**PLTW Sample Course Descriptions**

This document provides sample course descriptions for all Project Lead The Way (PLTW) high school courses in PLTW’s three pathways -- biomedical science, computer science, and engineering.  The intention is to provide schools with example descriptions based on student and teacher inputs. The samples below provide insight into the content covered in the course as well as the types of projects and learning experiences available to students.  Please note, the descriptions can be used as is or tailored as needed to reflect local school context (e.g., credit units, weighting, prerequisites, honors).

A few notes for local consideration:

* Courses are designed as full year (180 day) courses
* All PLTW courses (aside from the biomedical and engineering capstone courses) include an end-of-course exam that can help student qualify for college credit and scholarships ([more details here](https://mass-stemhub.org/our-programs/project-lead-the-way/massachusetts-scholarship-and-credit-opportunities-for-pltw-students/))
* All PLTW courses at the high school count as advanced coursework in DESE’s school accountability system
* Courses have PLTW-specific course codes in the SIMS system, found in EPIMS appendices ([linked here](https://www.doe.mass.edu/infoservices/data/epims/)). This has benefits such as advanced coursework noted above, Perkins reporting, and increased ease of college recognition
* Many districts across the state weight their PLTW programs as they would AP or honors

If you have any questions, ideas, feedback, please do not hesitate to get in touch with Andreina Parisi-Amon (aparisiamon@mass-stemhub.org) at Mass STEM Hub.

**PLTW Biomedical Science***Whether discovering new cancer treatments or teaching healthy lifestyle choices to their communities, today’s biomedical science professionals are tackling big challenges to make the world a better place. The PLTW Biomedical Sciences pathway offers students the opportunity to solve medical mysteries and explore different biomed professions, including: surgeon, geneticist, microbiologist, and medical investigator. A full four course pathway is offered that counts as advanced coursework in Massachusetts. All courses also offer students the opportunity to earn college credit and scholarship based on their coursework.*

*PLTW courses are full year courses.  Credit and scholarship opportunities are available based on course & pathway completion.*

**PLTW Principles of Biomedical Science** In the introductory course of the PLTW Biomedical Science program, students explore the human body by stepping into scientists’ shoes to:

* Conduct experiments to isolate the cause of a person’s death
* Examine chronic health conditions, explore the role of genetics in disease, develop a diagnosis, and ultimately create a treatment plan for a patient
* Act as a member of a disease defense team, investigating a mysterious community infection
* Work on a medical emergency response team where quick assessment and decisions are essential

Students then apply these learnings to compete for open lab space in an innovation incubator by proposing the design of a new medical innovation.

**PLTW Human Body Systems** In Human Body Systems, students explore the neurology and physiology of humans, including identity, personality, movement, power, immunity, and homeostasis. Students then apply what they learn to create solutions to real world problems. For example, after understanding the similarities and differences across an individual’s bones, muscles, and cells, leading to unique identifiers such as fingerprints, students apply this knowledge to create a biometrics-based security plan for a real-world client. After exploring how the body uses food, oxygen, and water to power itself and how it moves through joints, muscles, and blood flow, they take on the role of a sports medicine expert to develop a training plan for a professional athlete.

**PLTW Medical Interventions** In Medical Interventions, students follow a family through a series of medical challenges, learning alongside them how to prevent, diagnose, and treat diseases. Students explore the wide variety of professions in the biomedical sciences field as they learn how to detect and fight infection, screen and evaluate the code in human DNA, and evaluate cancer treatment options. Students apply their learnings to design a nanotechnology-based or immunotherapy cancer treatment and create a clinical trial to test its safety and efficacy, just like work currently being done by scientists in biomedical companies right in our own Massachusetts backyard.

**PLTW Biomedical Innovation** In the capstone course of the PLTW Biomedical Science sequence, students build on the knowledge and skills gained throughout the pathway to design solutions for some of our most pressing health challenges. The course involves eight different “missions.” One mission requires students to design an effective emergency room, considering all the aspects of patient, clinician, and information flow, prioritization of critical diagnostic information, and equipment needs for diagnosis and treatment. The final mission is an independent project of the student’s choosing, which could be an internship, research project, or an entrepreneurial venture around a community health issue.

**PLTW Computer Science**

*Through the PLTW Computer Science pathway, students don’t just learn how to code, they learn the fundamentals of computational thinking and team problem solving. The PLTW Computer Sciences pathway offers students the opportunity to learn about the fast-paced world of CS. With an accessible intro course, dedicated cybersecurity class, and two AP-aligned courses, the CS PLTW pathway gives students an engaging and sophisticated CS experience. A full four course pathway is offered that counts as advanced coursework in Massachusetts. All courses also offer students the opportunity to earn college credit and scholarship based on their coursework.*

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**PLTW Computer Science Essentials** In Computer Science Essentials, students begin by using visual, block-based programming to build their computational thinking skills. Then, students start coding with text-based programming languages such as Python, create apps, and develop websites just like a professional developer. Students continue to work with classmates like a team of developers, participating in a “scrum” to develop an app, computing device, or text-based code that solves a problem they or their community are facing.

**PLTW Cybersecurity** Students in Cybersecurity apply their knowledge of coding and computational thinking to seek out vulnerabilities in data storage systems and online commerce sites, then design solutions to increase safety and protection. Whether seeking a career in the growing field of cybersecurity or learning to defend their own personal data or a company’s data, students in Cybersecurity establish an ethical code of conduct while proactively defending data in today’s complex cyberworld.

