Main Criteria: Forward Education
Secondary Criteria: Utah Core Standards
Subjects: Mathematics, Science, Technology Education
Grades: 11, 12, Key Stage 4

Forward Education

Autonomous Electric Vehicles of the Future

Utah Core Standards
Mathematics
Grade **11** - Adopted: **2016**

STANDARD / AREA OF LEARNING	UT.SI.	SECONDARY MATHEMATICS I
OBJECTIVE / STRAND	**SI.MP.**	**MATHEMATICAL PRACTICES (MP)**
INDICATOR / CLUSTER	SI.MP.1.	Make sense of problems and persevere in solving them.
INDICATOR / CLUSTER	SI.MP.2.	Reason abstractly and quantitatively.
INDICATOR / CLUSTER	SI.MP.3.	Construct viable arguments and critique the reasoning of others.
INDICATOR / CLUSTER	SI.MP.4.	Model with mathematics.
INDICATOR / CLUSTER	SI.MP.8.	Look for and express regularity in repeated reasoning.

STANDARD / AREA OF LEARNING	UT.SI.	SECONDARY MATHEMATICS I
OBJECTIVE / STRAND	**SI.A.CED.**	**ALGEBRA—Creating Equations (A.CED)**
INDICATOR / CLUSTER		**Create equations that describe numbers or relationships. Limit these to linear equations and inequalities, and exponential equations. In the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs (Standards A.CED.1–4).**
EXPECTATION / STANDARD	SI.A.CED.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

STANDARD / AREA OF LEARNING	UT.SI.	SECONDARY MATHEMATICS I
OBJECTIVE / STRAND	**SI.A.REI.**	**ALGEBRA—Reasoning With Equations and Inequalities (A.REI)**
INDICATOR / CLUSTER		**Understand solving equations as a process of reasoning and explain the reasoning (Standard A.REI.1). Solve equations and inequalities in one variable (Standard A.REI.3). Solve systems of equations. Build on student experiences graphing and solving systems of linear equations from middle school. Include cases where the two equations describe the same line—yielding infinitely many solutions—and cases where two equations describe parallel lines—yielding no solution; connect to GPE.5, which requires students to prove the slope criteria for parallel lines (Standards A.REI.5–6). Represent and solve equations and inequalities graphically (Standards A.REI.10–12).**

EXPECTATION / STANDARD	SI.A.REI.1.	Explain each step in solving a linear equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. Students will solve exponential equations with logarithms in Secondary Mathematics III.

STANDARD / AREA OF LEARNING	**UT.SI.**	**SECONDARY MATHEMATICS I**
OBJECTIVE / STRAND	**SI.F.IF.**	**FUNCTIONS—Interpreting Linear and Exponential Functions (F.IF)**
INDICATOR / CLUSTER		**Understand the concept of a linear or exponential function and use function notation. Recognize arithmetic and geometric sequences as examples of linear and exponential functions (Standards F.IF.1–3). Interpret linear or exponential functions that arise in applications in terms of a context (Standards F.IF.4–6). Analyze linear or exponential functions using different representations (Standards F.IF.7,9).**
EXPECTATION / STANDARD	**SI.F.IF.7.**	**Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**
INDICATOR	SI.F.IF.7.a.	Graph linear functions and show intercepts.

STANDARD / AREA OF LEARNING	**UT.SI.**	**SECONDARY MATHEMATICS I**
OBJECTIVE / STRAND	**SI.F.LE.**	**FUNCTIONS—Linear and Exponential (F.LE)**
INDICATOR / CLUSTER		**Construct and compare linear and exponential models and solve problems (Standards F.LE.1–3). Interpret expressions for functions in terms of the situation they model. (Standard F.LE.5).**
EXPECTATION / STANDARD	**SI.F.LE.1.**	**Distinguish between situations that can be modeled with linear functions and with exponential functions.**
INDICATOR	SI.F.LE.1.b.	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

STANDARD / AREA OF LEARNING	**UT.SII.**	**SECONDARY MATHEMATICS II**
OBJECTIVE / STRAND	**SII.MP.**	**MATHEMATICAL PRACTICES (MP)**
INDICATOR / CLUSTER	SII.MP.1.	Make sense of problems and persevere in solving them.
INDICATOR / CLUSTER	SII.MP.2.	Reason abstractly and quantitatively.
INDICATOR / CLUSTER	SII.MP.3.	Construct viable arguments and critique the reasoning of others.
INDICATOR / CLUSTER	SII.MP.4.	Model with mathematics.
INDICATOR / CLUSTER	SII.MP.8.	Look for and express regularity in repeated reasoning.

STANDARD / AREA OF LEARNING	**UT.SII.**	**SECONDARY MATHEMATICS II**
OBJECTIVE / STRAND	**SII.A.CED.**	**ALGEBRA—Creating Equations (A.CED)**
INDICATOR / CLUSTER		**Create equations that describe numbers or relationships. Extend work on linear and exponential equations to quadratic equations (Standards A.CED.1–2, 4).**
EXPECTATION / STANDARD	SII.A.CED.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

STANDARD / AREA OF LEARNING	**UT.SII.**	**SECONDARY MATHEMATICS II**
OBJECTIVE / STRAND	**SII.F.IF.**	**FUNCTIONS—Interpret Functions (F.IF)**
INDICATOR / CLUSTER		**Interpret quadratic functions that arise in applications in terms of a context (Standards F.IF.4–6). Analyze functions using different representations (Standards F.IF.7–9).**
EXPECTATION / STANDARD	**SII.F.IF.7.**	**Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**
INDICATOR	SII.F.IF.7.a.	Graph linear and quadratic functions and show intercepts, maxima, and minima.

STANDARD / AREA OF LEARNING	**UT.SIII.**	**SECONDARY MATHEMATICS III**
OBJECTIVE / STRAND	**SIII.MP.**	**MATHEMATICAL PRACTICES (MP)**
INDICATOR / CLUSTER		**The Standards for Mathematical Practice in Secondary Mathematics III describe mathematical habits of mind that teachers should seek to develop in their students. Students become mathematically proficient in engaging with mathematical content and concepts as they learn, experience, and apply these skills and attitudes (Standards MP.1–8).**
EXPECTATION / STANDARD	SIII.MP.1.	Make sense of problems and persevere in solving them.
EXPECTATION / STANDARD	SIII.MP.2.	Reason abstractly and quantitatively
EXPECTATION / STANDARD	SIII.MP.3.	Construct viable arguments and critique the reasoning of others.
EXPECTATION / STANDARD	SIII.MP.4.	Model with mathematics.
EXPECTATION / STANDARD	SIII.MP.8.	Look for and express regularity in repeated reasoning.

STANDARD / AREA OF LEARNING	**UT.SIII.**	**SECONDARY MATHEMATICS III**
OBJECTIVE / STRAND	**SIII.A.CED.**	**ALGEBRA: CREATING EQUATIONS (A.CED)**

INDICATOR / CLUSTER		**Create equations that describe numbers or relationships, using all available types of functions to create such equations (Standards A.CED.1–4).**
EXPECTATION / STANDARD	SIII.A.CED.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
STANDARD / AREA OF LEARNING	**UT.P.**	**PRECALCULUS**
OBJECTIVE / STRAND	**P.MP.**	**MATHEMATICAL PRACTICES (P.MP)**
INDICATOR / CLUSTER	P.MP.1.	Make sense of problems and persevere in solving them.
INDICATOR / CLUSTER	P.MP.2.	Reason abstractly and quantitatively.
INDICATOR / CLUSTER	P.MP.3.	Construct viable arguments and critique the reasoning of others.
INDICATOR / CLUSTER	P.MP.4.	Model with mathematics.
INDICATOR / CLUSTER	P.MP.8.	Look for and express regularity in repeated reasoning.

