CKSD Curriculum
Unit Template
STEAM 7/Grade 7
Suggested Length of Unit – __10___ Days
Instructor: Sarah Gates

Lesson A: What is Engineering?

- In this lesson, students will learn about STEM careers and how they impact our world. STEM careers include all occupations that require an education in physical and life sciences, computer science, mathematics, engineering, health professions and social science. Students will keep a PLTW Gateway Notebook that includes a section for their PLTW Gateway Notebook and a section for their portfolio.

Major Academic Standards Addressed

S8.A.1.1.1
Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.

S8.A.1.1.2
Explain how certain questions can be answered through scientific inquiry and/or technological design.

S8.A.1.1.3
Use evidence, such as observations or experimental results, to support inferences about a relationship.

S8.A.1.1.4
Develop descriptions, explanations, predictions, and models using evidence.

S8.A.1.2.1
Describe the positive and negative, intended and unintended, effects of specific scientific results or technological developments (e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants).

S8.A.1.2.2
Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations).

S8.A.1.2.3
Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).

S8.A.1.2.4
Explain society's standard of living in terms of technological advancements and how these advancements impact on agriculture (e.g., transportation, processing, production, storage).

S8.A.2.1.2
Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.

S8.A.2.1.3
Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.

S8.A.2.1.4
Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

S8.A.2.1.5
Use evidence from investigations to clearly communicate and support conclusions.

S8.B.3.2.1
Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

S8.B.3.2.2
Use evidence to explain how diversity affects the ecological integrity of natural systems.

S8.B.3.2.3
Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.

S8.B.3.3.1
Explain how human activities may affect local, regional, and global environments.

S8.B.3.3.2
Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).

S8.B.3.3.3
Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).

Concepts – Content ——**What students should know**

- Science is the study of the natural world, while technology is the study of how humans develop new products to meet needs and wants.
- Teams of people can accomplish more than one individual working alone.
- Technological change is seen through inventions, innovations, and the evolution of technological artifacts, processes and systems.
- Technology can have positive and negative social, cultural, economical, political, and environmental consequences.

Objectives – also called competencies in the SAS

What students should be able to do as a result of the instruction

- Utilize standard procedures to use and maintain an engineering notebook.
- Operate as an effective member of a team to complete an investigation.
- Describe engineering and explain how engineers participate in or contribute to the invention and innovation of products.

Essential Questions – meant to challenge study to ponder, question and query

- Why is it important for an engineer to document their work in an engineering notebook?
- How are our lives impacted by engineers?
- What inventions and innovations do you think are essential to your life?
- How does the use of technology affect the way that you live?

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

- Notebook checks for notes
- Conclusion questions on assignments
- Projects

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

- Independent work – assuring each student is proficient with each skill
- Collaborative work – assuring students understand the importance of working as a unit to complete a large task

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Lesson B – Design Process

- A design process is used to create a solution or solve a problem. A design process has many forms, but is essentially a structured way to create a solution, and it reduces the danger and inefficiency of a simple trial-and-error approach. In this lesson, students will use a design process and associated tools similar to an engineer to create a solution and solve a problem.

Major Academic Standards Addressed

S8.A.1.1.1
Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.

S8.A.1.1.2
Explain how certain questions can be answered through scientific inquiry and/or technological design.

S8.A.1.1.3
Use evidence, such as observations or experimental results, to support inferences about a relationship.

S8.A.1.1.4
Develop descriptions, explanations, predictions, and models using evidence.

S8.A.1.2.1
Describe the positive and negative, intended and unintended, effects of specific scientific results or technological developments (e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants).

S8.A.1.2.2
Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations).

S8.A.1.2.3
Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).

S8.A.1.2.4
Explain society's standard of living in terms of technological advancements and how these advancements impact on agriculture (e.g., transportation, processing, production, storage).

S8.A.2.1.2
Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.

S8.A.2.1.3
Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.

S8.A.2.1.4
Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

S8.A.2.1.5
Use evidence from investigations to clearly communicate and support conclusions.

S8.B.3.2.1
Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

S8.B.3.2.2
Use evidence to explain how diversity affects the ecological integrity of natural systems.

S8.B.3.2.3
Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.

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Explain how human activities may affect local, regional, and global environments.

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Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).

S8.B.3.3.3
Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).

Concepts – Content ——**What students should know**

- Many different design processes are used to guide people in developing solutions problems.
- The design brief is a tool for defining the problem; it is an agreement between the engineer and client.
- Engineers use design briefs to explain the problem, identify solution expectations, and establish project constraints.
- Design teams use brainstorming techniques to generate large numbers of ideas in short amount of time, striving for quantity, not quality.
- A decision matrix is a tool used to compare solution ideas to the criteria so that you can select the best solution.

Objectives – also called competencies in the SAS

What students should be able to do as a result of the instruction

- Describe the design process and how it is used to aid in the problem solving.
- Describe the elements of design.
- Recognize design criteria and constraints.
- Describe the purpose and importance of working in a team.

