Principles of Physical Science

Course Description:

The curriculum for this required, non-weighted introductory course is developed from:

- Next Generation Science Standards *(NGSS)* for **science content**
- ACT College and Career Readiness Standards *(CCRS)* for **science skills**
- Common Core State Standards for Literacy in History/Social Studies, Science, and Technical Subjects *(CCSS.WHST [page 64-66])* for **science writing**.
- Common Core State Standards for Math *(CCSS.Math)* for **math skills**

Topics include the nature of science, motion, forces, energy, waves, astronomy, and climate change. Grades are determined by quizzes, tests, and projects. The information in this course overview outlines what students should understand and be able to do by the end of the semester/year.

Mastery Standards:

Introduction to Science:

Introduction to Science assesses the following **ACT College and Career Readiness Standards**:

- Identify basic features of a table, graph, or diagram (e.g., units of measurement). (CCRS.IOD.202)
- Find basic information in text that describes a simple data presentation. (CCRS.IOD.203)
- Understand basic scientific terminology. (CCRS.IOD.302)
- Determine how the values of variables change as the value of another variable changes in a simple data presentation. (CCRS.IOD.304)
- Compare or combine data from a simple data presentation (e.g. order or sum data from a table). (CCRS.IOD.402)
- Translate information into a table, graph, or diagram. (CCRS.IOD.403)
- Determine and/or use a simple (e.g., linear) mathematical relationship that exists between data. (CCRS.IOD.504)
- Find basic information in text that describes a simple experiment. (CCRS.SIN.201)
- Understand a simple experimental design. (CCRS.SIN.202)
- Understand the methods used in a simple experiment. (CCRS.SIN.301)
- Understand a simple experimental design. (CCRS.SIN.401)
- Identify a control in an experiment. (CCRS.SIN.403)
- Find basic information in a model (conceptual). (CCRS.EMI.201)
- Determine which models present certain basic information. (CCRS.EMI.302)

Introduction to Science also assesses the following **Common Core State Standard for Math**:

- Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. (CCSS.MATH.CONTENT.HSS.ID.B.6)

Introduction to Science also assesses the following **Common Core State Standards for Literacy in History/Social Studies, Science, and Technical Subjects**:

- Conduct short as well as more sustained research projects to answer a question (including self-generated or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (CCSS.WHST.9-10.7)
- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (CCSS.WHST.9-10.1)

Motion

The Motion unit assesses the following **Common Core State Standards for Math**:

- Solve problems involving velocity and other quantities that can be represented by vectors. (CCSS.MATH.CONTENT.HSN.VM.A.3)
- Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. (CCSS.MATH.CONTENT.HSF.IF.B.6)

- Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (CCSS.MATH.CONTENT.HSN.Q.A.1)

The Motion unit will also build upon the **ACT College and Career Readiness Standards** listed in the Introduction to Science unit and expand to include the following standards:

- Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text. (CCRS.EMI.401)
- Perform a simple interpolation or simple extrapolation using data in a table or graph (CCRS.IOD.404).

The Motion unit will also continue to reinforce and assess the following **Common Core State Standard for Literacy in History/Social Studies, Science, and Technical Subjects**:

- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (CCSS.WHST.9-10.1)

Forces

The Forces Unit assesses the following **Next Generation Science Standards**:

- Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. (NGSS.HS-PS2-1)

The Forces Unit also assesses the following **Common Core State Standards for Math:**

- Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. (CCSS.MATH.CONTENT.HSN.VM.B.4.B)

The Forces Unit will also build upon the **ACT College and Career Readiness Standards** listed in the Introduction to Science unit and expand to include the following standards:

- Compare or combine data from two or more simple data presentations. (CCRS.IOD.501)
- Determine the experimental conditions that would produce specified results (CCRS.SIN.503).

The Forces unit will also continue to reinforce and assess the following **Common Core State Standard for Literacy in History/Social Studies, Science, and Technical Subjects**:

- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (CCSS.WHST.9-10.1)

Energy

The Energy Unit assesses the following **Next Generation Science Standards**:

- Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). (NGSS.HS-PS3-2)
- Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (NGSS.HS-PS3-3)

The Energy Unit will also build upon the **ACT College and Career Readiness Standards** listed in the Introduction to Science unit and expand to include the following standards:

- Determine and/or use a complex (e.g., nonlinear) mathematical relationship that exists between data (CCRS.IOD.602)

The Energy unit will also continue to reinforce and assess the following **Common Core State Standard for Literacy in History/Social Studies, Science, and Technical Subjects**:

- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (CCSS.WHST.9-10.1)

Waves

The Waves Unit assesses the following **Next Generation Science Standard**:

- Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. (NGSS.HS-PS4-1)

The Waves Unit will also build upon the **ACT College and Career Readiness Standards** listed in the Introduction to Science unit and expand to include the following standards:

- Determine how the values of variables change as the value of another variable changes in a complex data presentation (CCRS.IOD.503).

The Waves unit will also continue to reinforce and assess the following **Common Core State Standard for Literacy in History/Social Studies, Science, and Technical Subjects**:

- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (CCSS.WHST.9-10.1)

Astronomy

The Astronomy Unit assesses the following **Next Generation Science Standard**:

- Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. (NGSS.HS-ESS1-2)

The Astronomy Unit will also build upon the **ACT College and Career Readiness Standards** listed in the Introduction to Science unit and expand to include the following standards:

- Determine whether presented information, or new information, supports or weakens a model, and why (CCRS.EMI.602).

