	Content Statement	I Can…	Key Vocabulary
Physical Earth (ESS)	1. The composition and properties of Earth's interior are identified by the behavior of seismic waves. **NOTE**: The thickness of each layer of Earth can vary and be transitional, rather than uniform and distinct as often depicted in textbooks. **NOTE**: In addition to the composition of Earth's interior, the history of the formation of Earth and the relationship of energy transfer, transformation and convection currents within the mantle and crust are essential in understanding sources of energy.	-Understand how scientists know about the structure and composition of the interior of Earth without being able to see it. -Use seismic data, graphics, charts, digital displays and cross sections to study Earth's interior. -Use data from the refraction and reflection of seismic waves to demonstrate how scientists have determined the different layers of Earth's interior. -Explain what planetary differentiation is and when it occurred in order to form Earth and the other planets in the solar system. -Identify the different composition and consistency of each layer of Earth's interior (inner and outer core, upper and lower mantle, crust). -Research new discoveries and technological advances relating to understanding Earth's interior. -Identify plates and plate boundaries using volcanic activity, earthquakes, tsunamis, geysers, faults, oceanic vents, island arcs, hot springs and rift valleys.	• Composition • Seismic wave • Reflection • Refraction • Inner core • Outer core • Upper mantle • Lower mantle • Crust • Convection current • Planetary differentiation • Energy transfer • Cross section • Energy transformation • Seismic data • Tsunamis • Geysers • Hot springs • Faults • Oceanic vents • Island arcs • Rift valleys

For further explanation and details visit the "Science Revised Academic Content Standards (2010) and Model Curriculum Development" on the ODE website.

	Content Statement	I Can…	Key Vocabulary
Physical Earth (ESS)	2. Earth's crust consists of major and minor tectonic plates that move relative to each other. **NOTE**: The historical data related to the present plate tectonic theory must include continental "puzzle-like-fit" noticed as early as Magellan and by other mapmakers and explorers, paleontological data, paleoclimate data, paleomagnetic data, continental drift (Wegener), convection theory (Holmes) and sea floor spreading (Hess, Deitz). Contemporary data must be introduced, including seismic data, GPS/GIS data (documenting plate movement and rates of movement), robotic studies of the sea floor and further exploration of Earth's interior. **NOTE**: The focus must be on the cause of plate movement, the type and direction of plate movement and the result of the plate movement, not on memorizing plate names.	-Describe the general history of plate tectonics, including the early observations, discoveries and ideas that combined, that eventually lead to the modern theory of plate tectonics. -Differentiate between plate tectonics and continental drift. -Identify the standard geologic features or events that occur at each of the boundaries (e.g., oceanic trenches are formed at converging plate boundaries, oceanic ridges form at diverging plate boundaries). -Use physical maps, cross sections, models (virtual or 3D) and data to identify plate boundaries, movement at the boundary and the resulting feature or event. -Explore the relationship between heat from Earth's core, convection in the magma and plate movement. -Investigate world distribution of tectonic activity of possible interest (e.g., Ring of Fire, San Andreas Fault, Mid-Atlantic Ridge, Mariana Trench, Hawaiian Islands, New Madrid Fault System).	• Tectonic plate • Crust • Magma • Sea floor spreading • Continental drift • Theory of plate tectonics • Convection theory • Diverging plate boundary • Converging plate boundary • Ring of Fire • Wegener • Oceanic ridges • Hess • Major tectonic plates • Oceanic trenches • Physical maps • San Andreas Fault • Holmes • Magellan • Mid-Atlantic Ridge • New Madria Fault System • Mariana Trench • Convection • Cross section • Deitz • Hawaiian Islands • Minor tectonic plates

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	Content Statement	I Can…	Key Vocabulary
Physical Earth (ESS)	3. A combination of constructive and destructive geologic processes formed Earth's surface.	-Identify examples of destructive geologic processes (e.g., flooding, mass wasting, volcanic activity, glacial movement, earthquakes, tsunamis). -Describe the characteristics of rocks and soil, climate, location, topography and geologic processes. -Explain the interactions between the hydrosphere and lithosphere as they relate to erosional events (e.g., flooding, mass wasting). -Distinguish between major geologic processes (e.g., tectonic activity, erosion, deposition) and the resulting feature on Earth's surface. -Use topographic, physical and aerial maps, cross-sections, field trips, virtual settings and other technologies to demonstrate the structure and formation of the features on the Earth's surface. -Study factors that affect the patterns and features associated with streams and floodplains (e.g., discharge rates, gradients, velocity, erosion, deposition), glaciers (e.g., moraines, outwash, tills, erratic, kettles, eskers), tectonic activity, coastlines, flooding and deserts. -Use technology (remote sensing, satellite data, LANDSAT) to access real-time photographs and graphic related to landforms and features.	• Constructive geologic processes • Destructive geologic processes • Hydrosphere • Lithosphere • Erosional events • Topography • Erosion • Deposition • Floodplains • Discharge rates • Gradients • Velocity • Moraines • Outwash • Tills • Erratic • Kettles • Eskers • Remote sensing • LANDSAT • Tsunamis • Mass wasting • Major geologic process • Physical maps • Aerial maps • Cross sections • Glaciers • Tectonic activity • Topographic maps

