

Advanced Green Chemistry: Connections to Our World

Online Course Syllabus

Updated March 1, 2022

Class Meeting Information

This is an online class to be completed between June 13-August 8, 2022. Please familiarize yourself with the process, syllabus, technical requirements, and review the 12 Principles of Green Chemistry. Forums and assignments are aligned with weekly due dates and 4 one-hour synchronous zoom meetings.

Synchronous Zoom Meetings:

- June 14, 2021: 9:00 am MST
- June 29, 2021: 9:00 am MST
- July 14, 2021: 9:00 am MST
- August 8, 2021: 9:00 am MST

Instructor Information

Name: Tanya Elmer

Cell Phone: 208-841-6396 **Please only use this cell phone number in case of an emergency.**

Email: elmer.tanya@westada.org I will check e-mail every business day and at least once over the weekends.

Tanya Elmer is a Beyond Benign Lead Teacher. Tanya earned her Master's in Educational Leadership in 2005 and has been teaching chemistry for 20 years. Tanya serves as an adjunct chemistry instructor at Northwest Nazarene University and is a former Idaho Science Teacher of the year for her region. Tanya was introduced to green chemistry at the Idaho Science Teachers Conference in 2013 and subsequently took both the Introduction to Green Chemistry and Advanced Green Chemistry Online Courses. She has been practicing green chemistry with her students since 2014.

Prerequisites: High School Science Teaching experience, basic understanding of green chemistry principles

Course Description:

Green Chemistry is the science of creating safe, energy efficient and non-toxic processes and products that provide sustainable solutions for the environmental problems facing our society today. Green Chemistry education must be integrated into the way we teach scientists from the earliest ages. This course will provide a more in-depth dive into the 12 principles of Green Chemistry to practice green chemistry pedagogy and procedures in their classrooms.

Students will review green chemistry technology analysis through the study of Presidential Green Chemistry Challenge winning projects, gain an understanding of how to incorporate toxicology into their curriculum, and delve into the application of green chemistry to student STEM activities and inquiry projects.

Course Objectives

After completing this course, the student will be able to:

- Discuss the 12 Principles of Green Chemistry in relationship to sustainability practices
- Apply Green Chemistry Principles to Presidential Green Chemistry Challenge projects
- Relate Green Chemistry principles to toxicology concepts
- Apply Green Chemistry and sustainable science principles to student-centered STEM activities and inquiry projects

Required readings:

All required readings will be given to students in the form of PDF or web-linked documents. No book purchases are required. The Green Chemistry community has made the majority of these resources available for free for educators and this class will encourage teachers to use those resources.

Forum Participation:

The asynchronous forums constitute the online class discussion and are a *substantial portion (20%)* of your grade. The student is expected to participate by posting substantive comments to the forums when assigned. The questions are designed to be based upon the readings and assignments for the week but you are also encouraged to post comments related to general teaching and pedagogy. In addition to posting your own thoughts and ideas, please respond to at least one person's posting for each lesson, you should learn more from your peers here than you can from me so please take advantage of their classroom implementation ideas and tips. The questions I post will not have right or wrong answers and you will be scored on thoughtful participation not on correct content. The purpose of this is to generate student-student interaction. Of course, I invite you to participate much more than the minimum. You may also be learning at different times so please revisit discussion forums often even if you have fulfilled your requirement there. You can set the online learning portal to send new posts to your e-mail if that is an easier way to keep track of the conversations.

PLEASE NOTE: I will not force the forum postings to come to you via email. You can come to the forum at your convenience, and/or you can choose individually for all discussion forum postings to be delivered to your email address. But for the sake of not forcing your inboxes to get filled up with postings, I will leave it to you to decide what method works best. Should you choose not to receive posts by email, you'll have to be responsible for frequently visiting the discussion forums to keep track of the postings.

