ENVIRONMENTAL SCIENCE

# Laboratory Science Subject Template

(Required Information needed to prepare for course submission)

## Course Guidance

**GENERAL LABORATORY SCIENCE GUIDANCE**

The intent of the laboratory science requirement is to ensure that entering freshmen have a minimum of one year of preparation in each of at least two of the areas of Physics, Chemistry, and Biology/Life Science. This requirement can be satisfied by taking two courses from among these specific subject areas, but courses from across the broad spectrum of scientific subjects are potentially acceptable, provided they conform to the Course Requirements specified below.

**Goals of the Laboratory Science Requirement**

The overarching goal of the subject requirement in laboratory science is to ensure that freshmen are adequately prepared to undertake university-level study in any scientific or science-related discipline. The term "laboratory" is intended to signify an empirical basis of the subject matter, as well as inclusion of a substantial experimental and/or observational activity in the course design. The requirement emphasizes biology/life sciences, chemistry and physics because these subjects are preparatory to university-level study in all scientific and science-related disciplines. However, coverage of these foundational subjects in suitable breadth and depth can potentially be found in a wide range of science courses provided the courses conform to the criteria described under the Course Requirements below.

All courses certified in the laboratory science subject area should be designed with the explicit intention of developing and encouraging these scientific habits of mind:

Students should develop a perception of science as a way of understanding the world around them, not as a collection of theories and definitions to be memorized.

Students should emerge from high school embracing an ease in using their scientific knowledge to perceive patterns and regularity, make predictions, and test those predictions against evidence and reason.

Students should recognize that abstraction and generalization are important sources of the power of science.

Students should understand that scientific models are useful to represent phenomena in the physical world. They should appreciate that models and theories are valuable only when vigorously tested against observation.

Students should understand that assertions require justification based on evidence and logic, and should develop an ability to supply appropriate justifications for their assertions. They should habitually ask "Why?" and "How do I know?"

Students should develop and maintain openness to using technological tools appropriately, including graphing calculators and computers, in gathering and analyzing data. They should be aware of the limitations of these tools, and should be capable of effectively using them while making sound judgments about when such tools are and are not useful.

Students should recognize that measurements and observations are subject to variability and error, and that these must be accounted for in a quantitative way when assessing the relationship between observation and theory.

**Course Requirements**

Regardless of the scientific subject, all approved courses are expected to satisfy these criteria:

Courses should be consistent with and illustrate the goals described above.

Courses must explain the relevant phenomena on the basis of the underlying biological, chemical and/or physical principles, as appropriate. They should provide rigorous, in-depth treatments of the conceptual foundations of the scientific subject studied.

Courses should afford students opportunities to participate in all phases of the scientific process, including formulation of well-posed scientific questions and hypotheses, design of experiments and/or data collection strategies, analysis of data and drawing of conclusions. They should also require students to discuss scientific ideas with other students and to write clearly and coherently on scientific topics.

Courses must specify, at a minimum, elementary algebra as a prerequisite or co-requisite, and should employ quantitative reasoning and methods wherever appropriate.

Courses must take an overall approach that is consistent with the scientific method in relation to observing, forming hypotheses, testing hypotheses through experimentation and/or further observation, and forming objective conclusions.

Courses must include hands-on laboratory activities that are directly related to and support the other class work, and that involve inquiry, observation, analysis and write-up. These hands-on activities should account for at least 20 percent of class time, and should be itemized and described in the course description.

The content for physics, chemistry and biology/life sciences courses in grades 9 through 12 will usually be drawn from the Science Content Standards for California Public Schools [PDF], and may, in some cases, also be drawn from the California Career Technical Education Model Curriculum Standards [PDF]. While these standards can be a useful guide, coverage of all items in the standards is not necessary for the specific purpose of meeting the subject requirements for university admission. Likewise, simple coverage of all standards is not enough to assure course approval. For success in college, secondary science teachers should help students learn to assimilate the major ideas and principles that encompass the standards rather than explore the breadth of all the standards. More important than the topics covered, or even than the skills directly used in class, are the more general abilities and attitudes gained through the effort of mastering the course content. These general abilities and attitudes are described in the goals section above.

