Grade 6 Science

BOONE COUNTY SCHOOLS

ACHIEVING EXCELLENCE TOGETHER

Priority Standards and Instructional Units

2020-2021

Unit 1: Forces & Interactions

(7 weeks + Intro day = 36 days)

MS-PS2-1 **Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.*** **[Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.]** ***[Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]***	**Priority Standard**
MS-PS2-2 **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.** **[Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.]** ***[Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]***	**Priority Standard**
MS-ETS1-1 **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**	**Supporting Standard**

Science and Engineering Practices:

Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.
Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions ortest solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.(06-PS2-2)
Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Apply scientific ideas or principles to design an object, tool, process or system. (06-PS2-1)
Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.

Crosscutting concepts:

Systems and System Models
Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (06-PS2-1),(07-PS2-4),
Stability and Change
Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (06-PS2-2)

Connections to Engineering, Technology, and Applications of Science
Influence of Science, Engineering, and Technology on Society and the Natural World
The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (06-PS2-1)

Disciplinary Core Ideas:

PS2.A: Forces and Motion
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). (06-PS2-1)
The motion of an object is determined by the sum of the forces acting on it; if 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. (06-PS2-2)
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. (06-PS2- 2)

Unit 2: Structure & Properties of Matter
(7 weeks = 35 days (5 days in term 1))

MS-PS1-1 **Develop models to describe the atomic composition of simple molecules and extended structures.** **[Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.]**	**Priority Standard**
MS-PS1-4 **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.** **[Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]**	**Priority Standard**
MS-PS1-3 **Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]**	**Supporting Standard**
Science and Engineering Practices:	
Developing and Using Models Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.	

Develop a model to predict and/or describe phenomena. (06-PS1-1),(06-PS1-4)
Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in
6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.
Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (06-PS1-3)

Crosscutting concepts:

Cause and Effect
Cause and effect relationships may be used to predict phenomena in natural or designed systems. (06-PS1-4)
Scale, Proportion, and Quantity
Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (06-PS1- 1)
Structure and Function
Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (06-PS1-3)
Connections to Engineering, Technology, and Applications of Science
Interdependence of Science, Engineering, and Technology
Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (06-PS1-3)
Influence of Science, Engineering and Technology on Society and the Natural World
The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

Disciplinary Core Ideas:

PS1.A: Structure and Properties of Matter
Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (06-PS1-1)
Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (06-PS1-3) (Note: This Disciplinary Core Idea is also addressed by 07-PS1-2.)
Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (06-PS1-4)
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. (06-PS1-4) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (06-PS1-1)
The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (06-PS1-4)
PS1.B: Chemical Reactions
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. (06-PS1-3) (Note: This Disciplinary Core Idea is also addressed by 07-PS1-2 and 07-PS1-5.)

PS3.A: Definitions of Energy 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 difference between two objects. (secondary to 06-PS1-4) 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's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. 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. (secondary to 06-PS1-4)

Unit 3: Earth Systems
(6 weeks = 30 days (13 days in Term 2)

MS-ESS1-1 **Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.** **[Clarification Statement: Examples of models can be physical, graphical, or conceptual.]**	**Priority Standard**
MS-ESS1-2 **Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.** **[Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]**	**Supporting Standard**
MS-ESS1-3 **Analyze and interpret data to determine scale properties of objects in the solar system.** **[Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]**	**Supporting Standard**
MS-ETS1-4 **Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**	**Supporting Standard**

Science and Engineering Practices:
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena. (06- ESS1-1),(06-ESS1-2) **Analyzing and Interpreting Data** Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze and interpret data to determine similarities and differences in findings. (06-ESS1-3)
Crosscutting concepts:
Patterns Patterns can be used to identify cause and effect relationships. (06-ESS1-1) **Scale, Proportion, and Quantity** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (06-ESS1-3) **Systems and System Models** Models can be used to represent systems and their interactions. (06-ESS1-2) **Connections to Engineering, Technology, and Applications of Science** *Interdependence of Science, Engineering, and Technology* Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (06-ESS1-3) **Connections to Nature of Science** *Scientific Knowledge Assumes an Order and Consistency in Natural Systems* Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (06-ESS1-1),(06-ESS1-2)
Disciplinary Core Ideas:
ESS1.A: The Universe and Its Stars Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (06-ESS1-1) Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (06-ESS1-2) **ESS1.B: Earth and the Solar System** The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (06-ESS1-2),(06-ESS1- 3) This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (06-ESS1-1) The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (06-ESS1-2)