Types of Communication

In an online course, the majority of our communication takes place in the course forums. However, when we have a need for communication that is private, we will use individual email or telephone. I prefer that you contact me by email for individual questions and only call if it's extremely time-sensitive. If you have questions of a general nature, please post them in the general question area so the whole class can participate.

Use of resources

I expect you to make use of materials in an ethical manner. Always cite your sources of information, and if you find you want to leverage someone's ideas, templates, etc., I expect you to credit the appropriate parties. Thanks in advance for being responsible!

Netiquette

In an online classroom, our primary means of communication is written. The written language has many advantages: more opportunity for reasoned thought, more ability to go in-depth, and more time to think through an issue before posting a comment. However, written communication also has certain disadvantages, such a lack of the face-to-face signaling that occurs through body language, intonation, pausing, facial expressions, and gestures. As a result, please be aware of the possibility of miscommunication and compose your comments in a positive, supportive, and constructive manner.

Expectations of Students:

I expect you to:

- Attend class fully prepared to discuss all assigned material –share responsibility for the quality of the experience.
- Contribute to the class discussion in a way that enhances the learning process.
- Conduct yourself in class as you would in a business situation (i.e., be courteous, offer constructive criticism, compliment on a job well done, and give thoughtful feedback).
- Provide ongoing feedback with regard to the extent in which this class is meeting your expectations and objectives.
- Complete all course work, reading and assignments by the due date: not doing so will affect your grade.
- Notify me as soon as possible if you have any emergencies or need more time to complete the course. I may or may not be able to accommodate this request.

Expectations of the Instructor:

You can expect me to:

- Review course content, materials, assignments and forum prompts prior to the start of the class
 - Post my syllabus to the class prior to the start date
 - Post my welcome message prior to the start date
 - Facilitate threaded discussions
 - Respond to individual email within 72 hours. My email address is elmer.tanya@westada.org
- Give you individual feedback on your posted assignments within about a week of the due date
- Enjoy teaching you and learning from you!

Evaluation and Grading

In this course you will be evaluated in the following way:

Topic 2 PowerPoint	20%
Topic 3 Lesson Plan	20%
Topic 4 Reflection	20%
Participation in discussion forums (4 Topics)	20%
Final Project	<u>20%</u>
	100%

Grading Scale

- A = 90% – 100%
- B = 80% – 89%
- C = 70% – 79%
- D = 60% – 69%

Course Outline

Instruction Time Total: 48 hours

Orientation Green Chemistry in Practice Overview	Topic 1 – complete by June 20 Students will use the first few days of class to orient yourself with the Moodle course delivery system where your course is located at http://beyondbenign.net/courses/ During this first week students will review the 12 Principles of Green Chemistry and begin to understand how Green Chemistry technologies are a wealth of recourses for integrating chemistry concepts with a real-world context.
Instructional time	10 hours
Learning resources	Readings: Current GC articles— such as below (articles may change over time to keep them current) http://www.thomasnet.com/articles/chemicals/green-chemistry-history http://www.theguardian.com/sustainable-business/2015/aug/19/green-chemistry-epa-tsca-clinton-california-prop-65-reach-ciel-whole-foods Videos:

	<p>YouTube – EPA Green Chemistry https://www.youtube.com/watch?v=rIE4T2HLW7c</p> <p>YouTube – Washington State Webinar Series Given by Beyond in Benign in 2013 (3 webinar videos) https://www.youtube.com/watch?v=Qfj9rZh3H78&list=PL8Bml4b96dKbkhgkrMrXS85VjNXprJdFv&index=1 https://www.youtube.com/watch?v=Xg2iTb8uID4&index=2&list=PL8Bml4b96dKbkhgkrMrXS85VjNXprJdFv https://www.youtube.com/watch?v=QW0am8lrkqo&index=3&list=PL8Bml4b96dKbkhgkrMrXS85VjNXprJdFv</p> <p>TED Talks William McDonough “Cradle to Cradle Design” http://www.ted.com/talks/william_mcdonough_on_cradle_to_cradle_design/transcript?language=en#t-26403</p>
	<p>Students will:</p> <ul style="list-style-type: none"> • Introduce themselves using the discussion forum • Read articles, create a post to the forum about one of the articles and reply to at least one class member’s post • Watch videos, create a post to the forum about one of the articles and reply to at least one class member’s post
Assignments	<p>Forum questions:</p> <ol style="list-style-type: none"> 1. Introduce yourself to the class. Please include information about how you got into teaching, where and what level of students you teach and what you love most about your job. 2. Describe your own goals for taking the course. 3. Where and how does green chemistry connect to the global sustainability movement? Be sure to cite the online resources you reference in your discussion.
Method of instruction	<p>Video viewing Readings Forum interactions Synchronous Zoom Meeting—June 14 at 9:00 am MST</p>