Essential Questions – meant to challenge study to ponder, question and query

- How is a design process different than how you solve problems in the past?
- Why is brainstorming important when modifying or improving a product?
- Why do people work in teams when solving design problems?

- Why are design elements considered when engineers and designers invent or innovate a product?

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- Notebook checks for notes
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- Projects

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

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Lesson 1: Investigating Energy

- In this lesson students will be given background information on the use and production of energy. Students will consider benefits and drawbacks of each type of energy (fossil fuels, renewable, and inexhaustible) and how it is used. Students will be given the chance to research, design, build, and test a prototype of windmill blades to demonstrate how an inexhaustible resource can be converted to power that can be harnessed as electricity.

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S8.A.1.1.2
Explain how certain questions can be answered through scientific inquiry and/or technological design.

S8.A.1.1.3
Use evidence, such as observations or experimental results, to support inferences about a relationship.

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Develop descriptions, explanations, predictions, and models using evidence.

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Describe the positive and negative, intended and unintended, effects of specific scientific results or technological developments (e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants).

S8.A.1.2.2
Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations).

S8.A.1.2.3
Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).

S8.A.1.2.4
Explain society's standard of living in terms of technological advancements and how these advancements impact on agriculture (e.g., transportation, processing, production, storage).

S8.A.2.1.2
Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.

S8.A.2.1.3
Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.

S8.A.2.1.4
Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

S8.A.2.1.5
Use evidence from investigations to clearly communicate and support conclusions.

S8.B.3.2.1
Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

S8.B.3.2.2
Use evidence to explain how diversity affects the ecological integrity of natural systems.

S8.B.3.2.3
Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.

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S8.B.3.3.2
Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).

S8.B.3.3.3
Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).

Concepts – Content ——**What students should know**

- Two types of energy exist: potential (stored energy) and kinetic (energy in motion).
- Energy sources can renewable, exhaustible, or inexhaustible. There are advantages and disadvantages to each.
- The six main forms of energy include solar or light radiation, thermal, electrical, mechanical, chemical, and nuclear.
- Energy efficiency and conservation are necessary in order to minimize pollution, improve business/economy, reduce dependence on foreign sources, and reduce our carbon footprint to create a sustainable world.
- Energy can be transferred, or moved, from one object to another.
- Energy can be transformed, or changed, from one form to another.
- The second law of thermodynamics states that not all energy is 100% efficient when it is converted from one form to another.
- Work is measured in joules and is defined as force acting over a distance. Power is measured in watts and is defined by how fast work is done.
- Engineers, designers, and engineering technologists are in high demand for the development of future technology to meet societal needs and wants.

Objectives – also called competencies in the SAS

What students should be able to do as a result of the instruction

- After this unit, it is expected that students will...
    - Describe the differences between, and the advantages and disadvantages of exhaustible, inexhaustible, renewable, and nonrenewable energy sources.
    - Describe the 6 main forms of energy, including solar or light radiation, thermal, electrical, mechanical, chemical, and nuclear.
    - Differentiate between potential and kinetic energy.
    - Identify global energy uses and explain trends toward future demands.
    - Demonstrate ways to increase the efficiency of energy used in homes and at school.
    - Calculate the financial savings and explain effects of our carbon footprint as a result of using energy efficiently.
    - 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.
    - Describe the roles and responsibilities of STEM professionals for high-demand technological careers.

Essential Questions – meant to challenge study to ponder, question and query

- *What is energy?*
- What causes an energy crisis?
- What would be the results if humans used only renewable and inexhaustible forms of energy?

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

- Notebook checks for notes
- Conclusion questions on assignments
- Projects

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

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Lesson 2: Sustainable Energy

- Sustainable energy is an important topic to research and develop. Everyone needs to get involved in issues of sustainability, whether it is investing in energy systems that reduce our carbon footprint and our dependence on fossil fuels or recycling and reducing wastes. This unit allows students to explore alternative energy sources and research their advantages, disadvantages, and potential applications.

Major Academic Standards Addressed

S8.A.1.1.1
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S8.A.1.1.2
Explain how certain questions can be answered through scientific inquiry and/or technological design.

S8.A.1.1.3
Use evidence, such as observations or experimental results, to support inferences about a relationship.

S8.A.1.1.4
Develop descriptions, explanations, predictions, and models using evidence.

S8.A.1.2.1
Describe the positive and negative, intended and unintended, effects of specific scientific results or technological developments (e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants).

S8.A.1.2.2
Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations).

S8.A.1.2.3
Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).

S8.A.1.2.4
Explain society's standard of living in terms of technological advancements and how these advancements impact on agriculture (e.g., transportation, processing, production, storage).

S8.A.2.1.2
Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.

S8.A.2.1.3
Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.

S8.A.2.1.4
Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

S8.A.2.1.5
Use evidence from investigations to clearly communicate and support conclusions.

S8.B.3.2.1
Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

S8.B.3.2.2
Use evidence to explain how diversity affects the ecological integrity of natural systems.

