**PLTW Environmental Sustainability (ES) /Engineering**

**Syllabus Student Contract Fall 2018 and Spring 2019**

**Ms. NJ McLaughlin Chapin HS 7000 Dyer St. El Paso TX 79904**

***Imagine a world where • there is abundant, healthy food for everyone • there is a clean, bountiful water supply • the environment is resilient and flourishing • there is sustainable, clean energy • good health is the norm What can you do to help make our world environmentally sustainable?***

*What is Environmental Sustainability?*

Project Lead the Way (PLTW) Environmental Sustainability (ES) aka Environmental Engineering, is a high-school-level specialization course in the PLTW Engineering pathway. In ES, students investigate and design solutions to solve real-world challenges related to clean drinking water, a stable food supply, and renewable energy. Students are introduced to environmental issues, use the engineering design process to research, and design potential solutions. Utilizing the activity-, project-, and problem-based (APB) teaching and learning pedagogy, student’s transition from completing structured activities to solving open-ended projects and problems that require them to develop planning, documentation, communication, and other professional skills. Through both individual and collaborative team activities, projects, and problems, students problem solve as they practice common design and scientific protocols such as project management, lab techniques, and peer review. Students develop skills in designing experiments, conducting research, executing technical skills, documenting design solutions according to accepted technical standards, and creating presentations to communicate solutions. The following is a summary of the units of study that are included in the course for the 2017-18 academic year. Activities, projects, and problems are provided in the form of student-ready handouts, teacher notes, lesson-planning resources, and supplementary materials. The course requires a rigorous pace.

***Primary Goal for PLTW ES***: Building enthusiasm for and a real understanding of the role, the impact, and practice of environmental sustainability is a primary goal of the course.

*Description/Overview of Units:*

**Unit 1: Environmental Sustainability for a Better Tomorrow**

Unit 1 establishes a foundation for the course and introduces students to key aspects of the environment while identifying important global problems. In this course, students learn how the biological engineering of organisms can be used to provide environmentally friendly and sustainable solutions to produce clean, safe drinking water; nutritious food sufficient for a growing world population; and affordable, renewable energy. This theme sets the stage for each unit within the course.

Lesson 1.1 Introduction to Environmental Sustainability

**Unit 2: Ensuring Safe and Abundant Water**

Unit 2: This unit begins by establishing context around the extent of the global drinking-water challenge. Students build models of natural water systems, investigate how these systems become contaminated, explore how contamination can be prevented, and examine how polluted waters can be purified. Students practice laboratory methods for quantitatively measuring water quality. They investigate the role and effectiveness of biological organisms in cleaning up water polluted with crude oil. The physical, chemical, and biological technologies and processes utilized by wastewater treatment plants are explored, with optional field trips to these facilities included. As a culmination project, students apply their knowledge of water issues, water treatment technologies, and the associated role of biological organisms, along with their engineering design experience, to the challenge of designing a small-scale water-treatment system for rapid deployment within natural disaster zones.

Lesson 2.1 Global Water Crisis

Lesson 2.2 Water Supply

Lesson 2.3 Water Remediation

Lesson 2.4 Disaster-Area Water-Treatment Design Challenge

**Unit 3: Food Security**

Unit 3: This unit focuses on the genetic modification of plants as a potential solution to food security issues around the globe. Students learn about the structure and function of DNA and the process of protein synthesis. They learn to determine whether familiar food items contain genetically modified organisms (GMOs). They investigate various molecular biology techniques while working through the steps necessary to create genetically modified plants. Through laboratory activities and simulations, students explore polymerase chain reaction (PCR), DNA sequencing techniques, restriction enzyme action, ligation, gel electrophoresis, bacterial transformation, and plant transformation. They work through the beginning steps of the engineering design process and propose a genetic-engineering solution to a global food security issue.

Lesson 3.1 World Food Security

Lesson 3.2 Introduction to DNA

Lesson 3.3 Genetic Engineering

Lesson 3.4 Design a Genetically Modified (GM) Food

**Unit 4: Renewable Fuels**

Unit 4: This unit concentrates on the role of biological engineering and biomanufacturing of biofuels from algae and cellulosic plant materials in solving the challenges associated with producing biofuels in a sustainable and environmentally friendly manner. The unit begins by exploring current global energy consumption patterns and then examines futuristic energy consumption models that utilize types of energy other than fossil fuels. Students conduct a household energy audit to contextualize their energy consumption patterns. They investigate the process of photosynthesis and its role in the formation of both fossil fuels and biofuels. Applying an engineering design process, students are challenged to design, build, and operate bench-top-scale algae bioreactors. Students design monitoring systems and apply standard laboratory processes in quantifying the efficiency of their systems at producing algae and purifying the products. Next, students dive into the production of ethanol from cellulosic plant sources. They investigate the role that enzymes play in this process. Students explore technologies used to produce ethanol and design an ethanol separation and purification system. In the last part of the unit, students are challenged to apply their knowledge of biofuels, engineering design, and biomanufacturing practices as they develop a proposal for a commercial-scale biofuels manufacturing plant.