Green Chemistry Technology Analysis	<p>Topic 2 – complete by June 30</p> <p>The Presidential Green Chemistry Challenge has been a driving force in the development of sustainable chemistry since 1996. Students will review projects focused in each of the six award categories. Students will also explore the concept of “Cradle to Cradle” that is currently used in research and development.</p>
Instructional time	15 hours
Learning resources	Review the following websites:

	<p>EPA Green Chemistry awards. Read sections under the tabs Introduction, Award Categories, Eligibility, and Selection Criteria in order to understand the scope of the challenge. http://www.epa.gov/greenchemistry/information-about-presidential-green-chemistry-challenge</p> <p>GCC winning project overviews http://www.epa.gov/greenchemistry/presidential-green-chemistry-challenge-winners</p> <p>Students will conduct online research that focuses on their selected topics in relationship to GCC winning projects.</p>
Objectives	<p>Students will:</p> <ul style="list-style-type: none"> • Review industry examples of Green Chemistry in action • Analyze a specific green chemistry technology • Respond to forum discussion prompt (citing online resources) and reply to at least one class member’s post • Create a PowerPoint presentation that gives an overview of a PGCC winning project and explains how it applies the 12 Principles of Green Chemistry
Assignments	<p>Forum question:</p> <ol style="list-style-type: none"> 1. Select one GCC winning project. In your forum post present an overview of the project and why you selected it based upon your understanding of its importance to the general public. How could you use information about this project to help you explain green chemistry to your students/colleagues/general public? <p>Written assignment</p> <ul style="list-style-type: none"> • Select a GCC winning project that you find particularly interesting. Research the product/technology/device that was replaced. Prepare a PowerPoint presentation that explains the previous product/technology/device and then give an overview of the replacement. List which of the 12 Principles of Green Chemistry were addressed with the award-winning product/technology/device, giving specific applications of the principle demonstrated. • Upload your presentation as a PDF file to the Moodle site by June 30 for shared reflections during Zoom meeting
Method of instruction	<p>Reading Website review Forum interactions Feedback on written assignment Synchronous Zoom Meeting—June 28 at 9:00 am MST</p>

Toxicology connections for chemistry classrooms	<p>Topic 3 – complete by July 14</p> <p>Toxicology, mechanism and environmental impact are topics that have traditionally been absent from chemistry courses. To avoid the unintended consequences of traditional chemistry it is essential that chemists have a better understand of what makes a molecule toxic and why. This topic digs into the subject and how it relates and links to chemistry content.</p>
Instructional time	12 hours
Learning resources	<p>Read the following articles: Chem Reviews Article Chemical Hazard Awareness Module: How toxic is toxic? (ChemMatters)</p> <p>Websites: Review two tutorials on the following site (ToxLearn Module I: Introduction to Toxicology and Dose-Response and Toxicology Tutor I) National Library of Medicine Toxicology Tutorials: http://sis.nlm.nih.gov/enviro/toxtutor.html</p> <p>Environmental, Health and Safety Data Resource (A webinar is available on the following link to introduce this resource for finding environmental, health and safety data): http://guides.turi.org/beyondmsds</p>
Objectives	<p>Students will:</p> <ul style="list-style-type: none"> • Understand hazards in the chemistry classroom • Review Safety Data Sheets and filter out relevant information • Analyze resources that evaluate chemical hazards • Create a lesson that integrates toxicity
Assignments	<p>Forum Question:</p> <ol style="list-style-type: none"> 1. Discuss ways toxicologists, environmental health scientists and chemists could be working together to share knowledge to improve the chemical design process. <p>Toxicology Lesson:</p> <ul style="list-style-type: none"> • Develop a lesson plan that incorporates components of toxicology and chemical hazards.
Method of instruction	<p>Readings Videos PowerPoint presentation Forum interactions Synchronous Zoom Meeting—July 14 at 9:00 am MST</p>

