PLTW Engineering Modules

**Kindergarten:**

 Structure and Function: Exploring Design

Students discover the design process and how engineers influence their lives. They explore the elements of structure and function by identifying products around them designed by engineers and asking questions engineers might ask. They are introduced to a design problem through a story in which Angelina wants to design a paintbrush. Students apply their knowledge from the module to design their own paintbrushes.

Pushes and Pulls

Students investigate pushes and pulls on the motion of an object and develop knowledge and skills related to forces of differing strengths and directions. Their explorations include pushes and pulls found in their everyday world, such as pushing a friend on a swing or pulling a wagon. In this module’s design problem, Suzi needs to move rocks from her yard so she can install a swing set. Students work through the problem by applying what they learn about forces.

**First Grade:**

Light and Sound

Students investigate the properties of light and sound, including vibration from sound waves and the effect of different materials on the path of a beam of light. After students develop an understanding of light and sound, they are challenged to solve a design problem Mylo, Suzi, and Angelina face. In the story, the characters are lost and must use only the materials in their backpack to communicate over a distance by using light and/or sound. Students use the design process to sketch, build, test, and reflect on a device that solves this design problem.

Light: Observing the Sun, Moon, and Stars

After observing the sun, moon, and stars, students identify and describe patterns in their recorded data. Angelina, Mylo, and Suzi introduce the design problem, which challenges students to create a playground structure designed to protect students from ultraviolet radiation. Students utilize their knowledge of light to design, build, and test structures created to solve this problem. Students then evaluate their designs, share their findings, and explore ideas to improve their structures based on the testing data.

Animal Adaptations

Students explore animal adaptations for protection, camouflage, food obtainment, and locomotion. Students learn what it means for an organism to be adapted to its environment and how different adaptations can be categorized. Students are introduced to the design challenge when Suzi announces she is visiting the Sahara and needs to get prepared for her trip. Students are challenged to design the ideal shoe for travelers to wear in extreme environments, applying what they have learned and looking to plant and animal adaptations to guide their designs.

**Second Grade:**

Materials Science: Form and Function

Students research the variety of ways animals disperse seeds and pollinate plants. They expand their understanding of properties of matter as they consider the form and function involved in seed dispersal and pollination. Students are introduced to the design problem when Angelina, Mylo, and Suzi are tasked with starting a wildflower garden on an expansive plot outside of their school. To solve the design problem, students apply their knowledge and skills to design, build, test, and reflect on a device that mimics a way in which animals disperse seeds or pollinate plants.

Materials Science: Properties of Matter

Students investigate and classify different kinds of materials by their observable properties, including color and texture. They learn about states of matter and properties of materials including insulators and conductors. In the design problem, Angelina, Mylo, and Suzi, are challenged to keep ice pops cold during a soccer game – without a cooler. Students apply their knowledge and skills to determine the best material to solve this design problem and then evaluate how their designs might be improved.

**Third Grade:**

Stability and Motion: Science of Flight

In this module, students learn about the forces involved in flight as well as Newton’s Laws of Motion. They design, build, and test an experimental model glider to find out how air and other forces affect its flight. Students discover aeronautics alongside Angelina, Mylo, and Suzi and are inspired by the characters’ desire to use their skills to help those in need. Students apply the design process to the problem of delivering aid to an area where supplies must be airlifted in and dropped to the ground from an aircraft.

Stability and Motion: Forces and Interactions

Students explore simple machines such as wheel and axles, levers, the inclined plane, and more. They investigate the effects of balanced and unbalanced forces on the motion of an object. Angelina, Mylo, and Suzi go on a field trip to the zoo and are faced with the design problem of how to rescue a trapped tiger. Students then apply their knowledge of forces and devise a way to rescue a heavy zoo animal while keeping it safe throughout the process.

**Fourth Grade:**

Energy: Collisions

Students explore the properties of mechanisms and how they change energy by transferring direction, speed, type of movement, and force. Students discover a variety of ways potential energy can be stored and released as kinetic energy. They explain the relationship between the speed of an object and the energy of that object, as well as predict the transfer of energy as a result of a collision between two objects. The design problem is introduced by Angelina, Mylo, and Suzi watching amusement park bumper cars collide. As students solve the problem for this module, they apply their knowledge and skills to develop a vehicle restraint system.

Energy: Conversion

Students identify the conversion of energy between forms and the energy transfer required to move energy from place to place. They also identify and explain how energy can be converted to meet a human need or want. The design problem is introduced through Angelina, Mylo, and Suzi, who need to move donated food from a truck to a food pantry. Students then apply scientific ideas about the conversion of energy to solve this design problem.

**Fifth Grade:**

Infection: Detection

Students explore transmission of infection, agents of disease, and mechanisms the body uses to stay healthy. Through a simulation, they compare communicable and non-communicable diseases. In the design problem, Suzi comes down with a fever and sore throat, and her friends wonder how this illness might have spread across the school. Students tackle the design problem by examining evidence to deduce the agent of infection, the likely source of the outbreak, and the path of transmission through a school. They design and run an experiment related to limiting the spread of germs and apply results to propose appropriate prevention methods.

Infection: Modeling and Simulation

In this module, students investigate models and simulations and discover powerful ideas about computing. The design problem – related to the Infection: Detection module – is introduced as Mylo and Angelina look to model an infectious disease to simulate how an illness spread through their class. Applying their new understandings, students program their own models and collect data by running simulations with different parameters.