Unit 4: Weather & Climate

(6 weeks = 30 days)

MS-ESS2-4 **Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.** **[Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]**	**Priority Standard**
MS-ESS2-5 **Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.** **[Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]**	**Priority Standard**
MS-ESS2-6 **Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.** **[Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]**	**Priority Standard**
MS-ETS1-2 **Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	**Supporting Standard**
Science and Engineering Practices:	
Asking Questions and Defining Problems Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, clarify arguments and models. **Developing and Using Models**	

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena.(06-ESS2-6) **Planning and Carrying Out Investigations** Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (06-ESS2-5)
Crosscutting concepts:
Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. (06-ESS2-5) **Systems and System Models** Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (06-ESS2-6)
Disciplinary Core Ideas:
ESS2.C: The Roles of Water in Earth's Surface Processes The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (06-ESS2- 5) Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (06-ESS2-6) **ESS2.D: Weather and Climate** Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (06-ESS2-6) Because these patterns are so complex, weather can only be predicted probabilistically. (06-ESS2-5) 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. (06-ESS2-6)

Unit 5: Geological Processes & History of Earth
(5 weeks = 25 days)

MS-ESS2-1 **Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** **[Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.]**	**Priority Standard**
MS-ESS2-2 **Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.** **[Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]**	**Priority Standard**
MS-ESS2-3 **Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.** **[Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]**	**Priority Standard**
Science and Engineering Practices:	
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena. (06-ESS2-1) Develop a model to describe unobservable mechanisms. (06-ESS2-4) **Analyzing and Interpreting Data** Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze and interpret data to provide evidence for phenomena. (06-ESS2-3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (08-ESS1-4),(06-ESS2-2)	

Connections to Nature of Science
Scientific Knowledge is Open to Revision in Light of New Evidence
Science findings are frequently revised and/or reinterpreted based on new evidence. (06-ESS2-3)

Crosscutting concepts:

Patterns
Patterns in rates of change and other numerical relationships can provide information about natural systems.(06-ESS2-3)
Scale Proportion and Quantity
Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (08-ESS1-4),(06-ESS2-2)
Energy and Matter
Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (06-ESS2-4)
Stability and Change
Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (06-ESS2-1)

Disciplinary Core Ideas:

ESS1.C: The History of Planet Earth
The geologic time scale interpreted from rock strata provides a way to organize Earth's history.
Tectonic processes continually generate new ocean sea floor atridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to 06-ESS2-3)
ESS2.A: Earth's Materials and Systems
The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (06-ESS2-2)
ESS2.B: Plate Tectonics and Large-Scale System Interactions Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (06-ESS2-3)
ESS2.C: The Roles of Water in Earth's Surface Processes
Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (06-ESS2-2)

Unit 6: Matter and Energy in Organisms and Ecosystems
(4 weeks = 20 days)

MS-LS2-1 **Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** **[Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]**	**Priority Standard**
MS-LS2-2 **Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** **[Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]**	**Priority Standard**
MS-LS2-3 **Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.** **[Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]**	**Priority Standard**

Science and Engineering Practices:

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
Develop a model to describe phenomena. (06-LS2-3)
Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
Analyze and interpret data to provide evidence for phenomena. (06-LS2-1)
Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.
Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

Crosscutting concepts:

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (06-LS2-1)
Patterns
Patterns can be used to identify cause and effect relationships. (06-LS2-2)
Energy and Matter
The transfer of energy can be tracked as energy flows through a natural system. (06-LS2-3)

Connections to Nature of Science
Scientific Knowledge Assumes an Order and Consistency in Natural Systems Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (06-LS2-3)

Disciplinary Core Ideas:

LS2.A: Interdependent Relationships in Ecosystems
Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (06-LS2-1) In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (06-LS2-1)
Growth of organisms and population increases are limited by access to resources. (06-LS2-1)
LS2.B: Cycle of Matter and Energy Transfer in Ecosystems
Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.(06-LS2-3)