15:30 – 18:30 (180 min), Location TBA.
 Exam format is a written section on Chapters 17 and 18 multiple choice on the whole course.
Make Up Final: Wed 26 April 2017, 08:30-11:30 (180 min), Location TBA.

► Important Dates

- First Day of Classes:** Thursday January 5, 2017, so our first class is January 6, 2017.
Reading Break: February 18-26, 2017. Note that the University is closed February 20 and 24
Family Day: February 20, 2017, University is closed, but the Library is open 8 AM to 8 PM.
University Offices Closed: February 24, 2017. Library is open 8 AM to midnight.
Good Friday: April 14, 2017, University closed
Last Day to Voluntarily Withdraw: March 15, 2017.
Last Day of Classes: 05 April 2017.

CHAPTER COVERAGE IN CHEMISTRY: A MOLECULAR APPROACH 2^E

► Chapter 13: Chemical Kinetics (Laboratory experiments 2 and 3)

- Rate of Chemical Reactions
- The Rate Law
- The Integrated Rate Law
- Effect of Temperature on Rate
- Reaction Mechanism
- Catalysis

► Chapter 14: Chemical Equilibrium (Laboratory experiment 4)

- Dynamic Equilibrium
- The Equilibrium Constant K
- Calculating Equilibrium Constants
- The Reaction Quotient Q
- Finding Equilibrium Concentrations (ICE)
- Le Châtelier's Principle

► Chapter 15: Acids and Bases (Laboratory experiment 5)

- Definitions of acids and bases
- Acid Ionization Constant K_a
- Base Solutions
- The pH Scale
- Finding $[H_3O^+]$
- Acid-Base Properties of Ions
- Polyprotic Acids and Acid Strength
- Lewis Acids and Bases

► Chapter 16: Aqueous Ionic Equilibria (Laboratory experiments 6 and 7)

- Buffers
- Titration and pH Curves
- Solubility Product K_{sp}
- Precipitation
- Complex Ion Equilibria

► Chapter 17: Free Energy and Thermodynamics (Laboratory experiment 7)

- Spontaneous Processes
- Entropy and the Second Law
- Heat Transfer and Entropy Changes
- Gibbs Free Energy
- Free Energy and non-Standard States
- Free Energy and Equilibrium

► Chapter 18: Electrochemistry

- Voltaic Cells
- Standard Electrode Potentials
- Gibbs Energy and the Equilibrium Constant
- Cell Potential and Concentration
- Batteries
- Electrolysis and Corrosion

COURSE OBJECTIVES

By the end of the course, the successful student will be able:

- to recall, select and apply knowledge of chemistry concepts and techniques in a variety of real world contexts;
- to master vocabulary, symbols, notation, terminology and nomenclature used in chemistry;
- to collect, process, interpret and present scientific data using appropriate graphical, numerical and computational techniques;
- to represent the physical and chemical transformations that substances undergo through a proper formulation of chemical compounds and balanced chemical equations;
- to perform calculations on chemical equilibrium and energetics of reactions;
- to apply principles of qualitative and quantitative analysis;
- to explain and use chemical equations for purposes of identifying concentrations of species at various times during a reaction and under various conditions of temperature and concentration.
- to apply basic laboratory techniques of wide use in chemical practice;
- to observe the safety guidelines for handling and disposing of hazardous materials.

COURSE LEARNING OUTCOMES

► **Acquisition, application and integration of knowledge:**

- Explain details of theory of chemical equilibrium as it applies to acid-base and aqueous ionic equilibria.
- Construct reaction profile diagrams and using them explain the basis of kinetic and thermodynamic theory.
- Explain the effect of concentration and temperature on reaction rates and recognize zeroth, first and second order reactions.
- Describe the construction of voltaic and electrolytic cells using diagrams and standard notation.
- Using mathematical equations describe the relationships between the cell potential, free energy and the value of the equilibrium constant.
- Demonstrate ability to incorporate multiple chemical and physical concepts to manage problem solving.

► **Literacy and Numeracy Skills:**

- Translate word problems to chemical and mathematical equations and, using conceptual planning principles to strategize problem solving, solve problems.

► **Literacy and Numeracy Skills:**

- Carry out complex algebraic calculations relating to chemical equilibrium, thermodynamics and kinetics of chemical reactions.
- Draw diagrams that can be used to explain theory of equilibrium, kinetics and thermodynamics.
- Prepare written laboratory reports and abstracts including theory, discussion, examples of calculations and conclusions based upon collected data.

ASSESSMENT

The marking system for exams, papers, problem sheets and laboratory reports is designed to quantify the student's achievements of the learning objectives. The assessment is intended to supply the students with the necessary feedback to progressively improve their performance.

► **Final mark:**

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| 40% on final examination | <i>If no laboratory (only if PLC)</i> |
| 30% on midterm examinations | 50% on final examination |
| 20% on laboratories | 34% on midterm examination |
| 10% on assignments | 16% on assignments |

If opting out of using Mastering Chemistry:

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| 46% on final examination | <i>If no laboratory you must request PLC</i> |
| 34% on midterm examination | 50% on final examination |
| 20% on laboratories | 50% on midterm examination |

Grades on one or both midterm exams may be dropped at the discretion of the course professors and in a manner that is fair to the whole class.

