Hoboken Public Schools

Project Lead The Way Curriculum
Grade 7

Project Lead The Way Grade Seven

HOBOKEN PUBLIC SCHOOLS

Course Description

PLTW Gateway's 9 units **empower students to lead their own discovery**. The hands-on program boosts classroom **engagement** and excitement, drives **collaboration**, and inspires "aha! moments" and deep **comprehension**. And as students engage in PLTW's activities in computer science, engineering, and biomedical science, they see range of paths and possibilities they can look forward to in high school and beyond.

Course Resources

PLTW Materials
Samsung tablets
Chromebooks

Pacing Guide

Unit Titles	Time Frame
Unit 1: Design and Marketing	**3-4 Months**
Unit 2: Energy and the Environment	**3 Months**
Unit 3: Green Architecture	**3-4 Months**

Unit 1 – Design and Modeling

3 – 4 Months

Unit 1
Design and Modeling (DM) provides students opportunities to apply the design process to creatively solve problems. Students are introduced to the unit problem in the first activity and are asked to make connections to the problem throughout the lessons in the unit. Students learn and utilize methods for communicating design ideas through sketches, solid models, and mathematical models. Students will understand how models can be simulated to represent an authentic situation and generate data for further analysis and observations. Students work in teams to identify design requirements, research the topic, and engage stakeholders. Teams design a toy or game for a child with cerebral palsy, fabricate and test it, and make necessary modifications to optimize the design solution

Essential Questions

- How do you think the U.S. should convert to all metric measuring, or should the U.S. stay with using both the Standard and Metric systems? Why?
- How do we use such measurement forms as the hand span, cubit, and pace very often today?
- How are pictorial drawings and how are they used by engineers?
- How is an orthographic drawing and how is it used by engineers?

- How would engineers use three-dimensional (3D) modeling when solving technological problems?
- How do assembly constraints differ from geometric and numeric constraints?
- How is the difference between a model, a mockup and a prototype defined?
- How do annotations serve in an assembly drawing?
- How are teams of people deployed used to solve problems?

Essential Learning Outcomes

- Students will select the appropriate value from a conversion chart to convert between standard and metric units.
- Students will convert between standard and metric measurements including inches, feet, yards, millimeters, centimeters, and meters.
- Students will demonstrate the ability to measure accurately with different devices and scales using both the standard and metric systems.
- Students will explain how to measure in different contexts.
- Students will summarize the reasoning for using sketching as a communication tool.
- Students will Use visualization, spatial reasoning, and geometric shapes to sketch two and three dimensional shapes.
- Students will recognize thumbnail, perspective, isometric, and orthographic sketches.
- Students will recognize one and two point perspective drawings.
- Students will create thumbnail, perspective, isometric, and orthographic sketches.
- Students will accurately interpret one and two point perspective drawings.
- Students will communicate ideas for a design using various sketching methods, notes, and drafting views.
- Students will Dimension an orthographic sketch following the guidelines of dimensioning.
- Students will Describe the coordinate system and how geometric shapes work together to create objects.
- Students will create a three-dimensional (3D) model of an object.
- Students will apply geometric and dimension constraints to design CAD-modeled parts.
- Students will assemble the product using the CAD modeling program.
- Students will demonstrate the ability to produce various annotated working drawings of a 3D model.
- Students will identify the difference between a prototype, a model and a mock-up.
- Students will analyze what circumstances call for the use of a prototype, a model, and a mock-up.
- Students will describe why teams of people are used to solve problems.
- Students will Brainstorm and sketch possible solutions to an existing design problem.
- Students will create a decision-making matrix.
- Students will Use a decision making matrix to select an approach that meets or satisfies the constraints given in a design brief.

Technology Infusion

8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
8.1.8.A.2	Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.

8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results
8.1.8.A.5	Create a database query, sort and create a report and describe the process, and explain the report results.

Standards Addressed

RL.7.1; RL.7.2; RL.7.3; RL.7.4; RL.7.5; RL.7.6; RL.7.7; RL.7.9

W.7.3a-e; W.7.4; W.7.5

Differentiation

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.

Assessments

- Class participation
- Completion of activity sheets
- Discussions demonstrating knowledge of subject matter
- Interactive journal responses
- Responses
- RST with Rubric Evaluation
- Academic Vocabulary

21st Century Learning Connection

"21st century skills" are the skills that today's students will need to be successful in this ever-changing world. The most recognizable of these skills are the 4C's: communication, collaboration, critical thinking and creativity. However, 21st century skills also include social and emotional intelligence, technological literacy and problem solving abilities. These skills emphasize "application of knowledge" and go beyond rote memorization.