Utah Core Standards

Mathematics

Grade **12** - Adopted: **2016**

STANDARD / AREA OF LEARNING	**UT.SI.**	**SECONDARY MATHEMATICS I**
OBJECTIVE / STRAND	**SI.MP.**	**MATHEMATICAL PRACTICES (MP)**
INDICATOR / CLUSTER	SI.MP.1.	Make sense of problems and persevere in solving them.
INDICATOR / CLUSTER	SI.MP.2.	Reason abstractly and quantitatively.
INDICATOR / CLUSTER	SI.MP.3.	Construct viable arguments and critique the reasoning of others.
INDICATOR / CLUSTER	SI.MP.4.	Model with mathematics.
INDICATOR / CLUSTER	SI.MP.8.	Look for and express regularity in repeated reasoning.
STANDARD / AREA OF LEARNING	**UT.SI.**	**SECONDARY MATHEMATICS I**

OBJECTIVE / STRAND	**SI.A.CED.**	**ALGEBRA—Creating Equations (A.CED)**
INDICATOR / CLUSTER		**Create equations that describe numbers or relationships. Limit these to linear equations and inequalities, and exponential equations. In the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs (Standards A.CED.1–4).**
EXPECTATION / STANDARD	SI.A.CED.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

STANDARD / AREA OF LEARNING	**UT.SI.**	**SECONDARY MATHEMATICS I**
OBJECTIVE / STRAND	**SI.A.REI.**	**ALGEBRA—Reasoning With Equations and Inequalities (A.REI)**
INDICATOR / CLUSTER		**Understand solving equations as a process of reasoning and explain the reasoning (Standard A.REI.1). Solve equations and inequalities in one variable (Standard A.REI.3). Solve systems of equations. Build on student experiences graphing and solving systems of linear equations from middle school. Include cases where the two equations describe the same line—yielding infinitely many solutions—and cases where two equations describe parallel lines—yielding no solution; connect to GPE.5, which requires students to prove the slope criteria for parallel lines (Standards A.REI.5–6). Represent and solve equations and inequalities graphically (Standards A.REI.10–12).**
EXPECTATION / STANDARD	SI.A.REI.1.	Explain each step in solving a linear equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. Students will solve exponential equations with logarithms in Secondary Mathematics III.

STANDARD / AREA OF LEARNING	**UT.SI.**	**SECONDARY MATHEMATICS I**
OBJECTIVE / STRAND	**SI.F.IF.**	**FUNCTIONS—Interpreting Linear and Exponential Functions (F.IF)**
INDICATOR / CLUSTER		**Understand the concept of a linear or exponential function and use function notation. Recognize arithmetic and geometric sequences as examples of linear and exponential functions (Standards F.IF.1–3). Interpret linear or exponential functions that arise in applications in terms of a context (Standards F.IF.4–6). Analyze linear or exponential functions using different representations (Standards F.IF.7,9).**
EXPECTATION / STANDARD	**SI.F.IF.7.**	**Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**
INDICATOR	SI.F.IF.7.a.	Graph linear functions and show intercepts.

STANDARD / AREA OF LEARNING	**UT.SI.**	**SECONDARY MATHEMATICS I**
OBJECTIVE / STRAND	**SI.F.LE.**	**FUNCTIONS—Linear and Exponential (F.LE)**
INDICATOR / CLUSTER		**Construct and compare linear and exponential models and solve problems (Standards F.LE.1–3). Interpret expressions for functions in terms of the situation they model. (Standard F.LE.5).**
EXPECTATION / STANDARD	**SI.F.LE.1.**	**Distinguish between situations that can be modeled with linear functions and with exponential functions.**
INDICATOR	SI.F.LE.1.b.	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

STANDARD / AREA OF LEARNING	**UT.SII.**	**SECONDARY MATHEMATICS II**

OBJECTIVE / STRAND	**SII.MP.**	**MATHEMATICAL PRACTICES (MP)**
INDICATOR / CLUSTER	SII.MP.1.	Make sense of problems and persevere in solving them.
INDICATOR / CLUSTER	SII.MP.2.	Reason abstractly and quantitatively.
INDICATOR / CLUSTER	SII.MP.3.	Construct viable arguments and critique the reasoning of others.
INDICATOR / CLUSTER	SII.MP.4.	Model with mathematics.
INDICATOR / CLUSTER	SII.MP.8.	Look for and express regularity in repeated reasoning.

STANDARD / AREA OF LEARNING	**UT.SII.**	**SECONDARY MATHEMATICS II**
OBJECTIVE / STRAND	**SII.A.CED.**	**ALGEBRA—Creating Equations (A.CED)**
INDICATOR / CLUSTER		**Create equations that describe numbers or relationships. Extend work on linear and exponential equations to quadratic equations (Standards A.CED.1–2, 4).**
EXPECTATION / STANDARD	SII.A.CED.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

STANDARD / AREA OF LEARNING	**UT.SII.**	**SECONDARY MATHEMATICS II**
OBJECTIVE / STRAND	**SII.F.IF.**	**FUNCTIONS—Interpret Functions (F.IF)**
INDICATOR / CLUSTER		**Interpret quadratic functions that arise in applications in terms of a context (Standards F.IF.4–6). Analyze functions using different representations (Standards F.IF.7–9).**
EXPECTATION / STANDARD	**SII.F.IF.7.**	**Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.**
INDICATOR	SII.F.IF.7.a.	Graph linear and quadratic functions and show intercepts, maxima, and minima.

STANDARD / AREA OF LEARNING	**UT.SIII.**	**SECONDARY MATHEMATICS III**
OBJECTIVE / STRAND	**SIII.MP.**	**MATHEMATICAL PRACTICES (MP)**
INDICATOR / CLUSTER		**The Standards for Mathematical Practice in Secondary Mathematics III describe mathematical habits of mind that teachers should seek to develop in their students. Students become mathematically proficient in engaging with mathematical content and concepts as they learn, experience, and apply these skills and attitudes (Standards MP.1–8).**
EXPECTATION / STANDARD	SIII.MP.1.	Make sense of problems and persevere in solving them.

EXPECTATION / STANDARD	SIII.MP.2.	Reason abstractly and quantitatively
EXPECTATION / STANDARD	SIII.MP.3.	Construct viable arguments and critique the reasoning of others.
EXPECTATION / STANDARD	SIII.MP.4.	Model with mathematics.
EXPECTATION / STANDARD	SIII.MP.8.	Look for and express regularity in repeated reasoning.

STANDARD / AREA OF LEARNING	**UT.SIII.**	**SECONDARY MATHEMATICS III**
OBJECTIVE / STRAND	**SIII.A.CED.**	**ALGEBRA: CREATING EQUATIONS (A.CED)**
INDICATOR / CLUSTER		**Create equations that describe numbers or relationships, using all available types of functions to create such equations (Standards A.CED.1–4).**
EXPECTATION / STANDARD	SIII.A.CED.2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

STANDARD / AREA OF LEARNING	**UT.P.**	**PRECALCULUS**
OBJECTIVE / STRAND	**P.MP.**	**MATHEMATICAL PRACTICES (P.MP)**
INDICATOR / CLUSTER	P.MP.1.	Make sense of problems and persevere in solving them.
INDICATOR / CLUSTER	P.MP.2.	Reason abstractly and quantitatively.
INDICATOR / CLUSTER	P.MP.3.	Construct viable arguments and critique the reasoning of others.
INDICATOR / CLUSTER	P.MP.4.	Model with mathematics.
INDICATOR / CLUSTER	P.MP.8.	Look for and express regularity in repeated reasoning.