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Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.

S8.B.3.3.1
Explain how human activities may affect local, regional, and global environments.

S8.B.3.3.2
Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).

S8.B.3.3.3
Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).

Concepts – Content ——**What students should know**

- There are events and issues that challenge us to use energy wisely and to develop alternate forms of energy, including economic and population growth, natural disasters, and conflicts with countries that provide the US with oil.
- Fossil fuel use and greenhouse gas emissions can be reduced by using innovative means to implement renewable and inexhaustible energy sources.
- Energy sources can be used to produce electricity and hydrogen, energy carriers that provide the greatest diversity and lowest impact on the environment.
- Decisions regarding the implementation of alternative energy sources involve the weighing of tradeoffs between predicted positive and negative effects on the environment and financial burdens.
- Careers in sustainable engineering will be created because our planet needs environmentally sustainable solutions to support population growth and preserve our limited natural resources.

Objectives – also called competencies in the SAS

It is expected that students will:

- Graph data that represent energy consumption, energy imports, and energy production.
- Recognize that alternative energies are not always available in every location.
- Recognize that the solution to our energy needs now and, in the future, will include conservation and wise use of resources as well as a wide variety of sources.
- Describe the roles and responsibilities of STEM careers that help solve environmental problems.
- Identify challenges in transferring alternative energies from where they are produced to where they are consumed.
- Research an alternative energy solution used for a specific purpose that will reduce the nation's dependency on fossil fuels.

Essential Questions – meant to challenge study to ponder, question and query

- *How do we educate the community about the need for sustainable energy sources?*

- If the sun provides 1,000 times the energy we need, why doesn't the US rely more on it?
- What factors are challenging governments to meet energy needs in the future?
- What is a smart grid and how will it affect our lives in the future?

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

- Notebook checks for notes
- Conclusion questions on assignments
- Projects

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

- Independent work – assuring each student is proficient with each skill
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Lesson 3: Making an Impact

- Students will actively explore methods in which to conserve energy consumption through hands on activities and research. They will look at energy consumption in the uses of electricity, water, transportation (fuel), and heating (natural gas).

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Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).

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Explain society's standard of living in terms of technological advancements and how these advancements impact on agriculture (e.g., transportation, processing, production, storage).

S8.A.2.1.2
Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.

S8.A.2.1.3
Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.

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S8.B.3.3.2
Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).

S8.B.3.3.3
Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).

Concepts – Content ——**What students should know**

- Water plays a critical role in our daily lives; it should be used wisely and users should be conscientious about conserving water.
- Environmental engineering focuses on developing a sustainable future, preventing pollution, and assessing the environmental impact of integrated waste management systems.
- The seven steps of integrated waste management include reduce, reuse, recycle, compost, incineration that creates usable energy, landfills, and incineration with no usable energy created.
- Engineers must consider a product's life cycle when designing because every product has an impact on the environment.
- Every individual impacts the environment through the choices they make in energy consumption and garbage disposal.
- Using energy efficiently will reduce the need for new power plants and utility infrastructure and will reduce the need to burn fossil fuels to produce energy, thereby reducing greenhouse gas emissions that contribute to climate change.
- Heat transfer occurs through conduction, convection, and radiation

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Objectives – also called competencies in the SAS

It is expected that students will:

- Calculate daily water consumption for a building such as a home or school and recommend water conservation strategies.
- Identify ways that individuals can reduce the effect on the environment through their energy choices and garbage disposal.
- Identify how STEM professionals are involved in integrated waste management and other environmental careers.
- Understand the difference between energy conservation and energy efficiency and be able to calculate both.
- Differentiate between conduction, convection, and radiation as forms of energy transfer.
- Compare the temperature of different materials to determine which are better at preventing heat transfer.
- Design an experiment to investigate the prevention of heat transfer.
- Evaluate a design to reduce heat transfer by weighing the amount of ice remaining; propose improvements for the design.

Essential Questions – meant to challenge study to ponder, question and query

- *Are we running out of water?*
- How does an individual person make an impact on the environment?
- Is the climate really changing? If the climate were to change, how would it effect you?

Assessments- Assessments should be directly related to the objectives identified for students in this unit.

- Notebook checks for notes
- Conclusion questions on assignments
- Projects

Best Instructional Practice(s): *Describe what you believe are the best instructional approaches you would employ in order to help students obtain proficiency on the standards identified in the unit. Develop this descriptor so that a student could understand the process. This can be a narrative.*

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Concepts – Content ——**What students should know**

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Objectives – also called competencies in the SAS
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Objectives – also called competencies in the SAS
What students should be able to do as a result of the instruction

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Essential Questions – meant to challenge study to ponder, question and query

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Assessments- Assessments should be directly related to the objectives identified for students in this unit.

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CKSD Curriculum
Unit Template
Course/Subject/Grade Level?
Suggested Length of Unit – _____ Days
Instructor:

Unit title and short description

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Major Academic Standards Addressed

Concepts – Content ——**What students should know**

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