Unit 2 Energy and the Environment

3 Months

Unit 2

In the Energy and the Environment Unit (EE), students are challenged to think big and look toward the future as they explore sustainable solutions to our energy needs and investigate the impact of energy on our lives and the world. They design and model alternative energy sources and evaluate options for reducing energy consumption.

Essential Questions

- How is energy defined?
- How is energy useful to us?
- Why is it important for engineers to know and understand the various forms of energy?
- How is the law of conservation explained?
- How is the difference between energy and power defined and how are they measured?
- If energy cannot be created or destroyed, why are we concerned about running out of energy?
- What would be the benefits if humans used more renewable and inexhaustible forms of energy?
- How much difference does replacing a regular light bulb with an energy saving bulb really make?
- How do power plants make electricity?
- Which type of renewable energy is currently most relied on in the United States?
- How do cars run on cow manure?
- How is the difference between alternative energy sources and renewable energy sources explored?
- What is a smart grid and how will it affect our lives in the future?
- How much water does an average household consume in a day?
- How does an individual person make an impact on the environment?
- How much of our trash can be discarded in a more environmentally friendly way?

Essential Learning Outcomes

- Students will describe the differences between, and the advantages and disadvantages of exhaustible, inexhaustible, renewable, and non-renewable energy sources.
- Students will describe the six main forms of energy; including solar or light radiation, thermal, electrical, mechanical, chemical, and nuclear.
- Students will differentiate between potential and kinetic energy.
- Students will Identify global energy uses and explain trends toward future demands.
- Students will demonstrate ways to increase the efficiency of energy used in homes and at school.
- Students will Calculate financial savings and explain effects of our carbon footprint as a result of using energy efficiently.
- Students will Use the design process to design, model, and test a wind turbine for efficiency.
- Calculate power and work by measuring force, distance, and time using the wind turbine model.
- Students will describe the roles and responsibilities of STEM professionals for high demand technological careers.
- Students will Calculate daily water consumption for a building such as a home or school and recommend water conservation strategies.

- Students will identify ways that individuals can reduce the effect on the environment through their energy choices and garbage disposal.
- Students will identify how STEM professionals are involved in integrated waste management and other environmental careers.
- Students will understand the difference between energy conservation and energy efficiency and be able to calculate both.
- Students will differentiate between conduction, convection, and radiation as forms of energy transfer.
- Students will compare the temperature of different materials to determine which are better at preventing heat transfer.
- Students will Design an experiment to investigate the prevention of heat transfer.
- Students will evaluate a design to reduce heat transfer by weighing the amount of ice remaining; propose improvements for the design.

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Unit 3 – Green Architecture

3 Months

Unit 3

In this unit, students will explore the notion that today's students have grown up in an age of "green" choices. In the Green Architecture (GA) unit, students learn how to apply this concept to the fields of architecture and construction by exploring dimensioning, measuring, and architectural sustainability as they design affordable housing units using Autodesk® 123D® Design software.

Essential Questions

- How is the proper way to write units when talking about lengths of an object used in construction described?
- How and why do we sometimes change architectural dimension units to decimal feet?
- How important is it to accurately calculate formulas like area and perimeter in home construction?
- How are residential structures constructed, and what systems are part of a structure.
- How are homes designed to be functional while also being pleasing to the home owner?
- How does term to be "green" important in this unit?
- Where do the products that you recycle end up?
- How does the air you breathe every day affect your health?
- How can you remodel a house to make it more "green"?
- How are houses constructed?

- How is a traditional wall structure assembled?
- How can shipping containers be reused for living or working space?
- How is the environment affected by shipping containers sitting on the dock?

Essential Learning Outcomes

- Students will communicate, using a variety of media, the effects that daily living has on the environment.
- Students will describe the steps of the recycling system.
- Students will List ways to improve indoor air quality.
- Students will Students will Explain the consequences of poor indoor air quality.
- Students will categorize concepts related to building eco-friendly.
- Students will identify the local home styles in the region and outside of the region.
- Students will describe different house styles and how they can be built green.
- Students will provide examples of STEM careers and the need for these professionals in our society.
- Students will demonstrate knowledge of measurement, construction, and design.
- Students will identify the parts of a wall section.
- Students will Measure accurately using a tape measure and architectural scale.
- Students will Read and interpret a blueprint of a floor plan.
- Students will construct a model of the framing of a wall section.
- Students will demonstrate use of the Design Process including a Design Brief, Sketching, and Students will Decision Making Matrix.
- Students will Use Autodesk Revit Architecture to create an architectural drawing.
- Students will Design an environmentally friendly home

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