Utah Core Standards

Science

Grade **11** - Adopted: **2019**

STANDARD / AREA OF LEARNING		**SEEd - Biology (2019)**
OBJECTIVE / STRAND	**Strand BIO.1:**	**INTERACTIONS WITH ORGANISMS AND THE ENVIRONMENT**

INDICATOR / CLUSTER		**The cycling of matter and flow of energy are part of a complex system of interactions within an ecosystem. Through these interactions, an ecosystem can sustain relatively stable numbers and types of organisms. A stable ecosystem is capable of recovering from moderate biological and physical changes. Extreme changes may have significant impact on an ecosystem's carrying capacity and biodiversity, altering the ecosystem. Human activities can lead to significant impacts on an ecosystem.**
EXPECTATION / STANDARD	Standard BIO.1.5.	Design a solution that reduces the impact caused by human activities on the environment and biodiversity. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Examples of human activities could include building dams, pollution, deforestation, or introduction of invasive species. (LS2.C, LS4.D, ETS1.A, ETS1.B, ETS1.C)
STANDARD / AREA OF LEARNING		**SEEd - Chemistry (2019)**
OBJECTIVE / STRAND	**Strand CHEM.3:**	**STABILITY AND CHANGE IN CHEMICAL SYSTEMS**
INDICATOR / CLUSTER		**Conservation of matter describes the cycling of matter and the use of resources. In both chemical and physical changes, the total number of each type of atom is conserved. When substances are combined, they may interact with each other to form a solution. The proportion of substances in a solution can be represented with concentration. In a chemical change, the atoms are rearranged by breaking and forming bonds to create different molecules, which may have different properties. Chemical processes can be understood in terms of the collisions of molecules and the rearrangements of atoms. The rate at which chemical processes occur can be modified. In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. Chemists can control and design chemical systems to create desirable results, although sometimes there are also unintended consequences.**
EXPECTATION / STANDARD	Standard CHEM.3.8.	Obtain, evaluate, and communicate information regarding the effects of designed chemicals in a complex real-world system. Emphasize the role of chemistry in solving problems, while acknowledging unintended consequences. Examples could include ozone depletion and restoration, DDT, development of medicines, the preservation of historical artifacts, or use of bisphenol-A in plastic manufacturing. (PS1.A)
STANDARD / AREA OF LEARNING		**SEEd - Chemistry (2019)**
OBJECTIVE / STRAND	**Strand CHEM.4:**	**ENERGY IN CHEMICAL SYSTEMS**
INDICATOR / CLUSTER		**A system's total energy is conserved as energy is continually transferred from one particle to another and between its various possible forms. The energy of a system depends on the motion and interactions of matter and radiation within that system. When bonds are formed between atoms, energy is released. Energy must be provided when bonds are broken. When electromagnetic radiation with longer wavelengths is absorbed by matter, it is generally converted into thermal energy or heat. When visible light is absorbed by matter, it results in phenomena related to color. When shorter wavelength electromagnetic radiation is absorbed by matter, it can ionize atoms and cause damage to living cells. Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve the release or absorption of large amounts of energy. Society's demand for energy requires thinking creatively about ways to provide energy that don't deplete limited resources or produce harmful emissions.**
EXPECTATION / STANDARD	Standard CHEM.4.1.	Construct an argument from evidence about whether a simple chemical reaction absorbs or releases energy. Emphasize that the overall change in energy is related to the energy absorbed when bonds are broken and the energy released when bonds are formed. Examples could include chemical reactions releasing or absorbing energy to or from the surrounding solution or the metabolism of glucose. (PS1.B, PS3.B)
EXPECTATION / STANDARD	Standard CHEM.4.3.	Design a device that converts energy from one form into another to solve a problem. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Emphasize chemical potential energy as a type of stored energy. Examples of sources of chemical potential energy could include oxidation-reduction or combustion reactions. (PS3.B, ETS1.A, ETS1.B, ETS1.C)
EXPECTATION / STANDARD	Standard CHEM.4.5.	Develop an argument from evidence to evaluate a proposed solution to societal energy demands based on prioritized criteria and trade-offs that account for a range of constraints that could include cost, safety, reliability, as well as possible social, cultural, and environmental impacts. (PS3.D, ETS1.A, ETS1.B, ETS1.C)

STANDARD / AREA OF LEARNING		**SEEd - Earth and Space Science (2019)**
OBJECTIVE / STRAND	**Strand ESS.3:**	**SYSTEM INTERACTIONS: ATMOSPHERE, HYDROSPHERE, AND GEOSPHERE**
INDICATOR / CLUSTER		**The abundance of liquid water on Earth's surface and its unique properties are central to the planet's dynamics and system interactions. The foundation for Earth's global weather and climate systems is electromagnetic radiation from the Sun. The ocean exerts a major influence on weather and climate by absorbing energy from the Sun, releasing it over time, and globally redistributing it through ocean currents. Changes in the atmosphere due to human activity increase carbon dioxide concentrations and thus affect climate. Current scientific models predict that future average global temperatures will continue to rise, although regional climate changes will be complex and varied.**
EXPECTATION / STANDARD	Standard ESS.3.3.	Construct an explanation for how energy from the Sun drives atmospheric processes and how atmospheric currents transport matter and transfer energy. Emphasize how energy from the Sun is reflected, absorbed, or scattered; how the greenhouse effect contributes to atmospheric energy; and how uneven heating of Earth's atmosphere combined with the Coriolis effect creates an atmospheric circulation system. (PS3.A, ESS1.B, ESS2.A, ESS2.D)
EXPECTATION / STANDARD	Standard ESS.3.5.	Develop and use a quantitative model to describe the cycling of carbon among Earth's systems. Emphasize each of Earth's systems (hydrosphere, atmosphere, geosphere, and biosphere) and how the movement of carbon from one system to another can result in changes to the system(s). Examples could include more carbon absorbed in the oceans leading to ocean acidification or more carbon present in the atmosphere leading to a stronger greenhouse effect. (LS2.B, ESS2.D, ESS3.D)

STANDARD / AREA OF LEARNING		**SEEd - Earth and Space Science (2019)**
OBJECTIVE / STRAND	**Strand ESS.4:**	**STABILITY AND CHANGE IN NATURAL RESOURCES**
INDICATOR / CLUSTER		**Humans depend on Earth's systems for many different resources, including air, water, minerals, metals, and energy. Resource availability has guided the development of human society and is constantly changing due to societal needs. Natural hazards and other geologic events have shaped the course of human history. The sustainability of human societies, and the biodiversity that supports them, requires responsible management of natural resources. Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that reduce ecosystem degradation. They also evaluate solutions to resolve complex global and localized problems that contain inherent social, cultural, and environmental impacts in an effort to improve the quality of life for all.**
EXPECTATION / STANDARD	Standard ESS.4.1.	Construct an explanation for how the availability of natural resources, the occurrence of natural hazards, and changes in climate affect human activity. Examples of natural resources could include access to fresh water, clean air, or regions of fertile soils. Examples of factors that affect human activity could include that rising sea levels cause humans to move farther from the coast or that humans build railroads to transport mineral resources from one location to another. (ESS3.A, ESS3.B)
EXPECTATION / STANDARD	Standard ESS.4.2.	Use computational thinking to explain the relationships between the sustainability of natural resources and biodiversity within Earth systems. Emphasize the importance of responsible stewardship of Earth's resources. Examples of factors related to sustainability could include costs of resource extraction, per-capita consumption, waste management, agricultural efficiency, or levels of conservation. Examples of natural resources could include minerals, water, or energy resources. (ESS3.A)
EXPECTATION / STANDARD	Standard ESS.4.3.	Evaluate design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios on large and small scales. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Emphasize the conservation, recycling, and reuse of resources where possible and minimizing impact where it is not possible. Examples of large-scale solutions could include developing best practices for agricultural soil use or mining and production of conventional, unconventional, or renewable energy resources. Examples of small-scale solutions could include mulching lawn clippings or adding biomass to gardens. (ESS3.A, ETS1.A, ETS1.B, ETS1.C)

EXPECTATION / STANDARD	Standard ESS.4.4.	Evaluate design solutions for a major global or local environmental problem based on one of Earth's systems. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Examples of major global or local problems could include water pollution or availability, air pollution, deforestation, or energy production. (ESS3.C, ETS1.A, ETS1.B, ETS1.C)

