

**UNIVERSITY OF NORTHERN COLORADO  
COLLEGE OF NATURAL AND HEALTH SCIENCES  
OFFICE OF EXTENDED STUDIES**

**Summer 2010**

CHEM 510-616: Green Chemistry for Secondary Educators)  
(3 hrs: 2 lecture, 3 laboratory)

Instructor: Ann Ratcliffe  
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**Lab Schedule:** The laboratory portion will be offered on-campus at UNC twice to accommodate students' schedules, either 6/18 - 6/20/2010 or 6/25 - 6/27/2010. Students must specify the lab weekend they will attend upon registering. All students will be online together 6/28 - 7/23/2010.

**Lab Times:** Friday - 8:30-4:30pm, Saturday - 8-4:30, Sunday - 8-12 noon

**Co-Requisites/Prerequisites:** None

**Course Description:** Applications of green chemistry principles to secondary science classrooms, techniques for recycling chemicals, reducing hazardous chemical use and waste. Must have completed 1 year of general chemistry.

**Course Objectives:**

Students will be able to

- design/revise age-appropriate Green Chemistry experiments for middle and high school students in which the students minimize, destroy, or reuse unwanted products;
- access a Toxics Release Inventory (TRI) from EPA for their local area, interpret it, and design age-appropriate activities around the TRI;
- "Green-up" existing experiments;
- analyze an experiment and give it a Green Chemistry rating;
- write an "environmental impact statement" for each experiment, showing their understanding of the green process they have used;
- discuss risk and hazard and analyze chemicals and reactions in terms of toxicity, potency, severity of an effect, reversibility, etc.
- analyze a traditional drug synthesis and its "green" replacement, and describe it in terms of atom economy and alternative reagents;
- "Green-up" their chemical stockrooms, appropriately eliminating chemicals that pose unnecessary hazard, are no longer used, or of which there is an excess;
- interpret the 12 principles of Green Chemistry to peers, parents, and administrators.

**Outline of Course Content:**

- What is "green" chemistry? (Evolution of the environmental movement. What do we mean by "green?" How might "green" be applied in chemistry laboratories? Is "dilution the solution to pollution"?)
- Paracelsus: "Everything is a poison, depending on the dose." (Risk=f[hazard,exposure]. Clean Water Act, Clean Air Act, Resource Recovery and Conservation Act, Safe Drinking Water Act, etc.)
- Tools of green chemistry: Industrial processes and feedstocks as they pertain to the chemical industry and the secondary classroom; catalysis
- The 12 principles of green chemistry: Applications to the chemistry classroom and lab
- Bringing green chemistry home: Examining local environmental problems using the EPA's Toxics Release Inventory (TRI)
- Changing the way we teach laboratory; designing green lab experiments
- Producing lesson plans that integrate green chemistry into a year's science/chemistry course

**Course Requirements:**

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|----------------------------|-----|
| ▪ Laboratory               | 30% |
| ▪ Written assignments      | 30% |
| ▪ Blackboard participation | 30% |
| ▪ Final Exam, online       | 10% |

**Method of Evaluation:**

Letter graded (A = 90 – 100; B = 80 – 89; C = 70 – 79; D = 60 – 69; F = <60)

**Required Texts:**

Textbook: Anastas, Paul T. and John C. Warner *Green Chemistry: Theory and Practice*, Oxford University Press, 1998.

An additional required text includes the student's choice of either McDonough and Braungart, *Cradle to Cradle: Remaking the Way We Make Things*, 2002; or Benyus, *Biomimicry: Nature as Model, Measure, and Mentor*, 2002.

*Rationale for using older texts:*

- *Green Chemistry: Theory and Practice* is an accessible introduction to the topic. (Most texts in this field are oriented toward industry only.)
- Both *Cradle to Cradle* and *Biomimicry* are “think-out-of-the-box,” research-oriented introductions to a new way of problem solving. Both are heavily quoted in later books; thus, readers should start with these texts.

**Disability Support Services:** Any student requesting disability accommodation for this class must inform the instructor giving appropriate notice. Students are encouraged to contact Disability Support Services at (970) 351-2289 to certify documentation of disability and to ensure appropriate accommodations are implemented in a timely manner.

**Honor Code:** All members of the University of Northern Colorado community are entrusted with the responsibility to uphold and promote five fundamental values: *Honesty, Trust, Respect, Fairness, and Responsibility*. These core elements foster an atmosphere, inside and outside of the classroom, which serves as a foundation and guides the UNC community's academic, professional, and personal growth. Endorsement of these core elements by students, faculty, staff, administration, and trustees strengthens the integrity and value of our academic climate.

**UNC's Policies:** UNC's policies and recommendations for academic misconduct will be followed. For additional information, please see the Dean of Student's website, Student Handbook link.

**Portable Electronic Devices:** Please extend courtesy to your instructor and fellow students by turning off your portable electronic devices, such as cell phones, pagers, and iPods. Although not an audio issue, text-messaging is a distraction to other students and prevents you from full participation in class. You should keep your portable electronic devices in your backpack or purse during class. Your personal electronic devices should not be on your desks. If you know that you may need to accept an emergency phone call during class or if you have children in childcare or school, please let the instructor know. If you need to take a phone call during class, please seep out of the classroom while you complete your call. Thank you for your cooperation.

**Library Services for Distance Education and Off-Campus Students: Obtaining Materials from UNC Libraries**

Off-campus students residing within 50 miles of the UNC campus are required to come to the library and borrow materials in person. Students residing more than 50 miles from campus may request that materials be delivered to them. All requests must include complete citations. We will supply materials from the UNC Libraries, as well as materials from other libraries obtained via Interlibrary Loan. Articles will be delivered via email. Books will be mailed first class. Delivery time by U.S. postal service is approximately 1 week. It is the responsibility of the student to return books by the date due. UNC does not pay return postage on books. For information on document delivery, call (970) 351-1446.

Requests for materials may be made through the following methods:

Online: <http://www.unco.edu/library/forms/distancerequest.htm>

By email: [library.ocp@unco.edu](mailto:library.ocp@unco.edu)

By fax: (970) 351-2540

### **Notice**

The Office of Extended Studies reserves the right to cancel or reschedule courses based upon enrollment. Enrolled students will be contacted with information of any change.

### **Student Satisfaction Evaluation**

Participants will be asked to evaluate the workshop for instructors' knowledge, interest and enthusiasm as well as providing additional information on classes or topics which you would like to see developed as a future offering from UNC.

### **Course Withdrawal Information**

In accordance with University and Colorado Department of Higher Education policy, if you drop this class after the course starts you will be assessed a drop fee. The drop fee is pro-rated up to the half-way point in the class. You are legally responsible for payment of full tuition once 50% of this course has been concluded. In order to be eligible to receive any refund of tuition, you must contact the Office of Extended Studies (1-800-232-1749) to formally withdraw from your class. Your refund, if applicable, will be based on the date of contact with our office. Withdrawals received via telephone during non-business hours will be processed and dated on the next working day. Failure to notify us will result in UNC tuition being owed even though you do not attend or complete the coursework.