**HONORS LABORATORY SCIENCE GUIDANCE**

Laboratory Science Honors courses are expected to provide both breadth and depth of exploration in the subject area, developing writing, research, and analytical skills. Specific detailed evidence must be included in the course outline.
The courses must offer content and/or experience that are demonstrably more challenging than what is offered through the regular college preparatory courses in the same field.
Factors considered for UC approved honors courses that satisfy the "d" requirement include but are not limited to the assignment and evaluation of one long or numerous short, challenging, and properly-annotated research papers and a comprehensive final examination. Specific details of each of these assignments are required.
The use of college-level textbooks is encouraged.
Regular college preparatory courses in the subject areas should be offered. If regular non-honors courses are offered, a strong justification for the lack of a regular course is required.
In addition to AP and IB higher level courses, high schools may certify as honors level courses **not more than one unit** for each Laboratory Science Discipline.
A single, written, comprehensive, full year final exam must be administered that encompasses all the material that has been covered for the entire year.

## Course Content

**NOTE:** The following questions are subject specific and ask for detailed information regarding the course curriculum. Since UC has developed their own criteria for the review of curricula, it is not necessary (and preferred) that the State Standards are not listed when submitting course descriptions to the University. When preparing the course submission, keep in mind that your audience is the UC High School Articulation unit and UC faculty. Include relevant information that would assist those reviewing the course and provide UC a better understanding and clarity about the intent of the curriculum. UC expects to see information that would show specific, detailed evidence of the course rigor and development of essential skills and habits of mind. Course template components need to be more expository and illustrative of the integration of each course component and how the overarching goals are being accomplished. The text boxes below will expand to accommodate additional text.

**Course Purpose:** *What is the purpose of this course? Please provide a brief description of the goals and expected outcomes. (How these will be accomplished should be reserved for the Course Outline, Key and Written assignments, Assessments, and/or Instructional Methods.)*

**NOTE:** More specificity than a simple recitation of the State Standards is needed.

**Purpose:**
Using STEM principles, the purpose of this course is to give students a broad overview of environmental science and concerns with an emphasis on their role and responsibility. Furthermore, using this course as a platform, students will be given the opportunity to:

- improve their reading and writing skills
- develop their ability to be objective observers of the world around them
- formulate testable questions and justify their position with evidence
- become comfortable with technological applications beyond social media.

**Goals:**
Students will develop three dimensional perspectives on how human populations, economics and global concerns interact and effect the environment through an understanding of our environmental resources, ecology, biodiversity and sustainability.
This course will create educated citizens that understand how their choices impact the world around them.
This course will influence individuals to become proactive agents of environmental change.
This course will foster enthusiasm and joy for the environment.

**Expected Outcomes:**

Students will become proficient at justifying their opinions with evidence and constructively critiquing others.
Students will, through the understanding of environmental concerns, be empowered to participate in civic minded environmental projects.
Students will participate in field studies involving environmental issues.
Students will take a stand and action on an environmental issue
Students will engineer solutions to environmental problems.

**Course Outline:** A *detailed descriptive summary of all topics covered. All historical knowledge is expected to be empirically based, give examples. Show examples of how the text is incorporated into the topics covered. A mere listing of topics in outline form is not sufficient (i.e. textbook table of contents or California State Standards).*

Course Outline

**Unit 1 – Ecology and Ecosystems**

This unit outlines ecosystems and how matter and energy flow through these systems.

A. Environment and Sustainability
   This chapter introduces limited resources, sustainability, and our ecological footprint.
B. Science Matter Energy and systems
   This chapter focuses on the carbon, nitrogen, phosphorous and water cycle and how mater and energy flow through the systems.
C. Ecosystem Dynamics
   This chapter details the components of ecosystems and their interactions.

**Unit 2 – Biodiversity**

This unit focuses on ecosystem characteristics and natural factors that affect and shape ecosystems.