STANDARD / AREA OF LEARNING		**SEEd - Physics (2019)**
OBJECTIVE / STRAND	**Strand PHYS.2:**	**ENERGY**
INDICATOR / CLUSTER		**Energy describes the motion and interactions of matter and radiation within a system. Energy is a quantifiable property that is conserved in isolated systems and in the universe as a whole. At the macroscopic scale, energy manifests itself in multiple ways such as in motion, sound, light, and thermal energy. Uncontrolled systems always evolve toward more stable states— that is, toward more uniform energy distribution. Examining the world through an energy lens allows us to model and predict complex interactions of multiple objects within a system and address societal needs.**

EXPECTATION / STANDARD	Standard PHYS.2.4.	Design a solution by constructing a device that converts one form of energy into another form of energy to solve a complex real-life problem. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Examples of energy transformation could include electrical energy to mechanical energy, mechanical energy to electrical energy, or electromagnetic radiation to thermal energy. (PS3.A, PS3.B, ETS1.A, ETS1.B, ETS1.C)

EXPECTATION / STANDARD	Standard PHYS.2.5.	Design a solution to a major global problem that accounts for societal energy needs and wants. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Emphasize problems that require the application of conservation of energy principles through energy transfers and transformations. Examples of devices could include one that uses renewable energy resources to perform functions currently performed by nonrenewable fuels or ones that are more energy efficient to conserve energy. (PS3.A, PS3.B, PS3.D, ETS1.A, ETS1.B, ETS1.C)

STANDARD / AREA OF LEARNING		**SEEd - Physics (2019)**
OBJECTIVE / STRAND	**Strand PHYS.4:**	**WAVES**
INDICATOR / CLUSTER		**Waves transfer energy through oscillations of fields or matter. The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it passes. Waves produce interference as they overlap but they emerge unaffected by each other. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. Electromagnetic radiation can be modeled as a wave of changing electric and magnetic fields or as particles called photons. When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy. Because waves depend upon the properties of fields and the predictable transformation of energy, they can be used to interpret the nature of matter and its energy. Waves are utilized to transmit information both in analog and digital forms.**

EXPECTATION / STANDARD	Standard PHYS.4.4.	Ask questions and construct an explanation about the stability of digital transmission and storage of information and their impacts on society. Emphasize the stability of digital signals and the discrete nature of information transmission. Examples of stability and instability could include that digital information can be stored in computer memory, is transferred easily, copied and shared rapidly can be easily deleted, has limited fidelity based on sampling rates, or is vulnerable to security breaches and theft. (PS4.A)

Grade **11** - Adopted: **2013**

STANDARD / AREA OF LEARNING		**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Key Ideas and Details**
INDICATOR / CLUSTER	RST.11-12.2.	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

INDICATOR / CLUSTER	RST.11-12.3.	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
STANDARD / AREA OF LEARNING		**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Craft and Structure**
INDICATOR / CLUSTER	RST.11-12.4.	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
INDICATOR / CLUSTER	RST.11-12.5.	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
INDICATOR / CLUSTER	RST.11-12.6.	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
STANDARD / AREA OF LEARNING		**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Integration of Knowledge and Ideas**
INDICATOR / CLUSTER	RST.11-12.9.	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
STANDARD / AREA OF LEARNING		**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Range of Reading and Level of Text Complexity**
INDICATOR / CLUSTER	RST.11-12.10.	By the end of grade 12, read and comprehend science/technical texts in the grades 11-12 text complexity band independently and proficiently.
STANDARD / AREA OF LEARNING		**Writing Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Text Types and Purposes**
INDICATOR / CLUSTER	**WHST.11-12.2.**	**Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.**
EXPECTATION / STANDARD	WHST.11-12.2(d)	Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
STANDARD / AREA OF LEARNING		**Writing Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Production and Distribution of Writing**
INDICATOR / CLUSTER	WHST.11-12.4.	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

INDICATOR / CLUSTER	WHST.11-12.6.	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Grade **11** - Adopted: **2022**

STANDARD / AREA OF LEARNING		**SEEd – Environmental Science (2022)**
OBJECTIVE / STRAND	**ENVS.2.**	**AVAILABILITY AND USE OF NATURAL ENERGY**
INDICATOR / CLUSTER		**Energy sources are necessary for human society. Sources of energy can either be renewable or nonrenewable and have varying levels of quantity and proportion. Energy sources originate and are consumed differently. Energy plans provide a way to measure and calculate need and energy consumption in a sustainable way.**
EXPECTATION / STANDARD	ENVS.2.1.	Construct an argument based on evidence about the risks and benefits caused by using renewable and nonrenewable energy sources. Examples of risks and benefits could include environmental, social, or economic factors.
EXPECTATION / STANDARD	ENVS.2.2.	Analyze and interpret data to communicate information on the origins, quantity/proportion, and consumption of renewable and nonrenewable energy sources. Examples of renewable energy sources could include wind, solar, geothermal, biofuel, or tidal. Examples of non-renewable energy sources could include fossil fuels and nuclear energy.
EXPECTATION / STANDARD	ENVS.2.3.	Design a solution in the form of a sustainable energy plan for your city, town, county or region of the state. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize the solution. Emphasize basing the plan on scientific principles and on the sustainability potential of renewable and nonrenewable energy resources.

STANDARD / AREA OF LEARNING		**SEEd – Environmental Science (2022)**
OBJECTIVE / STRAND	**ENVS.3.**	**AVAILABILITY, USE, AND MANAGEMENT OF NATURAL RESOURCES**
INDICATOR / CLUSTER		**Natural resources are necessary for human society. How humans obtain and use resources have an impact on their quality/quantity of the resource and their surrounding environment. Resource location, quantity, and proportion may be dependent on environmental factors. Governments and organizations manage the use and effect of natural resources. Resource management plans provide a way to measure and sustain resources for long-term use and effects.**
EXPECTATION / STANDARD	ENVS.3.1.	Construct an argument based on evidence for the effects humans have by obtaining and using natural resources. Emphasize the uses and importance of resources and potential impacts of obtaining them. Examples of human activities to obtain resources could include agriculture, ranching, mining, forestry, fishing, water use, or desalination.

STANDARD / AREA OF LEARNING		**SEEd – Environmental Science (2022)**
OBJECTIVE / STRAND	**ENVS.4.**	**SUSTAINABILITY AND HUMAN IMPACTS BOTH LOCAL AND GLOBAL**
INDICATOR / CLUSTER		**Human use of natural and energy resources has an effect on the environment. Population growth generally requires an increased use of these resources and has an increased effect. Humans have found solutions to some of these effects. There is a relationship between the quality of life and human impact on the environment. Some human impacts can have lasting effects on environments around the world and adjusting practices can reduce and reverse the effects. Global climate change is occurring and has an effect on both human populations and environments. Sustainability plans help individuals, cities, or regions reduce their impact on environments.**

EXPECTATION / STANDARD	ENVS.4.3.	Obtain, evaluate, and communicate information for how humans cause an impact on the environment and how individuals, state and local management plans, and government legislation have identified and adjusted practice to reduce and/or reverse these impacts. Emphasize the process and time necessary to pass Examples of impact could include water and air pollution, climate change, ozone depletion, deforestation, ocean acidification, or urbanization. Examples of adjusted practice could include the reduction of fossil fuel use, criminalization of dumping waste, or outlawing the use of chlorofluorocarbons.
EXPECTATION / STANDARD	ENVS.4.4.	Analyze and interpret data to construct an explanation based on evidence for the causes and impacts of global climate change on human populations and environments. Examples of evidence could include ice cores, ocean acidification, glacier retreat, atmospheric CO2 levels, or air and ocean temperature.
EXPECTATION / STANDARD	ENVS.4.5.	Design and defend a solution in the form of a sustainability plan to reduce individual, city, or regional contribution (causes) to environmental impacts. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize the solution. Emphasize how market forces and societal demands influence personal choices.