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	Content Statement	I Can…	Key Vocabulary
hysical Earth (ESS)	4. Evidence of the dynamic changes of Earth's surface through time is found in the geologic record. **NOTE**: Environmental and climate conditions also can be documented through the cryosphere as seen through ice cores. **NOTE**: The representation of the age of the Earth must include a graphic demonstration of the immensity of geologic time, as this is a very difficult concept to grasp. **NOTE**: The inclusion of new advances and studies (mainly due to developing technological advances) is important in learning about the geologic record.	-Describe the methods used by scientists to determine that the age of Earth is approximately 4.6 billion years. -Recognize the immensity of the geologic time scale. -Use superposition, crosscutting relationships and index fossils to understand relative age. -Describe radiometric dating and its role in absolute age. -Explain how uniformitarianism has helped scientists interpret the environmental conditions that existed throughout Earth's history. -Describe how scientists use fossil evidence to indicate specific environments and climate conditions that help interpret the geologic record. -Use ice core sampling and evidence from the geologic record to relate climate history to present-day climate issues. -Use actual data to generate geologic maps of local or statewide formations. -Use field studies and/or geologic research to identify local formations and the environment that existed at the time of the formation. -Analyze and interpret data to draw conclusions about geologic history.	• Geologic record • Relative age • Absolute age • Superposition • Crosscutting relationships • Index fossils • Cryosphere • Ice cores • Uniform-itarianism • Radiometric dating • Geologic time scale • Ice core sampling • Geologic maps • Geologic history

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	Content Statement	I Can…	Key Vocabulary
Species and Reproduction (LS)	5. Reproduction is necessary for the continuation of every species. **NOTE**: It is important that both mitosis and meiosis are addressed in preparation for future study of Mendelian genetics and embryology.	-Recognize that reproduction is necessary for the continuation of every species. -Compare the end products of mitotic and meiotic cell divisions as they relate to asexual and sexual reproduction. -Investigate and compare offspring to parents in sexual and asexual reproduction. -Describe the features of sexual and asexual reproduction. -Explain why genetic variation is a survival advantage.	• Sexual reproduction • Asexual reproduction • Mitosis • Meiosis • Genetic variation • Off-springs • Mitotic cell divisions • Meiotic cell divisions
	6. Diversity of species occurs through gradual processes over many generations. Fossil records provide evidence that changes have occurred in number and types of species. **NOTE**: Population genetics and the ability to use statistical mathematics to predict changes in a gene pool are reserved for grade 10. **NOTE**: Molecular clocks are not appropriate at this grade level. **NOTE**: The term "transitional form" should be used to describe parts of the fossil record that are incomplete.	-Describe how to determine the relative age of fossils found in sedimentary rock. -Create a timeline that illustrates the relative ages of fossils of a particular organism in sedimentary rock layers. -Explain why variation within a population can be advantageous for a population of organisms. -Compare and contrast the ability of an organism to survive under different environmental conditions. -Use data and evidence from the fossil record to develop further concepts of extinction, biodiversity and the diversity of species. -Understand that the fossil record documents the variation in a species that may have resulted from changes in the environment. -Explain how diversity can result from sexual reproduction. -Use evidence from geologic and fossil records to infer what the environment was like a time of deposition. -Explain how and why variations in appearance and behavior of an organism can be very different from their ancestors.	• Diversity of species • Biodiversity • Variation • Fossil record • Geologic record • Extinction • Sedimentary rock • Deposition • Sexual reproduction • Transitional form • Relative age • Fossils • Ancestors

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	Content Statement	I Can…	Key Vocabulary
Species and Reproduction (LS)	7. The characteristics of an organism are a result of inherited traits received from parent(s). **NOTE**: Myxobacteria reproduce by spore formation and streptomyces bacteria reproduce by budding. **NOTE**: Incomplete dominance is not suggested for this grade level to help avoid the misconception of "blending of traits." Codominance is encouraged because both traits are expressed in the resulting offspring. **NOTE**: The focus should be the link between DNA and traits without being explicit about the mechanisms involved. **NOTE**: The ways in which bacteria reproduce is beyond the scope of this content statement. **NOTE**: The molecular structure of DNA is not appropriate at this grade level.	-Describe how genes, chromosomes and inherited traits are connected. -Describe the characteristics and transfer of dominant and recessive traits. -Compare the exchange of genetic information during sexual and asexual reproduction. -Use a Punnett square to predict the genetic outcome of the offspring produced. -Understand that traits are determined by instructions encoded in DNA, which forms genes. -Demonstrate Mendel's two laws (Law of Segregation, Law of Independent Assortment) in a variety of organisms. -Investigate dominant, recessive, and co-dominant traits. -Conduct a pedigree analysis limited to dominant, recessive, or co-dominance of one trait. -Conduct a long-term investigation to analyze and compare characteristics passed on from parent to offspring through sexual and asexual reproduction. -Ask questions about the phenotypes that appear in the resulting generations and what they infer about genotypes of the offspring.	• Inherited traits • Spore • Budding • Codominance • Genes • DNA • Asexual reproduction • Sexual reproduction • Chromosomes • Dominant trait • Recessive trait • Punnett square • Offspring • Mendel • Law of Segregation • Law of Independent Assortment • Pedigree analysis • Phenotype • Genotype • Myxobacteria • Streptomyces bacteria • Traits • Genetic information

