The Kansas high school science assessment consists of two halves (Life Science and Physical Science). Both halves of the science assessment include Earth/Space Science (ESS) indicators. Since an ESS course is not available at all high schools and/or may not be a required course in all schools, an alternative for ESS standard incorporation is provided below. This alternative is an alignment of ESS standards, benchmarks, and indicators in courses beyond ESS and has been designed to ensure ESS concepts can be covered through eighth grade integrated science, biology, and physical science (physics and/or chemistry) courses. This alternative is strictly a recommendation. There are two formats of this alternative below; one with a vocabulary list and one without.

ESS Standards recommended to be taught in 8th grade/ Life Science/ Physical Science	
8th Grade	Life Science
4.1.1 (Mastered) Understands constructive and destructive processes, including weathering, erosion and deposition, dynamically reshape the surface of the earth. a. The rock cycle describes constructive and destructive processes that change the forms of rocks and soil (solid earth). b. Water, glaciers, winds, waves, and gravity are weathering and erosion agents.	x
4.1.2 a, c (Mastered) ▲ Understands the theory of Plate Tectonics explains that internal energy drives the earth's ever changing structure. a. Movable continental and oceanic plates make up earth's surface; the hot, convecting mantle is the energy source for plate movement. c. Convection circulation in the mantle is driven by the outward transfer of earth's internal heat.	x
4.1.3 The ultimate source of atmospheric and oceanic energy comes from the sun. Energy flow drives global climate and weather. Climate and weather are influenced by geographic features, cloud cover, and earth's rotation. a. Energy from the sun heats the oceans and the atmosphere, and drives oceanic and atmospheric circulation. d. Weather patterns and seasonal weather change are multi-variable phenomena. f. Weather in the troposphere redistributes water on the surface of the earth through the water cycle. i. Concepts and skills include basic weather forecasting, weather maps, fronts, pressure systems, severe storms and safety precautions.	4.1.3 The ultimate source of atmospheric and oceanic energy comes from the sun. Energy flow drives global climate and weather. Climate and weather are influenced by geographic features, cloud cover, and earth's rotation. b. Human activity impacts global climate. Example: Burning of fossil fuels produces ground level ozone that hinders plant growth. c. The composition and structure of earth's atmosphere is a factor in the earth's suitability to support life. e. Biogeochemical cycles are an example of the integration of earth, physical, and biological science concepts. g. The ozone layer in the upper stratosphere filters UV radiation which is harmful to living things.

	h. Gamma radiation and other high energy radiation from the sun is filtered by the upper atmosphere.
8th Grade	Life Science
4.2.1 b, e ▲ Understands geological time is used to understand the earth's past. b. Earth changes can be short term (during a human's lifetime), such as earthquakes and volcanic eruptions, or long term (over a geological time scale), such as mountain building and plate movements. e. Matching coastlines, similarities in rock types, similarities in fossils and life forms suggest that today's continents are separated parts of what was long ago a single continent.	4.2.1 a, c, d, e ▲ Understands geological time is used to understand the earth's past. a. Radioactive dating and relative dating (i.e. stratigraphy, fossils) are used to estimate the time rocks were formed. c. The earth's atmosphere has changed over time. For example: The dramatic changes in earth's atmosphere (i.e. introduction of O2) which were affected by the emergence of life on earth. d. Relates geologic evidence to a record of earth's historye. Matching coastlines, similarities in rock types, similarities in fossils and life forms suggest that today's continents are separated parts of what was long ago a single continent. e. Matching coastlines, similarities in rock types, similarities in fossils and life forms suggest that today's continents are separated parts of what was long ago a single continent.
Physical Science	
4.1.2 b, d, e (Mastered) ▲ Understands the theory of Plate Tectonics explains that internal energy drives the earth's ever changing structure. b. Essentially all energy on earth originates with the sun, is generated by radioactive decay in earth's interior, or is left over from earth's formation. d. Systems on earth's surface are powered principally by the sun and contain an essentially fixed amount of each stable chemical atom or element. e. Rocks, water, CO2/ O2, carbon and other nutrients cycle through different forms as a result of cycle biological and geologic processes.	
4.3.1 Understands gravitational attraction of objects in the solar system keeps solar system objects in orbit. a. Kepler's laws describe planetary motion. b. Newton's laws of inertia and gravity explain orbital motion. c. Because of the sun's large mass, the sun is the primary gravitational force in the solar system.	