Lesson 4.1 Challenges of Renewable Energy

Lesson 4.2 Biofuels from Algae

Lesson 4.3 Ethanol Biofuels

Lesson 4.4 Designing a Commercial-Scale Biofuels Manufacturing Plant

 ***My qualifications to teach this course:***

I have been a facilitator of Physics, Chemistry, Biology, Biotechnology, Anatomy and Physiology, and now Environmental Engineering for over 12 years. I have had 15 years as a certified, Generalist Medical Technologist with reference and hospital labs mainly in the fields of Special Chemistry, Radioimmunoassay, Microbiology, Mycology, Virology, Serology, Quality Control, Hematology, and Blood Bank. I have had experience in not only the lab testing and interpretation, but also in biomedical equipment troubleshooting and repair as well. I am able to give the student a lab perspective as well as an allied health professional experience of working in tandem with all departments of the lab and hospitals. I have designed this course to really emphasize good lab skills, processes, and techniques, which are things the student will use in many classes and careers from now on. I strive to make my labs and classes as authentic as real world scenarios. The student will need to make a commitment to stay current with their daily classwork, homework, and lab work. They must seek the answers to all their questions and grey areas either through their assignments, their facilitator (myself), their labs/ projects, their peers, community leaders, and/ or outside sources. All questions are welcome! Ask as many as you please until you thoroughly understand the concept or answer. My job is to make mastery learning a much easier experience by using our community of learners, our class, our school, our homes, and our community as real world references for any and all materials in this course. We will work closely with the water resource plants, wastewater treatment facilities, solar array facilities, wind generator facilities, water remediation facilities, and the geothermal resources available here in El Paso and elsewhere.

***Class procedures, policies, and rules.***

***Makeup Work***: It is your responsibility to contact me before school, at lunch, after school, or by email for any missing work. If you know in advance an absence will occur, please let me know so I can arrange a makeup lab, assignment, or assessment. One day will be allowed as an extension of time for every EXCUSED absence. Please see me with reasons for extensions.

Students must have ***Internet availability*** to reach pltw.org and sign up for an account to review the class curriculum/projects. Signed consent forms for Internet use must be on file with Chapin HS.

***Late Work Policy***: All work must be completed by the deadlines set or late points will be deducted as follows:

1 class day late = 75% maximum points

2 class days late = 50% maximum

3 class days late = 25%

Any other days late see me for possible allowable grade.

***The Redo policy*** is that you can make up work to receive an 85%. If you have a grade you want to adjust, you must do it before the start of the new unit. If you get an 85% or higher, you can raise your grade with a redo to 100% with all correct answers. If you have zeroes, a Biobuck can be used for allowable assignments such as daily work and things I say can be replaced by Biobucks. There are no redos possible unless an original paper/assignment was turned in with a grade assigned. Zero work will remain zeroes unless you and I have reached an equitable agreement for late work or Biobucks are submitted for allowable daily work.

***Participation*** Students must bring laptops to class daily, have your class ISN NB and your white Engineering NB as well. Failure to come prepared to class can result in loss of participation points at 5 pts. a day.

***Class grades are calculated as follows:***

Daily Class Work, Projects and Project Stages, Participation, and ISN NBs = 35%

Assessments: Daily Quizzes and Unit Exams = 25%

Labs and Engineering NBs = 30%

9 Weeks Exams = 10%

***No copied work***. All work must be original work of each student. Failure to follow copyright laws and rules for citations will result in major loss of points.

Please read the supply list and provide the supplies required daily. Replace all items as needed.

Sign the acknowledgment sheet and provide me with workable phone numbers and reachable emails.

I look forward to this new year of discovery learning together.

***Supplies: To be received by the Friday of the second week for full credit. Let me know if there are any problems obtaining the needed supplies.***

One 2” three ring binder, no larger

College ruled notebook paper, replace as required.

One box of nitrile lab gloves. NO latex or vinyl exam gloves. Your size, extra small, small, medium, large, or extra-large. No one size fits most. These do not fit well and break easily with the chemicals we use.

One roll paper towels

 3” X 3” post it notes to be replenished as needed.

One USB at least 8 GB.

Hand sanitizer is optional.

Student printed name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Parent or guardian printed name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Student email \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Parent or guardian email (must be reachable) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Please write me an email saying the syllabus is acceptable so I know the email is the correct one to use.

This syllabus, the supplies and the lab safety contract must be received by the Friday of the second week to receive full credit or a grade of NHI (zero) will be put in for the missing items. No labs can be done without the signed safety contract and a safety exam grade of at least 70%.