Region 14 Schools
Inspiring Excellence

| **Content Area: Science** | Course: Physical Science | **Grade Level: 6-8** |
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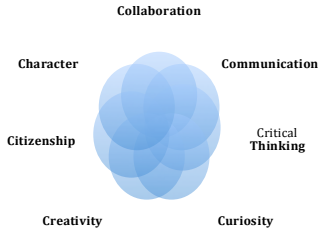
|  | **R14 The Seven Cs of Learning**<br>  | |

| **Unit Titles** | **Length of Unit** |
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| • Matter and its Interactions | • 6-8 weeks |
| • Forces and Interactions | • 6-8 weeks |
| • Energy | • 6-8 weeks |
| • Waves and Electromagnetic Radiation | • 6-8 weeks |

| Strands | Course Level Expectations |
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| **Forces and Interactions** | • Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.<br>• Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.<br>• Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.<br>• Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.<br>• Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. |
| **Matter and its Interactions** | • Develop models to describe the atomic composition of simple molecules and extended structures.<br>• Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.<br>• Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.<br>• Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.<br>• Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.<br>• Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. |

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| **Energy and Waves** | • Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object<br>• Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.<br>• Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.<br>• Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.<br>• Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.<br>• Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.<br>• Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.<br>• Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals |

| **Unit Title** | Matter and its Interactions | **Length of Unit** | 6-8 weeks |
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| **Inquiry Questions** **(Engaging & Debatable)** | • How can particles combine to produce a substance with different properties?<br>• How does thermal energy affect particles?<br>• What happens when new materials are formed? |
| **Standards*** | MS-PS1-1, MS-PS1-2, MS-PS1-3, MS-PS1-4, MS-PS1-5, MS-PS1-6, MS-ETS-1-1-4 |
| **Unit Strands & Concepts** | **DISCIPLINARY CORE IDEAS (DCI):**<br>• Structure and Properties of Matter<br>• Chemical Reactions<br>• Definitions of Energy<br>**Cross Cutting Concepts (CCC)**<br>• Cause and Effect<br>• Scale, Proportion, and Quantity<br>• Structure and Function<br>• Patterns<br>• Energy and Matter |
| **Key Vocabulary** | Matter, Molecule, Atom, Natural Resource, Synthetic Material, Heat, Temperature, Thermal Energy, Kinetic Energy, Chemical Reaction, Density, Melting Point, Boiling Point, Solubility, Flammability, Conservation of Matter, Data, Observations |

*Standards based on the Next Generation Science Standards (NGSS) and the National Research Council (NRC)
For more information visit: http://portal.ct.gov/SDE/Science/Science-Standards-and-Resources

| Unit Title | Matter and its Interactions | Length of Unit | 6-8 Weeks |
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| **Critical Content:**<br>**My students will Know…** | **Key Skills:**<br>**My students will be able to (Do)…** |
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| • Substances are made from different types of atoms, which combine with one another in various ways.<br>• Atoms form molecules that range in size from two to thousands of atoms.<br>• Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.<br>• Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.<br>• In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.<br>• Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).<br>• The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.<br>• Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.<br>• The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature | • Develop models to describe the atomic composition of simple molecules and extended structures<br>• Gather, synthesize, and make sense of information to describe that synthetic materials come from natural resources and impact society.<br>• Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.<br>• Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.<br>• Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.<br>• Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. |

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| difference between two objects.<br>• The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system' material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material.<br>• Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material.<br>• In a chemical reaction the total number of each type of atom is conserved, and thus the mass does not change.<br>• Some chemical reactions release energy, others store energy. | |

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| **Assessments:** | Performance Task(s) focused on demonstrating an understanding that pure substances have characteristic properties and are made from a single type of atom or molecule as well as the different states of matter, and how atoms rearrange during chemical reactions to form new substances. |
| **Teacher Resources:** | NGSS Frameworks, Region 14 Science Implementation Guide, Model Based Inquiry Investigations, Foss Kits, NGSS Phenomenon Resources, Stem Teaching Tools |

| **Unit Title** | Forces and Interactions | **Length of Unit** | 56-8 weeks |
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| **Inquiry Questions** **(Engaging & Debatable)** | • How do we know that forces exist if we cannot see them?<br>• What is the effect of different forces on the motion of objects? |
| **Standards** | MS-PS2-1, MS-PS2-2, MS-PS2-3 MS-PS2-4, MS-PS2-5, MS-ETS1-1-4 |
| **Unit Strands & Concepts** | **DISCIPLINARY CORE IDEAS (DCI):**<br>• Forces and Motion<br>• Types of Interactions<br>**Cross Cutting Concepts (CCC)**<br>• Cause and Effect<br>• Systems and System Models<br>• Stability and Change |
| | Balanced Force, Unbalanced Force, Motion, Inertia, Fields, Gravity, Data, Observations |

| Unit Title | Force and Interactions | Length of Unit | 6-8 weeks |
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| **Critical Content:**<br>**My students will Know…** | **Key Skills:**<br>**My students will be able to (Do)…** |
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| • For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).<br>• The motion of an object is determined by the sum of the forces acting on it; i the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.<br>• All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.<br>• Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.<br>• Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.<br>• Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object. | • Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects<br>• Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.<br>• Analyze data data to determine the factors that affect the strength of electric and magnetic forces.<br>• Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects<br>• Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. |