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	Content Statement	I Can…	Key Vocabulary
Forces and Motion (PS)	8. Forces between objects act when the objects are in direct contact or when they are not touching. **NOTE**: Magnetic poles are often confused with electric charges. It is important to emphasize the differences. **NOTE**: Mathematics is not used to describe fields at this level. **NOTE**: This content statement involves a basic introduction to the field model. Details about the field model are not required other than the idea that a field is a concept that is used to understand forces that act at a distance.	-Build an electromagnet to investigate magnetic properties and fields. -Recognize that the electrical force increases as the electrical charges increase. -Recognize that the electrical force decreases when the distance between the charges increases. -Given a simple interaction between two objects that are not touching (e.g., a ball falling to the ground, a magnet and a steel cabinet, hair and brush experiencing static), identify the objects involved in the interaction and give the direction of the force on each object. -Use the field model to explain why an apple will fall toward Earth. -Represent the effect of charges and distance on electrical forces graphically. -Explain how mass affects gravitational forces on objects. -Demonstrate the difference between mass and weight. -Explain how generators and motors produce their own magnetic field when an electric current flows through it. -Use field model to explain how 2 objects can exert forces on each other without touching. -Explain how distance affects strength of a magnetic field. -Explain how objects attract and repell each other in a electric field, magnetic field and gravitational field.	• Force • Field model • Electric field • Magnetic field • Mass • Weight • Electromagnet • Generator • Motor • Electric charge • Gravitational force • Magnetic properties • Gravitational field • Charge • Electrical force • Magnetic poles

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	Content Statement	I Can…	Key Vocabulary
Forces and Motion(PS)	9. Forces have magnitude and direction. **NOTE**: The concept of fields for objects that exert forces without touching is introduced at this grade level. **NOTE**: The content description states that there will be acceleration when "the net force is greater than zero." When positive and negative values are used to represent the direction of forces, this statement will need to be expanded. Any nonzero net force, including a negative net force, also may result in a change in speed or direction (acceleration).	-Create a force diagram to represent the forces acting on an object. -Describe the motion of an object based on different reference points (e.g., a pencil held in someone's hand may appear to be at rest, but to an observer in a car speeding by, the pencil may appear to be moving backward). -Recognize that an unbalanced force acted on an object changes that object's speed and/or direction. -Recognize that free fall results from the gravitational attraction between Earth and an object. -Predict the combined effect of several forces on an object at rest or an object moving in a straight line (e.g., speed up, slow down, turn left, turn right). -Investigate what happens to a stationary object when its net force equals zero. -Investigate what happens to a moving object when its net force equals zero. -Investigate what happens to a stationary object when its net force does not equal zero. -Investigate what happens to a moving object when its net force does not equal zero. -Experiment with kinetic friction and drag by using an object that has limited friction (e.g., a puck on an air hockey table, dry ice on a surface).	• Force • Magnitude • Reference point • Net force • Force diagram • Unbalanced force • Kinetic friction • Drag • Acceleration • Free fall • Gravitational attraction

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	Content Statement	I Can…	Key Vocabulary
Forces and Motion (PS)	10. There are different types of potential energy. **NOTE**: Potential energy is often taught as "stored" energy. If the word "stored" means that it is kept by the object and not given away to another object, then kinetic energy also can be classified as "stored" energy. A rocket moving at constant speed through space has kinetic energy and is not transferring any of this energy to another object.	-Investigate to determine how height and mass of an object affect gravitational potential energy. -Experiment with an object to change its elastic potential energy. -Experiment with the different types of potential energy (gravitational potential, elastic potential, chemical potential, chemical potential, electrical potential and magnetic potential) to explore the relationship of energy transfer and springs, magnets or static electricity. -Describe the different types of potential energy. -Recognize that rearranging atoms into new positions to form new substances (chemical reaction) is evidence that the chemical potential energy has most likely changed.	• Gravitational potential energy • Elastic potential energy • Chemical potential energy • Chemical reaction • Electrical potential energy • Magnetic potential energy • Potential energy • Static electricity

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