Grade **11** - Adopted: **2023**

STANDARD / AREA OF LEARNING		**SEEd – Meteorology (2023)**
OBJECTIVE / STRAND	**METR.1.**	**STRUCTURE AND FUNCTION OF EARTH'S ATMOSPHERE**
INDICATOR / CLUSTER		**The atmosphere has different layers and composition which can be identified from its properties. Observable changes in solar radiation affect both the atmosphere and the surface of Earth.**
EXPECTATION / STANDARD	METR.1.3.	Obtain, evaluate, and communicate what happens to solar radiation (energy) as it moves through the atmosphere and interacts with Earth's surface (matter). Emphasize the role of the greenhouse effect on supporting life.

STANDARD / AREA OF LEARNING		**SEEd – Meteorology (2023)**
OBJECTIVE / STRAND	**METR.3.**	**SYSTEM INTERACTIONS BETWEEN SOCIETY, EARTH'S CLIMATES, AND WEATHER**
INDICATOR / CLUSTER		**Various climate systems are present across the world with a variety of characteristics and conditions. Weather, climate, and society interact and affect each other. Climate change is defined as any systematic change in the long-term statistics of climate elements (such as temperature, pressure, or winds) sustained over several decades or longer. Climate change can have a variety of causes and effects. Technology and regulation can aid in minimizing property damage, preserving life, and reducing the impacts of climate change.**
EXPECTATION / STANDARD	METR.3.4.	Plan and carry out an investigation to determine the natural and human caused factors that produce changes in global climate. Emphasize Milankovitch and ENSO cycles, role of greenhouse gases, and changes in physical geography.
EXPECTATION / STANDARD	METR.3.5.	Evaluate proposed designed solutions intended to minimize property damage and preserve life by reducing the impacts (effect) of climate change and hazardous weather. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution.

Grade **11** - Adopted: **2022**

STANDARD / AREA OF LEARNING		**SEEd – Wildlife Biology (2022)**
OBJECTIVE / STRAND	**WILD.4.**	**HUMAN IMPACT AND WILDLIFE MANAGEMENT**

INDICATOR / CLUSTER		**Human activities have an effect on ecological systems and wildlife. Humans have found some solutions to minimize or reduce the effects of their actions. Species go extinct for specific reasons and their extinction may have an impact on their environment. Humans identify and protect endangered species to limit the effects of this extinction. Ecological collapse can occur if significant changes to the environment occur. Wildlife management plans are created and executed to support a wildlife habitat and/or specific species.**
EXPECTATION / STANDARD	WILD.4.3.	Analyze and interpret data to explain the causes and effects of ecological collapse. Emphasize investigating specific examples of this happening on Earth.

STANDARD / AREA OF LEARNING		**SEEd – Zoology (2022)**
OBJECTIVE / STRAND	**ZOOL.1.**	**STRUCTURES, FUNCTIONS, AND PROCESSES IN ANIMALS**
INDICATOR / CLUSTER		**Animals share common life functions necessary for survival. They also have similar yet diverse structures that they use to fulfil these life functions. Some animals have a unique life cycle. Animals depend upon their environment for survival.**
EXPECTATION / STANDARD	ZOOL.1.1.	Obtain, evaluate, and communicate information to explain the life functions shared by most animals. Emphasize that most animals depend on and perform these functions in different ways. Examples of life functions could include the need to feed, respire, circulate, excrete, move, respond, or reproduce.

STANDARD / AREA OF LEARNING		**SEEd – Zoology (2022)**
OBJECTIVE / STRAND	**ZOOL.3.**	**HUMAN AND ANIMAL INTERACTIONS**
INDICATOR / CLUSTER		**Animal structures are used for different purposes by humans. Human activities may have an impact on natural habitats and populations of animals. Humans can also create management plans and legislation that can reduce or reverse the impacts humans have on animals in the wild. Management plans can be used to control invasive species and conserve native animal species.**
EXPECTATION / STANDARD	ZOOL.3.2.	Ask questions and define problems to identify the cause and effect of human activities on natural habitats and populations of animals. Emphasize how individuals, state, and local management plans, and government legislation have identified and adjusted practice to reduce and/or reverse these impacts. Examples of human activities could include habitat destruction, overharvesting, water consumption, or pollution.

Utah Core Standards

Science

Grade **12** - Adopted: **2019**

STANDARD / AREA OF LEARNING		**SEEd - Biology (2019)**
OBJECTIVE / STRAND	**Strand BIO.1:**	**INTERACTIONS WITH ORGANISMS AND THE ENVIRONMENT**
INDICATOR / CLUSTER		**The cycling of matter and flow of energy are part of a complex system of interactions within an ecosystem. Through these interactions, an ecosystem can sustain relatively stable numbers and types of organisms. A stable ecosystem is capable of recovering from moderate biological and physical changes. Extreme changes may have significant impact on an ecosystem's carrying capacity and biodiversity, altering the ecosystem. Human activities can lead to significant impacts on an ecosystem.**
EXPECTATION / STANDARD	Standard BIO.1.5.	Design a solution that reduces the impact caused by human activities on the environment and biodiversity. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Examples of human activities could include building dams, pollution, deforestation, or introduction of invasive species. (LS2.C, LS4.D, ETS1.A, ETS1.B, ETS1.C)

STANDARD / AREA OF LEARNING		**SEEd - Chemistry (2019)**

OBJECTIVE / STRAND	**Strand CHEM.3:**	**STABILITY AND CHANGE IN CHEMICAL SYSTEMS**
INDICATOR / CLUSTER		**Conservation of matter describes the cycling of matter and the use of resources. In both chemical and physical changes, the total number of each type of atom is conserved. When substances are combined, they may interact with each other to form a solution. The proportion of substances in a solution can be represented with concentration. In a chemical change, the atoms are rearranged by breaking and forming bonds to create different molecules, which may have different properties. Chemical processes can be understood in terms of the collisions of molecules and the rearrangements of atoms. The rate at which chemical processes occur can be modified. In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. Chemists can control and design chemical systems to create desirable results, although sometimes there are also unintended consequences.**
EXPECTATION / STANDARD	Standard CHEM.3.8.	Obtain, evaluate, and communicate information regarding the effects of designed chemicals in a complex real-world system. Emphasize the role of chemistry in solving problems, while acknowledging unintended consequences. Examples could include ozone depletion and restoration, DDT, development of medicines, the preservation of historical artifacts, or use of bisphenol-A in plastic manufacturing. (PS1.A)
STANDARD / AREA OF LEARNING		**SEEd - Chemistry (2019)**
OBJECTIVE / STRAND	**Strand CHEM.4:**	**ENERGY IN CHEMICAL SYSTEMS**
INDICATOR / CLUSTER		**A system's total energy is conserved as energy is continually transferred from one particle to another and between its various possible forms. The energy of a system depends on the motion and interactions of matter and radiation within that system. When bonds are formed between atoms, energy is released. Energy must be provided when bonds are broken. When electromagnetic radiation with longer wavelengths is absorbed by matter, it is generally converted into thermal energy or heat. When visible light is absorbed by matter, it results in phenomena related to color. When shorter wavelength electromagnetic radiation is absorbed by matter, it can ionize atoms and cause damage to living cells. Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve the release or absorption of large amounts of energy. Society's demand for energy requires thinking creatively about ways to provide energy that don't deplete limited resources or produce harmful emissions.**
EXPECTATION / STANDARD	Standard CHEM.4.1.	Construct an argument from evidence about whether a simple chemical reaction absorbs or releases energy. Emphasize that the overall change in energy is related to the energy absorbed when bonds are broken and the energy released when bonds are formed. Examples could include chemical reactions releasing or absorbing energy to or from the surrounding solution or the metabolism of glucose. (PS1.B, PS3.B)
EXPECTATION / STANDARD	Standard CHEM.4.3.	Design a device that converts energy from one form into another to solve a problem. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Emphasize chemical potential energy as a type of stored energy. Examples of sources of chemical potential energy could include oxidation-reduction or combustion reactions. (PS3.B, ETS1.A, ETS1.B, ETS1.C)
EXPECTATION / STANDARD	Standard CHEM.4.5.	Develop an argument from evidence to evaluate a proposed solution to societal energy demands based on prioritized criteria and trade-offs that account for a range of constraints that could include cost, safety, reliability, as well as possible social, cultural, and environmental impacts. (PS3.D, ETS1.A, ETS1.B, ETS1.C)
STANDARD / AREA OF LEARNING		**SEEd - Earth and Space Science (2019)**
OBJECTIVE / STRAND	**Strand ESS.3:**	**SYSTEM INTERACTIONS: ATMOSPHERE, HYDROSPHERE, AND GEOSPHERE**
INDICATOR / CLUSTER		**The abundance of liquid water on Earth's surface and its unique properties are central to the planet's dynamics and system interactions. The foundation for Earth's global weather and climate systems is electromagnetic radiation from the Sun. The ocean exerts a major influence on weather and climate by absorbing energy from the Sun, releasing it over time, and globally redistributing it through ocean currents. Changes in the atmosphere due to human activity increase carbon dioxide concentrations and thus affect climate. Current scientific models predict that future average global temperatures will continue to rise, although regional climate changes will be complex and varied.**