A. Biodiversity and Evolution
   Biodiversity and mechanisms explain species origins based on scientific evidence.
B. Species Interactions
   Species interactions deals with species relationships, such as, predator prey, mutualism, parasitism, etc.
C. Ecological Succession
   Ecological succession describes how ecosystems respond to change in conditions. For instance, how a pond can become a meadow and eventually a tree stand. Or, factors that can limit succession.
D. Population Control
   Population control deals with factors that limit the growth in plant and animal populations. Human populations will be dealt with later in the course.
E. Ecosystems and Climate
   Ecosystems and climate details how climatic conditions, along with topography, latitude, and proximity to bodies of water can determine ecosystem characteristics.
F. Terrestrial and Aquatic Ecosystems
   These chapters detail the similarities and unique characteristics of each major terrestrial and aquatic ecosystem, including fresh and salt water systems.

**Unit 3- Sustaining Biodiversity**

This unit dives into the problems and issues created by human interaction with nature and what humans are doing to rectify and insure sustainable biodiversity for the future.

A. Sustaining Species
   The focus is on individual species and how to protect them. It details endangered and threatened species and the issues surrounding them, as well as, their species sustainability.
B. Sustaining Ecosystems
   The focus here changes from individual species to an entire ecosystem, treating all components of an ecosystem as vital to the survival of the whole. Problems and solutions in sustaining valuable ecosystems are addressed.
C. Politics of Biodiversity

This section deals with the role politics plays in protecting endangered species and critical ecosystems. It delves primarily into the EPA, Environmental Protection Act.

**Unit 4 – Environment Quality**

This unit centers on natural resources and services, their protection and management, and methods to increase sustainability.

A. Agriculture
   This chapter focuses on the role and importance agriculture plays in the world. This includes; food security, agriculture systems and developments, and procedural changes.
B. Water Resources and Pollution
   This chapter is about the limited supply of freshwater on the planet. It includes; management of the fresh water supply, increasing the sustainability of that supply, and water pollution issues that threaten the supply.
C. Geology and Nonrenewable Mineral Resources
   This chapter describes geological processes with the focus on mineral resource use, ecological effects, and sustainability.
D. Nonrenewable Energy Resources
   This chapter enumerates the advantages and disadvantages of fossil fuels and nuclear power.
E. Renewable Energy Resources
   This chapter discusses energy efficiency, sources of renewable energy and society's transition to renewable energy sources.

**Unit 5 – Environmental Concerns**

In this unit, the human factor is the focus.

A. Human Population and Urbanization
   This chapter focuses on human population demands. It examines factors that influence and effect urbanization. It closes with new ideas for becoming more sustainable.
B. Environmental Hazards and Human Health
   This chapter discusses types of health hazards which include both biological hazards and chemical hazards. It discusses risk evaluation, the population's perception of risk and postulates methods of avoidance.
C. Air Pollution, Climate Change, and Ozone Depletion
   This chapter tackles major air pollution problems. It addresses the effects of climate change and ideas for slowing climate change. It finishes with a discussion on reversing ozone depletion.
D. Solid and Hazardous Waste
   This chapter is about dealing with solid waste and hazardous waste. It also suggests ways to transition to low waste economy.
E. Environmental Economics, Politics, and World Views
   This chapter is about how economic systems are related to ecological resources and services. It addresses the use of economic tools to address environmental problems. It discusses the challenges global political systems have had in the past to enact global environmental policies. It ends with suggesting the social enactment of just environmental politics, and the encouragement to live more sustainably.

**Laboratory Activities:** *Acceptable courses include hands-on scientific activities that are directly related to and support the other classwork, and that involve inquiry, observation, analysis, and write-up. These hands-on activities should account for at least 20% of class time, and should be listed and described in detail. Please itemize and describe each laboratory activity in detail.*

Most laboratory activities take multiple 50 minute periods to complete.

**Photosynthesis:** Using Vernier probe ware students investigate the concentration of carbon dioxide, pH and oxygen levels of a photosynthetic system through various environments.

