Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Science and Technology Education	Course:	PLTW Gateway to Technology (DSF)	Unit 8 Title:	Science of Technology Applied Physics	Grade Level(s):	7-8
Assessed Trimester:	Trimester 2	Pacing:	9 Days	Date Created:	6/16/2014	Last Revision Date:	

Course Understandings: *Students will understand that:*

- In the United States, we use both standard and metric systems of measurement
- Three-dimensional computer modeling uses descriptive geometry, geometric relationships and dimensioning to communicate an idea or solution to a technological problem
- Engineers use a design process to create solutions to existing problems
- Different chemical properties affect invention and innovation in going from concept to production.
- Nanotechnology is an emerging field with many new applications.
- Physics control our world and set constraints for motion and mechanism.
- Various forces affect flight.
- There is a relationship between airfoils and bernoulli's principle.

DESIRED RESULTS (Stage 1) - WHAT WE WANT STUDENT TO KNOW AND BE ABLE TO DO?

Established Goals

Science

Engineering Design

- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (MS.ETS1.1)
- **Standard: 6.1.2.2:** Engineering design is the process of devising products, processes and systems that address a need, capitalize on an opportunity, or solve a specific problem.
  Benchmark:
  6.1.2.2.1: Applying a Design Process- Apply and document an engineering design process that includes identifying criteria and constraints, making representations, testing and evaluation, and refining the design as needed to construct a product or system that solves a problem.
- **Standard: 9.1.3.4:** Science, technology, engineering and mathematics rely on each other to enhance knowledge and understanding.
  Benchmark:
  9.1.3.4.3: Appropriate Representations- Select and use appropriate numeric, symbolic, pictorial, or graphical representation to communicate scientific ideas, procedures and experimental results.
- **Standard: 9.1.2.2:** Engineering design is an analytical and creative process of devising a solution to meet a need or solve a specific problem
  Benchmark:
  9.1.2.2.2: Using Models in Designing - Develop possible solutions to an engineering problem and evaluate them using conceptual, physical and mathematical models to determine the extent to which the solutions meet the design specifications.

Math

- **Ratios and Proportional Relationships**
  Understand ratio concepts and use ratio reasoning to solve problems.
  1. Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes." (6.RP.A.1)
  3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. (6.RP.A.3)
- **Expressions and Equations**
  Apply and extend previous understandings of arithmetic to algebraic expressions.
  2. Write, read, and evaluate expressions in which letters stand for numbers. (6.EE.A.2)

Transfer

Students will be able to independently use their learning to: (product, high order reasoning)

- Build a complex system using multiple simple machines
- Understand that many pieces add to a whole
- Work with a team
- Creatively problem solve
- Communicate ideas from concept to product
- Students will learn & demonstrate 21st Century Skills that include creative problem solving, systems interaction, teamwork, and communication skills.

Meaning

Unit Understanding(s):

Students will understand that:

- Simple machines can make work easier by increasing mechanical advantage.
- Mechanical advantage is the ratio of the force produced by a machine to the force applied to the machine.
- Compound machines are made from a combination of several simple machines.
- Energy cannot be created or destroyed but may be transferred into different types of energy.
- Humans use their energy, along with simple machines, to do work by changing the state of energy of an object from potential to kinetic.
- Prototyping is an important step in the design process and provides the designer with a scaled working model that can be used for testing.

Essential Question(s):

Students will keep considering:

- What is the difference between a simple and compound machine?
- If energy cannot be created or destroyed, why do we need to be concerned about our energy sources?
- What is the relationship between potential energy and kinetic energy?
- How do subsystems interact to create a system?
- Why is the design process used when creating new products?

Acquisition

Knowledge:

- Identify the six simple machines: the lever, pulley, wheel and axle, inclined plane, wedge, and screw.
- Identify a machine as something that helps use energy more efficiently.
- Describe work as the force applied over a distance.
- Explain the applications of the six simple machines.
- Compare and contrast kinetic and potential energy.
- Recognize and demonstrate safety rules for using lab tools and machines.

Reasoning:

- Build, test, and evaluate a model of a design problem.
- Analyze a product through testing methods and make modifications to the product.

Skill:

- Determine mechanical advantage from assembled simple machines.

Common Misunderstandings

- Speed and velocity are the same
- Mass and weight are the same
- Energy is created

Essential Vocabulary

- Applied Physics
- Conservation of Energy
- Energy
- Force
- Friction
- Gravity
- Inclined Plane
- Kinetic Energy
- Lever
- Mechanical Advantage
- Newton's Laws of Motion
- Potential Energy
- Pulley
- Screw
- Simple Machine
- Subsystem
- System
- Torque
- Velocity
- Wedge
- Wheel and Axle
- Work