EXPECTATION / STANDARD	Standard ESS.3.3.	Construct an explanation for how energy from the Sun drives atmospheric processes and how atmospheric currents transport matter and transfer energy. Emphasize how energy from the Sun is reflected, absorbed, or scattered; how the greenhouse effect contributes to atmospheric energy; and how uneven heating of Earth's atmosphere combined with the Coriolis effect creates an atmospheric circulation system. (PS3.A, ESS1.B, ESS2.A, ESS2.D)
EXPECTATION / STANDARD	Standard ESS.3.5.	Develop and use a quantitative model to describe the cycling of carbon among Earth's systems. Emphasize each of Earth's systems (hydrosphere, atmosphere, geosphere, and biosphere) and how the movement of carbon from one system to another can result in changes to the system(s). Examples could include more carbon absorbed in the oceans leading to ocean acidification or more carbon present in the atmosphere leading to a stronger greenhouse effect. (LS2.B, ESS2.D, ESS3.D)
STANDARD / AREA OF LEARNING		**SEEd - Earth and Space Science (2019)**
OBJECTIVE / STRAND	**Strand ESS.4:**	**STABILITY AND CHANGE IN NATURAL RESOURCES**
INDICATOR / CLUSTER		**Humans depend on Earth's systems for many different resources, including air, water, minerals, metals, and energy. Resource availability has guided the development of human society and is constantly changing due to societal needs. Natural hazards and other geologic events have shaped the course of human history. The sustainability of human societies, and the biodiversity that supports them, requires responsible management of natural resources. Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that reduce ecosystem degradation. They also evaluate solutions to resolve complex global and localized problems that contain inherent social, cultural, and environmental impacts in an effort to improve the quality of life for all.**
EXPECTATION / STANDARD	Standard ESS.4.1.	Construct an explanation for how the availability of natural resources, the occurrence of natural hazards, and changes in climate affect human activity. Examples of natural resources could include access to fresh water, clean air, or regions of fertile soils. Examples of factors that affect human activity could include that rising sea levels cause humans to move farther from the coast or that humans build railroads to transport mineral resources from one location to another. (ESS3.A, ESS3.B)
EXPECTATION / STANDARD	Standard ESS.4.2.	Use computational thinking to explain the relationships between the sustainability of natural resources and biodiversity within Earth systems. Emphasize the importance of responsible stewardship of Earth's resources. Examples of factors related to sustainability could include costs of resource extraction, per-capita consumption, waste management, agricultural efficiency, or levels of conservation. Examples of natural resources could include minerals, water, or energy resources. (ESS3.A)
EXPECTATION / STANDARD	Standard ESS.4.3.	Evaluate design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios on large and small scales. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Emphasize the conservation, recycling, and reuse of resources where possible and minimizing impact where it is not possible. Examples of large-scale solutions could include developing best practices for agricultural soil use or mining and production of conventional, unconventional, or renewable energy resources. Examples of small-scale solutions could include mulching lawn clippings or adding biomass to gardens. (ESS3.A, ETS1.A, ETS1.B, ETS1.C)
EXPECTATION / STANDARD	Standard ESS.4.4.	Evaluate design solutions for a major global or local environmental problem based on one of Earth's systems. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Examples of major global or local problems could include water pollution or availability, air pollution, deforestation, or energy production. (ESS3.C, ETS1.A, ETS1.B, ETS1.C)
STANDARD / AREA OF LEARNING		**SEEd - Physics (2019)**
OBJECTIVE / STRAND	**Strand PHYS.2:**	**ENERGY**

INDICATOR / CLUSTER		**Energy describes the motion and interactions of matter and radiation within a system. Energy is a quantifiable property that is conserved in isolated systems and in the universe as a whole. At the macroscopic scale, energy manifests itself in multiple ways such as in motion, sound, light, and thermal energy. Uncontrolled systems always evolve toward more stable states— that is, toward more uniform energy distribution. Examining the world through an energy lens allows us to model and predict complex interactions of multiple objects within a system and address societal needs.**
EXPECTATION / STANDARD	Standard PHYS.2.4.	Design a solution by constructing a device that converts one form of energy into another form of energy to solve a complex real-life problem. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Examples of energy transformation could include electrical energy to mechanical energy, mechanical energy to electrical energy, or electromagnetic radiation to thermal energy. (PS3.A, PS3.B, ETS1.A, ETS1.B, ETS1.C)
EXPECTATION / STANDARD	Standard PHYS.2.5.	Design a solution to a major global problem that accounts for societal energy needs and wants. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Emphasize problems that require the application of conservation of energy principles through energy transfers and transformations. Examples of devices could include one that uses renewable energy resources to perform functions currently performed by nonrenewable fuels or ones that are more energy efficient to conserve energy. (PS3.A, PS3.B, PS3.D, ETS1.A, ETS1.B, ETS1.C)
STANDARD / AREA OF LEARNING		**SEEd - Physics (2019)**
OBJECTIVE / STRAND	**Strand PHYS.4:**	**WAVES**
INDICATOR / CLUSTER		**Waves transfer energy through oscillations of fields or matter. The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it passes. Waves produce interference as they overlap but they emerge unaffected by each other. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. Electromagnetic radiation can be modeled as a wave of changing electric and magnetic fields or as particles called photons. When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy. Because waves depend upon the properties of fields and the predictable transformation of energy, they can be used to interpret the nature of matter and its energy. Waves are utilized to transmit information both in analog and digital forms.**
EXPECTATION / STANDARD	Standard PHYS.4.4.	Ask questions and construct an explanation about the stability of digital transmission and storage of information and their impacts on society. Emphasize the stability of digital signals and the discrete nature of information transmission. Examples of stability and instability could include that digital information can be stored in computer memory, is transferred easily, copied and shared rapidly can be easily deleted, has limited fidelity based on sampling rates, or is vulnerable to security breaches and theft. (PS4.A)

Grade **12** - Adopted: **2013**

STANDARD / AREA OF LEARNING		**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Key Ideas and Details**
INDICATOR / CLUSTER	RST.11-12.2.	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
INDICATOR / CLUSTER	RST.11-12.3.	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
STANDARD / AREA OF LEARNING		**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Craft and Structure**

INDICATOR / CLUSTER	RST.11-12.4.	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
INDICATOR / CLUSTER	RST.11-12.5.	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
STANDARD / AREA OF LEARNING		**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Integration of Knowledge and Ideas**
INDICATOR / CLUSTER	RST.11-12.9.	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
STANDARD / AREA OF LEARNING		**Reading Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Range of Reading and Level of Text Complexity**
INDICATOR / CLUSTER	RST.11-12.10.	By the end of grade 12, read and comprehend science/technical texts in the grades 11-12 text complexity band independently and proficiently.
STANDARD / AREA OF LEARNING		**Writing Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Text Types and Purposes**
INDICATOR / CLUSTER	**WHST.11-12.2.**	**Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.**
EXPECTATION / STANDARD	WHST.11-12.2(d)	Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
STANDARD / AREA OF LEARNING		**Writing Standards for Literacy in Science and Technical Subjects**
OBJECTIVE / STRAND		**Production and Distribution of Writing**
INDICATOR / CLUSTER	WHST.11-12.4.	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
INDICATOR / CLUSTER	WHST.11-12.6.	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Grade **12** - Adopted: **2022**