**PLTW Computer Science Principles** In Computer Science Principles, students solve digital challenges by developing the computational thinking and technical skills of leading computer scientists. Learning by doing, students:

* Become fluent in Python, professionals’ primary computational language
* Debug code to ensure programs act as intended and are useful to the user
* Create an engaging computer game
* Code and decode data to keep it safe on the internet
* Make sense of large quantities of data by creating data visualizations

The PLTW Computer Science Principles course is aligned to the AP Curriculum Framework and PLTW is recognized by the College Board as an endorsed provider.

**PLTW Computer Science A** Helping to answer the now ubiquitous question “is there an app for that?”, in Computer Science A, students focus on their mobile app development skills. Using the same tools as the pros - Android Studio, Java, XML, and device emulators - students collaborate to create mobile app solutions to problems they’re currently facing. This course aims to prepare students to successfully take the AP CS A exam.

**PLTW Engineering**

*From launching space explorations to delivering safe, clean water to communities, engineers find solutions to pressing problems and turn their ideas into reality. The PLTW Engineering pathway offers students the opportunity to learn real-world skills and solve real-world problems. These hands-on courses allow students to apply math, science, computer science, and design skills. All courses offered in the pathway count as advanced coursework in Massachusetts. All courses also offer students the opportunity to earn college credit and scholarship based on their coursework.*

*PLTW courses are full year courses.  Credit and scholarship opportunities are available based on course & pathway completion.*

**PLTW Introduction to Engineering Design**In the first course of the engineering pathway, students will learn the foundational skills of an engineer and apply what they learn to manage an engineering design process from concept to solution.  Working collaboratively on a team, students develop user-centric design principles to ensure products meet customer needs, build and test prototypes, evaluate prototype effectiveness, and use these insights to iterate, improve, and deliver an effective solution. Using the same 3D modeling and design tools engineering professionals use, students reverse engineer a product to understand the design decisions made by the creator.

**PLTW Principles of Engineering** This course explores different types of engineering, including computer hardware, electrical, environmental, mechanical, and materials engineering. Each of these requires the engineer to deeply understand user needs from a technical and personal perspective. The best solutions are developed in teams, so students work together to design and create solutions for the future. Sample hands-on projects include:

* developing solutions for a renewable electrical energy generation and distribution system that uses wind, solar, and fuel cell energy conversion systems
* architecting, building, and testing a functioning bridge
* configuring a recycling system that can automatically separate different materials

**PLTW Aerospace Engineering** In this course, students are propelled into the world of aerospace engineering, learning the fundamentals of atmospheric and space flight. Exploring the physics of flight, students apply what they learn to design an airfoil, a propulsion system, and rockets. Working with the industry software the professionals use, students learn basic orbital mechanics to create designs, and they also explore robot systems in remotely operated (autonomous) vehicles.

**PLTW Civil Engineering and Architecture** In this course, students experience the work of civil engineers and architects by applying the stylistic and technical skills (e.g., 3D drawing, measurement, and meeting a spec) to create plans for both residential and commercial design projects. Students select a homeowner client and follow the Habitat for Humanity guidelines to develop an Affordable Housing Design, aiming to make it comfortable, usable, efficient, and environmentally responsible. The second project will find students applying their skills to transform a shuttered factory into a community library, applying both creativity and technical know-how.

**PLTW Computer Integrated Manufacturing** Get introduced to the high-tech, innovative field of modern manufacturing that develops products we rely on every day. Students learn advanced manufacturing processes, including additive and automated manufacturing, product design, and robotics. After exploring the many factors that influence the design of a product, including cost, safety, and functionality, students choose a product and design a system to manufacture it. Building on 3D design CAD experience, students use Computer Aided Manufacturing (CAM) software to translate a digital design into a program that 3D Printers and Computer Numerical Controlled (CNC) mills use to transform raw material into a final product. Successful completion of this course earns an industry recognized manufacturing credential.

**PLTW Computer Science Principles** In Computer Science Principles, students will solve digital challenges by developing the computational thinking and technical skills of leading computer scientists. Learning by doing, students will:

* Become fluent in Python, professionals’ primary computational language
* Debug code to ensure programs act as intended and are useful to the user
* Create an engaging computer game
* Code and decode data to keep it safe on the internet
* Make sense of large quantities of data by creating data visualizations

PLTW is recognized by the College Board as an endorsed provider; PLTW CSP’s offerings are aligned to the AP Curriculum Framework standards and the AP CSP assessment.

**PLTW Digital Electronics** Get real experience in electrical engineering with PLTW Digital Electronics, exploring the engineering behind smartphones, appliances, and other digitally-powered products. Students will learn combinational and sequential logic and use industry circuit design tools, including logic gates, integrated circuits, and programmable logic devices. Students not only learn the scientific principles that make a circuit work, but also dive into circuit design and soldering to create their own devices. For example, students are tasked with designing and implementing a machine that controls the operation of a fixture, such as a garage door or tollbooth. These key skills lay the foundation for students to build electronic products of the future.

**PLTW Environmental Sustainability** Apply engineering skills to take on one of the world’s greatest challenges – environmental sustainability. Among other projects, students investigate and design solutions to solve the desperate need for clean drinking water globally. With hands-on projects and digital simulations, students research and design solutions to these existential challenges.

**PLTW Engineering Design & Development** This course is the capstone experience for PLTW Engineering students. Students have the opportunity to drive their own learning by selecting a problem they want to solve. Students practice the skills core to being a strong engineer by devoting the time, dedication, and ingenuity needed to create a new product that truly meets their user’s needs. Once they select the problem to solve, students research needs, develop the theory of how to create the solution, and use all they have learned in PLTW Engineering to create a product, ultimately presenting their final solution to a panel of engineers. Student projects in prior years have included creating and cloning recombinant DNA, developing an inexpensive mobile video editor, creating a competition-ready underwater submarine, and designing a prosthetic arm for a classmate at a price point that could be covered by standard health insurance.