**Biomass:** Developed by the MSP, Math Science Project, Biomass is a series of experiments that lead students through photosynthesis and the uptake of carbon dioxide to form biomass.

**Runoff:** In this lab, students create a model to help conduct a controlled experiment to examine how ground cover effects the amount, quality, or composition of water runoff.

**Owl Pellets, Food webs, and Pyramids:** This lab extends the common use of owl pellets to a more complex level that relates the contents of the owl pellet to the flow of energy and matter. Students will dissect owl pellets to collect and count the contents. Students will use their data to create food webs and biomass pyramids.

**Design a system to access a local species:** Students will learn how to function as Citizen Scientists as they follow the prescribed protocol from the Sandy Beach Monitoring Program to collect, analyze and share data.

**Bottle-ology Ecosystems:** Students engineer aquatic, terrestrial, and decomposing solid waste ecosystems which include biotic and abiotic components. Students will perform experiments to track nutrients as they pass through the various systems. Their systems must be in contact with one another, sustainable and cycle nutrients throughout all the systems.

**Food Webs**: Working in groups, students will use photos of various organisms to create a hypothetical food chain, then a food web. Peer review will allow students to both critique and justify their arrangements. Students will explore the ramifications of an extinction event and the significance of keystone species. Finally, students will demonstrate the effects of biological magnification in a role-playing exercise.

**Heat Transfer on Earth**: Students will develop a model to investigate the specific heat content of various surfaces on earth. Students will explore how latitude effects the intensity of solar radiation. Finally, students will determine how surface covering, and latitude effect temperature ranges.

**$CO_2$ and Ocean Acidification:** Using Vernier probe ware, students will explore the chemical properties of seawater such as; pH, $CO_2$ levels, and oxygen levels. Other tests will determine ammonium, nitrate, and temperature levels. Students will explore what happens to the chemical balance of sea water and various shell fish when this balance is altered.

**Investigate Species Diversity:** Students will dissect a holdfast from our local offshore kelp forest. Students will examine this mini ecosystem and identify the diverse invertebrate organisms living in this environment. Students will use the statistical analysis tool, Shannon-Weiner Diversity Index, to analyze their data and determine the diversity of this mini-ecosystem.

**Endangered Species Data Analysis:** Students will use the data presented by the textbook to design a model that shows the proportion of endangered and threatened species.

**Camping trip to Big Basin Redwood Forest**: Students will participate in several experiments and activities that will take place over several days during an extended camping trip. Students will access the forest's health and gain an appreciation for an old growth forest.

- Using a random sampling plot method, students will examine, identify and record all the species they can identify on the forest floor using identification guides as a reference. They will then perform a statistical analysis of their data using the Simpson Diversity Index to determine the biodiversity of the area.

- Students will explore the forest looking for evidence of nutrient cycling. Students will then participate in a discussion where they will attempt to track biotic and abiotic cycling through the forest ecosystem. Students will be encouraged to justify their positions with the evidence they found.

- Students will examine the forest for producers, consumers, and decomposers and the food webs that they create. In addition, students will hypothesize about the interspecies relationships that might exist and support their opinion with their observations and findings.

- Students will examine evidence for ecological succession in the forest.

- Students will develop an understanding of forest resources, services, and management by gathering and analyzing data from a stand in the Big Basin Redwood Forest. Student will determine an estimate of the total stand volume.

- Students will examine some of the challenges facing our forests today including invasive species, wildfire, ownership, and climate change.

**Fire Ecology**: Students will examine the role of fire in forest and chaparral ecosystems. Students will focus on the natural role fire plays in the life cycle of these ecosystems and how fire is being used to manage these ecosystems. Students will experiment with charade which is charred wood remains left after a fire that contain leachable chemicals that stimulate seed germination in some plant species. Students will finally explore the issues that present themselves at the wildland-urban interface and propose fire safety solutions.