STANDARD / AREA OF LEARNING		**SEEd – Environmental Science (2022)**
OBJECTIVE / STRAND	**ENVS.2.**	**AVAILABILITY AND USE OF NATURAL ENERGY**

INDICATOR / CLUSTER		**Energy sources are necessary for human society. Sources of energy can either be renewable or nonrenewable and have varying levels of quantity and proportion. Energy sources originate and are consumed differently. Energy plans provide a way to measure and calculate need and energy consumption in a sustainable way.**
EXPECTATION / STANDARD	ENVS.2.1.	Construct an argument based on evidence about the risks and benefits caused by using renewable and nonrenewable energy sources. Examples of risks and benefits could include environmental, social, or economic factors.
EXPECTATION / STANDARD	ENVS.2.2.	Analyze and interpret data to communicate information on the origins, quantity/proportion, and consumption of renewable and nonrenewable energy sources. Examples of renewable energy sources could include wind, solar, geothermal, biofuel, or tidal. Examples of non-renewable energy sources could include fossil fuels and nuclear energy.
EXPECTATION / STANDARD	ENVS.2.3.	Design a solution in the form of a sustainable energy plan for your city, town, county or region of the state. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize the solution. Emphasize basing the plan on scientific principles and on the sustainability potential of renewable and nonrenewable energy resources.
STANDARD / AREA OF LEARNING		**SEEd – Environmental Science (2022)**
OBJECTIVE / STRAND	**ENVS.3.**	**AVAILABILITY, USE, AND MANAGEMENT OF NATURAL RESOURCES**
INDICATOR / CLUSTER		**Natural resources are necessary for human society. How humans obtain and use resources have an impact on their quality/quantity of the resource and their surrounding environment. Resource location, quantity, and proportion may be dependent on environmental factors. Governments and organizations manage the use and effect of natural resources. Resource management plans provide a way to measure and sustain resources for long-term use and effects.**
EXPECTATION / STANDARD	ENVS.3.1.	Construct an argument based on evidence for the effects humans have by obtaining and using natural resources. Emphasize the uses and importance of resources and potential impacts of obtaining them. Examples of human activities to obtain resources could include agriculture, ranching, mining, forestry, fishing, water use, or desalination.
STANDARD / AREA OF LEARNING		**SEEd – Environmental Science (2022)**
OBJECTIVE / STRAND	**ENVS.4.**	**SUSTAINABILITY AND HUMAN IMPACTS BOTH LOCAL AND GLOBAL**
INDICATOR / CLUSTER		**Human use of natural and energy resources has an effect on the environment. Population growth generally requires an increased use of these resources and has an increased effect. Humans have found solutions to some of these effects. There is a relationship between the quality of life and human impact on the environment. Some human impacts can have lasting effects on environments around the world and adjusting practices can reduce and reverse the effects. Global climate change is occurring and has an effect on both human populations and environments. Sustainability plans help individuals, cities, or regions reduce their impact on environments.**
EXPECTATION / STANDARD	ENVS.4.3.	Obtain, evaluate, and communicate information for how humans cause an impact on the environment and how individuals, state and local management plans, and government legislation have identified and adjusted practice to reduce and/or reverse these impacts. Emphasize the process and time necessary to pass Examples of impact could include water and air pollution, climate change, ozone depletion, deforestation, ocean acidification, or urbanization. Examples of adjusted practice could include the reduction of fossil fuel use, criminalization of dumping waste, or outlawing the use of chlorofluorocarbons.
EXPECTATION / STANDARD	ENVS.4.4.	Analyze and interpret data to construct an explanation based on evidence for the causes and impacts of global climate change on human populations and environments. Examples of evidence could include ice cores, ocean acidification, glacier retreat, atmospheric CO_2 levels, or air and ocean temperature.

EXPECTATION / STANDARD	ENVS.4.5.	Design and defend a solution in the form of a sustainability plan to reduce individual, city, or regional contribution (causes) to environmental impacts. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize the solution. Emphasize how market forces and societal demands influence personal choices.

Grade **12** - Adopted: **2023**

STANDARD / AREA OF LEARNING		**SEEd – Meteorology (2023)**
OBJECTIVE / STRAND	**METR.1.**	**STRUCTURE AND FUNCTION OF EARTH'S ATMOSPHERE**
INDICATOR / CLUSTER		**The atmosphere has different layers and composition which can be identified from its properties. Observable changes in solar radiation affect both the atmosphere and the surface of Earth.**
EXPECTATION / STANDARD	METR.1.3.	Obtain, evaluate, and communicate what happens to solar radiation (energy) as it moves through the atmosphere and interacts with Earth's surface (matter). Emphasize the role of the greenhouse effect on supporting life.

STANDARD / AREA OF LEARNING		**SEEd – Meteorology (2023)**
OBJECTIVE / STRAND	**METR.3.**	**SYSTEM INTERACTIONS BETWEEN SOCIETY, EARTH'S CLIMATES, AND WEATHER**
INDICATOR / CLUSTER		**Various climate systems are present across the world with a variety of characteristics and conditions. Weather, climate, and society interact and affect each other. Climate change is defined as any systematic change in the long-term statistics of climate elements (such as temperature, pressure, or winds) sustained over several decades or longer. Climate change can have a variety of causes and effects. Technology and regulation can aid in minimizing property damage, preserving life, and reducing the impacts of climate change.**
EXPECTATION / STANDARD	METR.3.4.	Plan and carry out an investigation to determine the natural and human caused factors that produce changes in global climate. Emphasize Milankovitch and ENSO cycles, role of greenhouse gases, and changes in physical geography.
EXPECTATION / STANDARD	METR.3.5.	Evaluate proposed designed solutions intended to minimize property damage and preserve life by reducing the impacts (effect) of climate change and hazardous weather. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution.

Grade **12** - Adopted: **2022**

STANDARD / AREA OF LEARNING		**SEEd – Wildlife Biology (2022)**
OBJECTIVE / STRAND	**WILD.4.**	**HUMAN IMPACT AND WILDLIFE MANAGEMENT**
INDICATOR / CLUSTER		**Human activities have an effect on ecological systems and wildlife. Humans have found some solutions to minimize or reduce the effects of their actions. Species go extinct for specific reasons and their extinction may have an impact on their environment. Humans identify and protect endangered species to limit the effects of this extinction. Ecological collapse can occur if significant changes to the environment occur. Wildlife management plans are created and executed to support a wildlife habitat and/or specific species.**
EXPECTATION / STANDARD	WILD.4.3.	Analyze and interpret data to explain the causes and effects of ecological collapse. Emphasize investigating specific examples of this happening on Earth.

STANDARD / AREA OF LEARNING		**SEEd – Zoology (2022)**
OBJECTIVE / STRAND	**ZOOL.1.**	**STRUCTURES, FUNCTIONS, AND PROCESSES IN ANIMALS**

INDICATOR / CLUSTER		**Animals share common life functions necessary for survival. They also have similar yet diverse structures that they use to fulfil these life functions. Some animals have a unique life cycle. Animals depend upon their environment for survival.**
EXPECTATION / STANDARD	ZOOL.1.1.	Obtain, evaluate, and communicate information to explain the life functions shared by most animals. Emphasize that most animals depend on and perform these functions in different ways. Examples of life functions could include the need to feed, respire, circulate, excrete, move, respond, or reproduce.
STANDARD / AREA OF LEARNING		**SEEd – Zoology (2022)**
OBJECTIVE / STRAND	**ZOOL.3.**	**HUMAN AND ANIMAL INTERACTIONS**
INDICATOR / CLUSTER		**Animal structures are used for different purposes by humans. Human activities may have an impact on natural habitats and populations of animals. Humans can also create management plans and legislation that can reduce or reverse the impacts humans have on animals in the wild. Management plans can be used to control invasive species and conserve native animal species.**
EXPECTATION / STANDARD	ZOOL.3.2.	Ask questions and define problems to identify the cause and effect of human activities on natural habitats and populations of animals. Emphasize how individuals, state, and local management plans, and government legislation have identified and adjusted practice to reduce and/or reverse these impacts. Examples of human activities could include habitat destruction, overharvesting, water consumption, or pollution.