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| **Assessments:** | Performance Task(s) focused on demonstrating an understanding of Newton's Laws of Motion through application of Newton's Third Law of Motion. How gravitational, electrical, and magnetic forces can explain a variety of phenomena such as that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. |
| **Teacher Resources:** | NGSS Frameworks, Region 14 Science Implementation Guide, Model Based Inquiry Investigations, Foss Kits, NGSS Phenomenon Resources, Stem Teaching Tools |

| **Unit Title** | Energy | **Length of Unit** | 6-8 weeks |
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| **Inquiry Questions (Engaging & Debatable)** | • How can energy be transferred from one object or system to another?<br>• How is temperature affected by thermal energy transfer, the type of matter, and the mass of the sample? |
| **Standards*** | MS-PS3-1, MS-PS3-2, MS-PS3-3, MS-PS3-4, MS-PS3-5, MS-ETS1-1, MS-ETS1-4 |
| **Unit Strands & Concepts** | **DISCIPLINARY CORE IDEAS (DCI):**<br>• Definitions of Energy<br>• Conservation of Energy and Energy Transfer<br>• Relationship Between Energy and Forces<br>**Cross Cutting Concepts (CCC)**<br>• Scale, Proportion, and Quantity<br>• Energy and Matter<br>• Systems and System Models |
| **Key Vocabulary** | Kinetic Energy, Potential Energy, Temperature, Thermal Energy, Data, Observations |

| Unit Title | Energy | Length of Unit | 6-8 weeks |
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| **Critical Content:**<br>**My students will Know…** | **Key Skills:**<br>**My students will be able to (Do)…** |
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| • Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.<br>• system of objects may also contain stored (potential) energy, depending on their relative positions.<br>• Temperature is a measure of the average kinetic energy of particles of matter.<br>• The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.<br>• When the motion energy of an object changes, there is inevitably some other change in energy at the same time.<br>• The amount of energy transfer needed to change the temperature of a matter sample by given amount depends on the nature of the matter, the size of the sample, and the environment.<br>• Energy is spontaneously transferred out of hotter regions or objects and into colder ones<br>• When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object | • Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.<br>• Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.<br>• Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer<br>• Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample<br>• Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. |

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| **Assessments:** | Performance Task(s) focused on demonstrating an understanding of energy transfer and the relationship between force and energy. |
| **Teacher Resources:** | NGSS Frameworks, Region 14 Science Implementation Guide, Model Based Inquiry Investigations, Foss Kits, NGSS Phenomenon Resources, Stem Teaching Tools |

| **Unit Title** | Waves and Electromagnetic Radiation | **Length of Unit** | 6-8 weeks |
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| **Inquiry Questions** **(Engaging & Debatable)** | • What are the characteristic properties of waves and how can they be used?<br>• How are waves reflected, absorbed or transmitted through various materials? |
| **Standards*** | MS-PS4-1, MS-PS4-2, MS-PS4-3 |
| **Unit Strands & Concepts** | **DISCIPLINARY CORE IDEAS (DCI):**<br>• Wave Properties<br>• Electromagnetic Radiation<br>• Information Technologies and Instrumentation<br>**Cross Cutting Concepts (CCC)**<br>• Patterns<br>• Structure and Function |
| **Key Vocabulary** | Repeating Wave, Amplitude, Wavelength, Frequency, Digital Signal, Analog Signal, Data, Observations |

| Unit Title | Waves and Electromagnetic Radiation | Length of Unit | 6-8 weeks |
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| **Critical Content:**<br>**My students will Know…** | **Key Skills:**<br>**My students will be able to (Do)…** |
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| • simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.<br>• sound wave needs a medium through which it is transmitted.<br>• When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.<br>• The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.<br>• wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. However, because light can travel through space, it cannot be a matter wave, like sound or water waves.<br>• Digitized signals (sent as wave pulses) are more reliable way to encode and transmit information | • Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave<br>• Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.<br>• Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals |

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| **Assessments:** | Performance Task(s) focused on demonstrating an understanding of the characteristic properties of waves and how they interact with matter as well as how waves can be utilized as a means to send digital information. |
| **Teacher Resources:** | NGS Frameworks, Region 14 Science Implementation Guide, Model Based Inquiry Investigations, Foss Kits, NGSS Phenomenon Resources, Stem Teaching Tools |