**Soil Analysis:** Students will identify soil types and characteristics based on: ribbon test, sieve test, sedimentation test, field test, and the soil pyramid. Students will identify organic matter, sand, silt, clay percentages in a variety of soil types. Furthermore, students will determine soil productive capacity based on: nitrogen test, phosphorus test, potassium test, pH test and percolation rate test. Using test results, students will determine best fit plant life and identify strategies to maximize production.

**Effects of Nitrogen on Plant Growth: Eutrophication from Agricultural Run-off**: This is a series of experiments. Students will be working in small groups. When the experiments are completed, students will prepare a presentation of their findings and share with the class.

Part one: Design an experiment to assess the changes in the dynamics of a freshwater system (interplay of such parameters as turbidity, pH, $CO_2$) as nutrients become increasingly more available.

Part two: Students will investigate one of the following:

- Design an experiment that could be used to compare the effects of nutrient enrichment on two different bodies of water.
- Design an experiment to access the dissolved oxygen content of similar bodies of water with different surrounding factors.
- Design an experiment to determine what types of household items might be contributing to cultural eutrophication (i.e.; many detergents contain phosphorus; lawn fertilizer contains nitrogen).
- Design an experiment to determine whether there is a marked difference in the biological consequences of continuous low-level nutrient enhancement and sudden high-level nutrient enhancement.

**Design, Build and Test a Passive Water Filtration System:** Students must keep in mind the usefulness of their design to a third world area as they build a passive water filtration system. Students will test the quantity and effectiveness of various factors that contribute to their passive water filtration system. Students will access the quality of the filtered water by the following factors: total dissolved solids, pH, and bacteria content. In addition to the chemical tests, student will need to learn sterile technique, microbiology techniques, and serial dilutions to test their water.

**Serial Dilutions:** Students will learn how to perform serial dilutions and calculate the resulting concentrations of each solution.

**Microbiology:** Students will learn sterile techniques as they prepare petri dishes with medium. Students will learn how to streak a petri plate and how to identify and count colonies. Do to the potential hazard, students will not be identifying strains of bacteria.

**Water Quality Study:** Students will follow established protocols to sample and test local water from around the Santa Maria area. Some additional water samples will be provided by the instructor in the classroom for students unable to go into the field. Students will use probe ware when possible. Some of the chemical tests will involve different techniques. Students will analyze their results and discuss their findings.

**Get the Lead Out:** Get the Lead Out is a guided-inquiry lab where students are challenged to determine how lead can be removed from a sample of contaminated water.

**NEED Energy Transformation Investigations**: Students will perform many experiments to become familiar with the various forms of energy transformations. Students will also learn about sources of energy, energy production and energy efficiency.

**Electricity Use and Efficiency**: Students will use a device called a Kill a Watt which is an electric usage monitor to evaluate electricity consumption of personal electrical appliances around their home. Students will pick one appliance to perform calculations to determine the amount of energy consumed.
In addition, students will choose one of the following or suggest their own investigation.

- evaluate several different devices with the same purpose.
- evaluate an electrical device in the variety of modes offered; such as, heat on/off, sleep mode or active mode for a

computer
- evaluate hidden electric use by appliances that always consume electricity even when turned off

**Nicotine Toxicity**: Students will investigate how various concentrations of nicotine affect the behavior of Lumbriculus variegatus (California blackworms)

**$LD_{50}$ :** LD stands for lethal dose and $LD_{50}$ signifies the single dose needed to kill 50% of the animals used in the experiment. It is widely used to test the toxicity of household products, pesticides, cosmetics, drugs, weed killers and industrial products. Students will use serial dilution to create different concentrations of a copper sulfate solution. Students will expose Daphnia magna, a small planktonic crustacean, to the various concentrations. The results are graphed on semi log paper and the $LD_{50}$ is determined.

**Greenhouse:** Students will create a model to simulate the greenhouse effect and monitor temperature and $CO_2$ levels with Vernier probe ware. Students will analyze the data and discuss the relationship between $CO_2$ levels and temperature.