Utah Core Standards

Technology Education

Grade **11** - Adopted: **2019**

STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Concepts**
INDICATOR / CLUSTER		**Data and Analysis (DA):**
EXPECTATION / STANDARD		Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, and the need to process data effectively is increasingly important. Data is collected and stored so it can be analyzed to better understand the world and make more accurate predictions.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Concepts**
INDICATOR / CLUSTER		**Algorithms and Programming (AP):**
EXPECTATION / STANDARD		An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems. The development process to create meaningful and efficient programs involves choosing which information to use and how to process and store it, breaking apart large problems into smaller ones, recombining existing solutions, and analyzing different solutions.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**

INDICATOR / CLUSTER	**Practice 1:**	**Fostering an Inclusive Computing Culture**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	1	Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational products.
INDICATOR	2	Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 2:**	**Collaborating Around Computing**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	2	Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 3:**	**Recognizing and Defining Computational Problems**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	2	Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures.
INDICATOR	3	Evaluate whether it is appropriate and feasible to solve a problem computationally.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 4:**	**Developing and Using Abstractions**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	3	Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**

INDICATOR / CLUSTER	**Practice 5:**	**Creating Computational Artifacts**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	1	Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations.
INDICATOR	2	Create a computational artifact for practical intent, personal expression, or to address a societal issue.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 6:**	**Testing and Refining Computational Artifacts**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	1	Systematically test computational artifacts by considering all scenarios and using test cases.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Network and the Internet (NI):**
INDICATOR / CLUSTER	**Standard 11/12.NI.2.**	**Compare and contrast cryptographic techniques to model the secure transmission of information (data). (Practice 3. Recognizing and Defining Computational Problems; Practice 5. Creating Computational Artifacts; Practice 7: Communicating About Computing)**
EXPECTATION / STANDARD		Students will demonstrate an understanding of how information is transformed/manipulated via cryptography by creating an encryption algorithm. For example, students will understand how Alan Turing was able to break the Enigma code in World War II. Students will then create their own cypher and share among their peers.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Algorithms and Programming (AP):**
INDICATOR / CLUSTER	**Standard 11/12.AP.1.**	**Iteratively design and develop computational artifacts for practical, personal, or societal expression that implements an algorithm based on the result of an evaluation or user input. (Practice 2: Collaborating Around Computing Practice 3: Recognizing and Defining Computational Problems; Practice 5: Creating Computational Artifacts; Practice 6: Testing and Refining Computational Artifacts)**
EXPECTATION / STANDARD		Students design and create a computational artifact that develops and implements algorithms (steps) based on the results of an evaluation of a result or user input. For example, students can brainstorm ideas for creating solutions to energy problems with prioritized criteria and trade-offs while considering cost, safety, reliability, as well as possible social, cultural, and environmental impacts.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Algorithms and Programming (AP):**

INDICATOR / CLUSTER	**Standard 11/12.AP.3.**	**Design and develop computational artifacts working in team roles using collaborative tools. (Practice 2: Collaborating Around Computing; Practice 4: Developing and Using Abstractions; Practice 5: Creating Computational Artifacts; Practice 6: Testing and Refining Computational Artifacts; Practice 7: Communicating About Computing)**
EXPECTATION / STANDARD		Students will collaborate to design and develop multiple artifacts in teams. For example, students will work together to develop a video game in their subject matter expert roles, which may include, writer, programmer, artist, audio, etc.

STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Impacts of Computing (IC):**
INDICATOR / CLUSTER	**Standard 11/12.IC.3.**	**Demonstrate computational thinking using algorithms to problem solving across multiple disciplines. (Practice 3. Recognizing and Defining Computational Problems; Practice 4: Developing and Using Abstractions; Practice 6: Testing and Refining Computational Artifacts; Practice 7: Communicating About Computing)**
EXPECTATION / STANDARD		Students will demonstrate ways to problem-solve across disciplines. For example, students can use computational thinking and patterns to predict certain genetic traits in chromosomes that will be passed on from parents to offspring.

Utah Core Standards

Technology Education

Grade **12** - Adopted: **2019**

STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Concepts**
INDICATOR / CLUSTER		**Data and Analysis (DA):**
EXPECTATION / STANDARD		Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, and the need to process data effectively is increasingly important. Data is collected and stored so it can be analyzed to better understand the world and make more accurate predictions.

STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Concepts**
INDICATOR / CLUSTER		**Algorithms and Programming (AP):**
EXPECTATION / STANDARD		An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems. The development process to create meaningful and efficient programs involves choosing which information to use and how to process and store it, breaking apart large problems into smaller ones, recombining existing solutions, and analyzing different solutions.

STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**

INDICATOR / CLUSTER	**Practice 1:**	**Fostering an Inclusive Computing Culture**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	1	Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational products.
INDICATOR	2	Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 2:**	**Collaborating Around Computing**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	2	Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 3:**	**Recognizing and Defining Computational Problems**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	2	Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures.
INDICATOR	3	Evaluate whether it is appropriate and feasible to solve a problem computationally.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 4:**	**Developing and Using Abstractions**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	3	Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**

OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 5:**	**Creating Computational Artifacts**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	1	Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations.
INDICATOR	2	Create a computational artifact for practical intent, personal expression, or to address a societal issue.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Core Practices**
INDICATOR / CLUSTER	**Practice 6:**	**Testing and Refining Computational Artifacts**
EXPECTATION / STANDARD		**By the end of Grade 12, students should be able to:**
INDICATOR	1	Systematically test computational artifacts by considering all scenarios and using test cases.
STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Network and the Internet (NI):**
INDICATOR / CLUSTER	**Standard 11/12.NI.2.**	**Compare and contrast cryptographic techniques to model the secure transmission of information (data). (Practice 3. Recognizing and Defining Computational Problems; Practice 5. Creating Computational Artifacts; Practice 7: Communicating About Computing)**
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STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Algorithms and Programming (AP):**
INDICATOR / CLUSTER	**Standard 11/12.AP.1.**	**Iteratively design and develop computational artifacts for practical, personal, or societal expression that implements an algorithm based on the result of an evaluation or user input. (Practice 2: Collaborating Around Computing Practice 3: Recognizing and Defining Computational Problems; Practice 5: Creating Computational Artifacts; Practice 6: Testing and Refining Computational Artifacts)**
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STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**

OBJECTIVE / STRAND		**Algorithms and Programming (AP):**
INDICATOR / CLUSTER	**Standard 11/12.AP.3.**	**Design and develop computational artifacts working in team roles using collaborative tools. (Practice 2: Collaborating Around Computing; Practice 4: Developing and Using Abstractions; Practice 5: Creating Computational Artifacts; Practice 6: Testing and Refining Computational Artifacts; Practice 7: Communicating About Computing)**
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STANDARD / AREA OF LEARNING		**Utah 6-12 Computer Science Standards**
OBJECTIVE / STRAND		**Impacts of Computing (IC):**
INDICATOR / CLUSTER	**Standard 11/12.IC.3.**	**Demonstrate computational thinking using algorithms to problem solving across multiple disciplines. (Practice 3. Recognizing and Defining Computational Problems; Practice 4: Developing and Using Abstractions; Practice 6: Testing and Refining Computational Artifacts; Practice 7: Communicating About Computing)**
EXPECTATION / STANDARD		Students will demonstrate ways to problem-solve across disciplines. For example, students can use computational thinking and patterns to predict certain genetic traits in chromosomes that will be passed on from parents to offspring.