PLC – if you have previously taken the course you can apply to the Laboratory Coordinator (TBA) to be issued a Prior Laboratory Credit. Date of registration in a previous section of this course or laboratory information from another institution must be provided.

The written assessments consist of TWO midterm exams and a final exam:

- The midterm exams covers topics up to approximately one week prior to the midterm exam.
- There is no supplementary/makeup exam for the midterms, the percentage is transferred to the final exam.
- The final exam covers the whole course through a series of multiple choice questions and written answer questions on the latter part of the course.

► **Marking based on a 100-point scale:**

To determine the final grade in this course the accumulated mark, as a percentage (%), will be reported. Decimal components of grades are rounded to the nearest integer grade.

MATERIALS FOR THE COURSE

► Items available at the bookstore (<http://www.bookstore.uwindsor.ca/>):

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| Textbook: Tro, Chemistry, 2 nd Edition | ~\$160 (includes student solutions manual) |
| Other text options are available, see the bookstore for details (e-book, binder ready etc.). | |
| Exam-approved calculator | ~\$25 |
| Caution card (bookstore) | ~\$27.50 |
| Lab Manual (bookstore) | ~\$15 |

Your caution card from last term is still valid.

► Safety equipment is mandatory in the laboratories.

Items available from the Chemistry Graduate Club one half hour before all labs EH 173-2.
(Graduate Club funds support department activities, your purchases contribute back to you)

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| Lab coat | \$15 |
| Safety glasses | \$5 |

LABORATORY

All students must complete the Chemical Control Centre Laboratory Safety Awareness Tutorial and Quiz prior to entering the lab.

web4.uwindsor.ca/units/chemicalcontrolcentre/labsafety.nsf/

If you have already completed the lab safety tutorial it is not necessary to do it again.

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| Jan. 16 – 20 | Lab and Safety Orientation AND Experiment 1: An Exercise in Solution Preparation |
| Jan. 23 – 27 | Experiment 2: Decomposition Kinetics of Hydrogen Peroxide |
| Jan. 30 – Feb. 3 | Experiment 3: Rate & Activation Energy of the Crystal Violet Reaction |
| Feb. 6 – 10 | Experiment 4: Determination of an Equilibrium Constant |
| Feb. 13 – 17 | Experiment 5: Titration of a Diprotic Acid & Determination of K_a |
| Feb. 18 – 26 | Study Week - NO LABS |
| Feb. 27 – Mar. 3 | Experiment 6: Investigating Buffers |
| Mar. 6 – 10 | Experiment 7: Solubility of Calcium Iodate & the Common-Ion Effect |
| Mar. 13 – 17 | Experiment 8: Determination of Enthalpy and Entropy of a Borax Solution |

COURSE POLICIES

► Assessment & Academic Honesty:

- No programmable calculators will be allowed for use in exams. Calculators must be approved for use. Recommended inexpensive calculators are, for example, any Texas Instruments TI-30, any Casio FX-250, any Sharp EL-509 or EL-531.
- Every document handed in for assessment must be typed or written in non-erasable ink. If you use pencil the item may not be eligible for appeal at the discretion of the course professor.
- Upon request of re-marking, the entire assignment or examination script will be re-assessed.
- Any form of academic dishonesty (e.g., cheating, deception, fabrication, plagiarism, sabotage, etc.) will be reported to the Senate Secretariat for disciplinary action.

► Attendance & Workload:

- Class attendance has been demonstrated to be strongly correlated with the students' good performance and academic success in any course. It is assumed that all students will attend the classes for which they are registered. Thus, class absence should be avoided unless absolutely necessary. Notwithstanding, each student is ultimately responsible for regular and punctual attendance and for the material covered in class, regardless of whether the student is absent or present.
- Attendance to any form of assessment is mandatory.
- Attendance to the lab is mandatory. Students may be excused from individual laboratory experiments for medical or other documented reasons.
- The average student should be working about 4 hours per week outside of classes and labs for the successful completion of this course.

► Excused Absences

- Attendance for mandatory assessment may be excused, at the discretion of the course professors, upon submission of a Department of Chemistry and Biochemistry medical certificate. See the Department website for further information, www.uwindsor.ca/chemistry.

► Classroom Etiquette

- Unavoidably late comers and early leavers, please, minimize the disturbance for your classmates (e.g., take the things that you need before entering the classroom, quietly take/leave the seat without interrupting those around you).
 - **No cell phones or headphones in class.**
 - Browsing facebook, streaming sports, movies and playing games in class is very distracting to other class participants. **Please do these activities OUTSIDE of the classroom.**
 - Obtain explicit consent before any type of audio-visual recording can take place.
 - No unauthorized distribution of any audio-visual recording is allowed.
 - No unauthorized distribution of any course material is allowed. This includes copies of examinations, assignments and electronic data associated with the course.
 - Discussion with the professor in class is encouraged. Discussion with neighbors in class is sometimes encouraged. Random chatting with friends is strongly discouraged.
 - Noise in the large section of the course is a problem. Please keep quiet in class.
 - Anyone disrupting the class in the judgment of the professor will be asked to leave the classroom. Disciplinary actions may be taken for failure to follow directions.
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