**Lab Albedo:** In a controlled experiment, equal amounts of shaved ice are placed on different colored metal substrates. The amount of "snow" that melts as a function of time is measured and the data is graphed. Students will discuss their results as a model for polar ice verse land base ice melt and the compounding ramifications of global warming. Students will explore the concept of a positive feedback loop and realize the complexity of these scenarios.

**Key Assignments**: *Detailed descriptions of all Key Assignments which should incorporate activities and projects, as well as, short answers and essay questions. How do assignments incorporate topics? Include all assignments that students will be required to complete. Assignments should be linked to components mentioned in the course outline. It is not appropriate or necessary to include instructions given to students regarding the execution of assignments (formatting, timeliness, etc.). Do not include exams or assessments in this section.*

**Students will be assigned a writing activity for each chapter.** It will focus on the case study presented by that chapter. It will be modeled after the Common Core writing standards for technical writing. The first six will have the data that the chapter offers. The next six assignments will have additional data provided by outside sources to provide students with experience from multiple data sources. The final six assignments will include opposing points of view from multiple sources to help prepare students to be proficient writers. The 18 case study topics are: The Greening of American Schools, Experimenting with a Forest, Disappearing Tropical Rain Forests, Amphibians at Risk, The Southern Sea Otter: A Species in Recovery, The Importance of Coral Reefs, A Honeybee Mystery, Costa Rica; A Global Conservation Leader, Growing Power- An Urban Food Oasis, The Colorado river Story, The Importance of Rare Earth Metals, Fracking for Oil and Gas, The Potential for Wind Power in the United States, Population 7.3 Billion, Mercury's Toxic Effects, Melting Ice in Greenland, E-Waste- An Exploding Problem, The United States, China, and Sustainability.

**Tragedy of the Commons**: In this activity students discovery, how individuals typically act independently and in accordance with their own self-interests. Students are introduced to the concept of sustainability and the necessity of shared public resources for the common good of everyone.

**Ecological Footprint:** In this activity student examine their own ecological footprint and then the footprint of the school as a business using an on-line calculator. Students then work in groups to develop recommendations and strategies of implementation to improve our school's footprint. These recommendations will be sent to the principal and interested parties.
www.footprintnetwork.org/en/index.php/GFN/page/calculators/

**Fieldtrip to Santa Barbara Natural History Museum:** Students will be able to compare a multitude of similar species up close and study their adaptions. Students will speculate to the forces that acted on the species and postulate how the adaptions can to be.

**Butcher paper Biomes:** Using knowledge of latitude, topography, ocean currents, precipitation and temperature, students will create an imaginary island around the world where they will have to determine the climate, biomes present, and subsequent species supported by that biome.

**Fieldtrip to Oso Flaco Lake:** Oso Flaco Lake is located three miles north of Guadalupe. It is part of the Santa Maria Valley watershed in which Oso Flaco Creek drains into the lakes after passing through miles of agricultural land. There is a riparian zone along Oso Flaco creek, a marsh, a wooded ecosystem, and a sand dunes ecosystem. Students will study the diverse habitats as well as the impact of agricultural run-off on these habitats.

**Trip to Tidal pools at Shell Beach:** Students will explore this fragile tidal region near Shell Beach. Students will examine and identify ten plant species and ten invertebrate species. Students will pay close attention to the special adaptions that allow

these species to exist in this difficult habitat. This is a protected marine area and as such, no specimen collection is allowed. Students will document their "collection" with photographs and report the classification, habitat, reproduction, and adaptions of each species.

**Fieldtrip/Camping trip to Refugio State Beach:** All students, including those who have never been in the ocean, will go body surfing on boogie boards for the first time. Students will experience the wonder and power of the ocean. Students will feel the characteristics of the ocean as they try to catch a wave.

**Honeybee Habitat**: After researching about CCD, Colony Collapse Disorder, students will work in small groups to develop a proposal for a Honeybee Habitat to be created on campus. The habitat should take into consideration technical, social, economic, and environmental impacts as well as location and climatic requirements. Groups will present their proposal to the class. The students will determine a final decision. Students will work in small groups to build various aspects of the habitat.