The Astronomy unit will also continue to reinforce and assess the following **Common Core State Standard for Literacy in History/Social Studies, Science, and Technical Subjects**:

- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (CCSS.WHST.9-10.1)

Climate Change

The Climate Change Unit assesses the following **Next Generation Science Standard**:

- Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems. (NGSS.HS-ESS3-5)

The Climate Change Unit will also build upon the **ACT College and Career Readiness Standards** listed in the Introduction to Science unit and expand to include the following standards:

- Determine whether presentation information, or new information, supports or contradicts a complex hypothesis or conclusion, and why (CCRS.EMI.702).

The Climate Change unit will also continue to reinforce and assess the following **Common Core State Standard for Literacy in History/Social Studies, Science, and Technical Subjects**:

- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (CCSS.WHST.9-10.1)

Unit	Description of Unit and Learning Targets
Unit Title: Introduction to Science Essential Questions: ● How can I identify patterns in nature and use them to predict or explain events?	Learning Targets: 1. I can define theory, law, hypothesis, subjective, objective, inference, qualitative, quantitative. 2. I can **use mathematics and computational thinking** to calculate the mean, median and mode of a series of numbers and I know when to use one over the other. 3. I can identify the independent, dependent, controlled variables, and the control group to ultimately **plan and carry out an investigation** of a self-generated question. 4. I can determine which graph (line, scatter, bar, pie) is best to **analyze and interpret data** in a given experiment.

	5. I can **analyze and interpret data** by identifying the independent and dependent variables on a data table, graph, and formula, and state the relationship shown on each one. 6. I can understand and give an example of units in the metric system in real life. 7. I can **use mathematics and computational thinking** to solve multiplication and division problems and use dimensional analysis and convert between units. 8. I can **obtain, evaluate, and communicate information** in a CER. 9. I can **plan and carry out an investigation** that allows me to **analyze and interpret data**, **using mathematics and computational thinking** to create a tri-fold poster that demonstrates my ability to **obtain, evaluate, and communicate information.**
Unit Title: Motion <u>Essential Questions:</u> ● How can I use representations of motion to describe and predict future motion?	<u>Learning Targets:</u> 1. I can represent motion through the use of words. 2. I can **plan and carry out investigations** that show constant velocity on a position versus time graph. 3. I can **use mathematics and computational thinking** to calculate constant velocity from a formula. 4. I can **plan and carry out investigations** that show acceleration on a position versus time graph and connect it to the three ways an object can accelerate. 5. I can **develop and use models** to connect vector diagrams to position/time graphs.
Unit Title: Forces <u>Essential Questions:</u> ● How can I accurately and quantifiably control an object's motion?	<u>Learning Targets:</u> 1. I can **analyze and interpret data** that explains motion in terms of Newton's First Law. 2. I can **develop and use models** to determine the magnitude and direction of the net force on an object and use it to predict the object's motion. 3. I can **develop and use models** to connect vector diagrams, position versus time graphs, and free body diagrams. 4. I can **develop and use models** that represent the specific forces acting on an object. 5. I can **use mathematics and computational thinking** to analyze Newton's Second Law and predict the acceleration of an object.
Unit Title: Energy <u>Essential Questions:</u> ● What is energy? ● How is energy transferred between	<u>Learning Targets:</u> 1. I can identify when work has been done on an object and use **mathematics and computational thinking** to calculate how much work has been done on the object. 2. I can **use mathematics and computational** thinking to

objects or systems?	calculate kinetic energy. 3. I **use mathematics and computational thinking** to calculate gravitational potential energy. 4. I can **plan and carry out an investigation** to **analyze and interpret data** that demonstrates the Law of Conservation of Energy. I can **develop and use models** that diagram the energy changes within that system. 5. I can identify six simple machines and understand how they make work easier without adding fuel. 6. I can design, build, and refine a device that works within given constraints to convert one form of energy into another, and **obtain, evaluate, and communicate information** in the form of a Google Slides presentation.
Unit Title: Waves and Light Essential Questions: ● How do waves transfer energy through different media to communicate information to our senses?	Learning Targets: 1. I can **develop and use models** to identify and label three types of mechanical waves. 2. I can **plan and carry out investigations** to **analyze and interpret data** that show how frequency, wavelength and speed are related, and **use mathematics and computational thinking** to calculate the speed from the wavelength and frequency. 3. I can **obtain, evaluate, and communicate information** to show that light is an electromagnetic wave whose differences in properties and functions are due to differences in their wavelength.
Unit Title: Astronomy Essential Questions: ● Why do planets, stars, solar systems, and galaxies move the way they do? ● How does light tell us where the universe came from?	Learning Targets: 1. I can **develop and use models** that demonstrate a sense of size and scale. I know what objects in the universe are. 2. I can **use models** of Kepler's three laws to explain and how planets revolve around the sun and **use mathematics and computational thinking** to predict an object's revolution around the sun based on its distance and Kepler's third law. 3. I **use mathematics and computational thinking** to analyze the variables that affect how gravity keeps planets in orbit around the sun. 4. I can **analyze and interpret data** to identify the composition of an unknown star by comparing it to the spectra of known elements. 5. I can **analyze and interpret data** of the Doppler Effect and emission spectra to tell whether objects are moving toward or away from me. 6. I can **obtain, evaluate, and communicate information** that cites the three main pieces of evidence that support the Big Bang Theory.
Unit Title: Climate Change Essential Questions: ● How do changes in Earth's climate affect its ability to provide a home for all living things? ● In what ways can individuals bring	Learning Targets: 1. I know the difference between weather and climate. 2. I can **develop and use models** that show what happens to energy after it leaves the sun, is absorbed by the Earth's surface and is reemitted into space.

about change on a global scale?	3. I can use the definition of albedo to **analyze and interpret data** that show how positive feedback loops affect climate change. 4. I can **obtain, evaluate, and communicate information** that evaluates how my plan to mitigate climate change affects a variety of stakeholders.