STEM Applications of Green Chemistry: Supporting Student Primary Research	<p>Topic 4– complete by July 28</p> <p>NGSS and most state standards require that teachers integrate STEM and inquiry practices into their curricula. This topic will explore ways that teachers can embed green chemistry principles into STEM activities and guide students towards primary research that causes them to focus on and apply sustainability as an underlying foundation.</p>
Instructional time	5 hours
Learning resources	<p>PowerPoint – access on Moodle</p> <p>Review the following videos and websites:</p> <p>Videos:</p> <p>Janine Benyus: Biomimicry's surprising lessons from nature's engineers http://www.ted.com/talks/janine_benyus_shares_nature_s_designs</p> <p>Biomimicry at the nano level: Dr. How Yong Lee https://www.youtube.com/watch?v=5yFMyeaCKhs</p> <p>Eben Bayer: Are mushrooms the new plastic? http://www.ted.com/talks/eben_bayer_are_mushrooms_the_new_plastic</p> <p>Websites:</p> <p>Journal of Emerging Investigators http://www.emerginginvestigators.org/</p> <p>Biomimicry Institute http://biomimicry.org/</p> <p>Science Daily http://www.sciencedaily.com/</p> <p>Beyond Benign Steelcase Advanced Green Chemistry Modules http://www.beyondbenign.org/K12education/highschool.html</p>
Objectives	<p>Students will:</p> <ul style="list-style-type: none"> • Understand how to guide students through a STEM or inquiry project • Explore resources used to gather ideas for projects • Participate in discussion forum
Assignments	<p>Forum questions</p> <ol style="list-style-type: none"> 1. How can materials science or biomimicry provide a venue through which you can infuse STEM or inquiry projects into your chemistry curriculum. 2. Discuss one place in your current curriculum in which you could incorporate a STEM or inquiry project.
Method of instruction	<p>PowerPoint</p> <p>Video and Website review</p> <p>Forum interactions</p> <p>Synchronous Zoom Meeting—August 8 at 9:00 am MST</p>

Final Project	<p>Complete by Aug 8—No extensions!!!!</p> <p>Students have a choice of one of two project listed below</p> <ul style="list-style-type: none"> • Write a 5 to 7 page research paper on an advanced green chemistry topic of their choice (MLA format with parenthetical citations) • Design a unit of instruction that incorporates an advanced green chemistry concept
Instructional time	6 hours
Learning resources	Students will use online resources related to their individual projects
Objectives	<p>Students will:</p> <ul style="list-style-type: none"> • Write a paper or develop a unit of instruction (depending on personal preference) that will apply to their individual needs and interests • Select the project format that best fits their interest and needs • Research their selected topic using online resources • Submit work and report on progress for formative assessment feedback at given checkpoints during the course • Prepare and submit a final product
Assignments	<ul style="list-style-type: none"> • Students will select project focus by June 30 • Submit progress reports for formative assessment feedback • The final document will be uploaded onto Moodle
Method of instruction	Students will be supported with their individual research as needed through email or direct interaction on Moodle. Feedback will be given at formative checkpoints and a summative assessment will be made on the final project.