**Design a hydroponics system:** Working in groups, students will be assigned a system to be design. These systems include; construction of support structure, electrical pumps, and wiring, attaching lighting fixtures, lights and wiring, light timing, chemical composition of nutrients, testing and maintenance of nutrients, and plumbing. Students will need to work together to build and integrate all the systems to create a functioning hydroponic growing environment.

**Fish Consumption: Designing models**: Using the information provided by the textbook, students will graph and analyze data to determine how much food is available and used for human consumption.

**Take Action: Track your food:** For one week, students will weigh the food that is purchased in their home and the food that is thrown out. Students will use categories to keep track of the food they eat. After one week, students will compare their data with other students. Students will then develop a plan to increase their food sustainability and share that plan with their family. Finally, students will report to the class their family's reaction to their recommendations.

**Fieldtrip to Waste water treatment facility:** Students will research and compare the components of an urban waste water treatment facility to an artificial wetlands system which can be used to treat sewage. Students will examine the advantages and disadvantages of both systems prior to going to the facility. At the facility, students will take a tour and learn how the plant operate. Students will take part in a question/answer session with plant personnel to get their prospective of the future of waste water treatment.
**Cradle to Cradle Product life cycle**: In this activity, students will research three products that could have a cradle to cradle life cycle and learn what it takes to make the products more sustainable.

**Create recycling program for heavy metals**: Students will search EPA website for information on e-waste recycling. Students will create an e-waste/ heavy metal recycling program for the school. Students will create a PSA to educate the student body about ways to reduce their e-waste.

**Fracking:** In this activity supplied by the textbook, students will investigate potential impacts of fracking on a community and decide if it should or should not be allowed there.

**Take Action EPA and MyEnviroment:** The EPA runs an interactive database on their website called MyEnvironment. Its purpose is to provide a cross-section of environmental data for any geographic location in the US. Students will develop a question that they can investigate regarding nonrenewable energy use as it relates to their community.

**Design and build solar ovens:** After researching various designs, students will build and evaluate the effectiveness of their solar oven by determining the highest temperature reached and highest temperature range sustained for more than one hour.

**24 Hour Challenge**: Students are challenged to live "off the grid" using no electricity for 24 hours. The challenge begins at the end of one school day. The next school day, students will prepare a great meal cooked in the solar ovens they have made. At the end of the day, students will sit down for a great meal and wonderful stories of personal revelation and sustainability.

**Build solar lanterns:** After researching global projects which bring solar light and power to regions without electricity, students will build solar lanterns using a solar cell and a mason jar.

**Design a carbon-capture device:** Following the directed-inquiry provided by the textbook, students will design, build, and test a habitat for cultivating algae and create a carbon-capture and storage device

**Design a sustainable, carbon neutral city of the future:** Using what they have learned about sustainability, student groups will design and build a model of a carbon neutral city. Student groups will present their model to the class and a discussion will follow which will focus on the merits of the various models.

**Analyze data to create age structure diagrams:** An age structure diagram shows the distribution by ages of females and males within a certain population in graphic form. Data for constructing the diagram will come from Census Year 2000 data.

Students will access a database, http://www.census.gov/population/cen2000/phc-t9/tab03.pdf , graph the data and analyze the diagram to make predictions about the condition of the population.

**Solid waste personal inventory:** For one week, students will collect all of their personal waste. Some waste will be simulated with clean alternatives. At the end of a week, students will sort their waste into categories and weigh the waste products. Students will graph their data and compare their data to other students in the class. A class discussion will follow about the types of waste and their quantities. Students will propose alternative habits that would limit their personal waste.

**Fieldtrip to landfill and recycling plant**: Students will research solid waste disposal and develop questions before setting off to the municipal landfill and recycling plant. Students will tour the facilities and learn how the plants operate. Students will interview the managers of the plants to get their prospective of the future of waste disposal in our area.

**Climate Change and the Global Summit**: In this activity, students will have an opportunity to investigate climate change for themselves. Each student will be a representative of an interest group. They will research the topics relates climate change and represent their interest's perspectives at an international summit where they will express and debate the viewpoint of their interest group and share their vital concerns with this issue much like the United Nations and the Kyoto Protocol.

**Instructional Methods and/or Strategies:** *Indicate how the Instructional Methods and/or Strategies support delivery of the curriculum. What portions of the Course Outline are supported by the methods and strategies?*

Environmental Science is designed as a student-centered interactive course. This course is intentionally design to be very hands-on, minds-on with an extensive list of laboratories, projects, and activities for the students to participate in.

Higher order thinking skills and personal connections happen primarily though the labs, projects and activities as students discuss and justify their reasoning. Through the projects and activities, students see themselves as active participants in a movement for environmental change.

The camping trips are included to stimulate the students' affective educational domain. Imagine their experience as, for the first time, early dawn breaks through the silence in the old redwood forest. While the fog still shrouds the canopy, it feels as though the trees go straight to heaven. And, with the first glimmer of light, crowning over the mountains, the birds start to sing as if to welcome in a new day. How can you not be affected by that?

Most, 80-90%, of our population are second language learners. These kids carry the hopes and dreams of their families and they want so badly to do well in school. When they take notes from a book, they copy everything. They don't want to miss anything because to them, it might be important. The problem with this is that they are overwhelm with the sheer volume of work. They can't discern main ideas, and supporting material from the remaining text. Our challenge, as we see it, is to help our students develop reading strategies to distinguish important key ideas and supporting details from the rest of the text. To this end, and in keeping with a student-centered course, students will discover the main ideas themselves as they work in small groups to unwrap and digest the textbook. A new reading strategy to assist them will be introduced each chapter during the first semester.

There will be a writing activity for each chapter which will center on the core case study presented by the textbook. The writing assignments will be modeled after the Common Core writing standards for technical writing. The writing activities will get progressively more challenging to help prepare students to be proficient writers. Student will learn to make a scientific claim, support that claim with scientific evidence, and develop conclusions utilizing scientific reasoning.

Each chapter will include vocabulary development and will be primarily delivered using on-line game formats such as; Quizlet, bingo, and jeopardy.

Each chapter will also have concept development using another on-line game format called Kahoot. In addition to gaming, students will also regularly participate in white boarding, jigsaw grouping, museum walks and short student presentations. Student discussions and debates will become prominent in the second term as students become more familiar with justifying their opinions with evidence.

Students will also be exposed to a new technological application in each chapter and will then utilize these new applications throughout the remainder of the year. These applications include the following: Microsoft OneNote, Collaboration space in OneNote, Microsoft Word using tables and graphs, File hierarchy and file storage systems, One Drive, Dropbox, Microsoft PowerPoint, Google Docs, Google Calendar, Survey Monkey, Basic Microsoft Excel, Skype and video conferencing, and search engine strategies.

**Assessments Including Methods and/or Tools:** *Indicate the intent of each assessment and a brief description of how each relates to the Course Purpose and goals related to the development of critical thinking and other habits of mind skills.*

Grades will be determined by total points accumulated within weighted categories. Some assignments with holistic assessment will be converted to a point system to be integrated into the overall assessment of students.

35% tests and quizzes
20 % laboratory
15% projects
15% activities
15% writing assignments

On-going informal assessments

Quizzes are formative assessments carried out concurrently with instruction. Students can retake quizzes after participating in an afterschool tutorial.
Tests are formal, summative assessments which will include multiple choice and free response writing.
Laboratory work, projects, and activities will include a written report which is graded based on a published rubric given to students prior to the exercise. These rubrics all share common elements as well as unique elements specific to each assignment. Students may receive assistance with reports during afterschool tutoring. Some of the activities may be based on a holistic assessment. These assessments will be based on a published rubric provided to the students prior to the activity.
Writing assignments are graded based on the Common Core assessment for technical writing. On-going informal assessments are used to adjust the pace and scope of the class and make minor adjustments when warranted.