4.3.2 ▲ Understands the relationship between the earth, moon, and sun explains the seasons, tides and moon phases. a. The angle of incidence of solar energy striking earth's surface effect the amount of heat energy absorbed at earth's surface. b. The gravitational relationship between the earth, moon, and sun causes tides.
4.3.3 Understands the relative sizes and distances of objects in the solar system.
4.3.4 Understands the sun, earth, and other objects in the solar system formed from a nebular cloud of dust and gas.
4.4.1 ▲ Understands stellar evolution. a. Condensation of gases, due to gravity, is a foundation for the formation of stars b. The life cycle of the star begins with the nebula, which contains mostly hydrogen and helium. Heavier elements were, and continue to be, made by the nuclear fusion reactions in stars. c. The Hertzsprung-Russell (H-R) diagram is used to classify stars. The sun is a main sequence star. d. Stars are classified by their color, temperature, age, apparent brightness and distance from earth.
4.4.2 Understands the current scientific explanation of the origin and structure of the universe. a. The formation of the universe began with an expansion of gases from a hot, dense state. By studying the light emitted from distant galaxies, it has been found that galaxies are moving apart from one another. b. The red shift of light, within the Doppler effect, emitted by distance galaxies supports the conclusion that the universe is expanding. c. Galaxies are a level of organization of the universe. There are at least 100 billion galaxies in the observable universe. Galaxies are organized into superclusters with large voids between them. d. The sun is a second-generation star, which, along with our galaxy (The Milky Way which includes about 100 billion stars) formed billions of years after the Big Bang.
4.4.3 Understand how the tools of astronomy have revolutionized the study of the universe. a. Current telescopes can measure across the Electromagnetic-Spectrum. b. Spectral analysis is used to determine chemical composition and energy of stars. c. Relative mass of objects can be determined by observing motion of objects in space and the effect one object's gravity has on another. d. The tools and skills of astronomers have changed through time: ancient astronomy (Stonehenge, Greeks, Chinese, Aristotle) through modern astronomy (Copernicus to present). e. Astronomical tools and skills allow astronomers to research phenomena and objects that cannot be observed and measured directly.

ESS Standards recommended to be taught in 8th grade/ Life Science/ Physical Science	
8th Grade	**Vocabulary**
4.1.1 (Mastered) Understands constructive and destructive processes, including weathering, erosion and deposition, dynamically reshape the surface of the earth. a. The rock cycle describes constructive and destructive processes that change the forms of rocks and soil (solid earth). b. Water, glaciers, winds, waves, and gravity are weathering and erosion agents.	o Constructive process o Destructive process o Weathering o Erosion o Deposition o Rock cycle
4.1.2 a, c (Mastered) ▲ Understands the theory of Plate Tectonics explains that internal energy drives the earth's ever changing structure. a. Movable continental and oceanic plates make up earth's surface; the hot, convecting mantle is the energy source for plate movement. c. Convection circulation in the mantle is driven by the outward transfer of earth's internal heat.	o Plate tectonics o Convection circulation o Mantle o Convection currents o Continental drift o Seismic activity o Convergent plate boundary o Divergent plate boundary o Transform or slip
4.1.3 ▲ The ultimate source of atmospheric and oceanic energy comes from the sun. Energy flow drives global climate and weather. Climate and weather are influenced by geographic features, cloud cover, and earth's rotation. a. Energy from the sun heats the oceans and the atmosphere, and drives oceanic and atmospheric circulation. d. Weather patterns and seasonal weather change are multi-variable phenomena. f. Weather in the troposphere redistributes water on the surface of the earth through the water cycle. i. Concepts and skills include basic weather forecasting, weather maps, fronts, pressure systems, severe storms and safety precautions.	o Weather patterns o Seasons o Atmospheric layers o Fronts o Pressure systems

4.1.4 (Mastered) * Understands the processes of water cycling through surface water (oceans, lakes, streams, glaciers), ground water (aquifers), and the atmosphere. (hydrological cycle). a. Processes of evaporation, condensation, precipitation, transpiration, runoff, and filtration move water through the water cycle. b. Weather in the troposphere redistributes water on the surface of the earth through the water cycle. c. Ground water is stored in aquifers and moved through underground streams. d. Water in the atmosphere is in the form of water vapor and clouds.	o Water (hydrologic) cycle o Groundwater (aquifers) o Surface water o Atmosphere o Evaporation o Condensation o Precipitation o Transpiration o Runoff o Filtration
4.2.1 b, e ▲ Understands geological time is used to understand the earth's past. b. Earth changes can be short term (during a human's lifetime), such as earthquakes and volcanic eruptions, or long term (over a geological time scale), such as mountain building and plate movements. e. Matching coastlines, similarities in rock types, similarities in fossils and life forms suggest that today's continents are separated parts of what was long ago a single continent.	o Geological time scale
Life Science	**Vocabulary**
4.1.3 The ultimate source of atmospheric and oceanic energy comes from the sun. Energy flow drives global climate and weather. Climate and weather are influenced by geographic features, cloud cover, and earth's rotation. b. Human activity impacts global climate. Example: Burning of fossil fuels produces ground level ozone that hinders plant growth. c. The composition and structure of earth's atmosphere is a factor in the earth's suitability to support life. e. Biogeochemical cycles are an example of the integration of earth, physical, and biological science concepts. g. The ozone layer in the upper stratosphere filters UV radiation which is harmful to living things. h. Gamma radiation and other high energy radiation from the sun are filtered by the upper atmosphere.	o Global climate o Biogeochemical cycles o Ozone layer

4.2.1 a, c, d, e ▲ Understands geological time is used to understand the earth's past. a. Radioactive dating and relative dating (i.e. stratigraphy, fossils) are used to estimate the time rocks were formed. c. The earth's atmosphere has changed over time. For example: The dramatic changes in earth's atmosphere (i.e. introduction of O2) which were affected by the emergence of life on earth. d. Relates geologic evidence to a record of earth's historye. Matching coastlines, similarities in rock types, similarities in fossils and life forms suggest that today's continents are separated parts of what was long ago a single continent. e. Matching coastlines, similarities in rock types, similarities in fossils and life forms suggest that today's continents are separated parts of what was long ago a single continent.	o Geologic time o Radioactive dating o Relative dating o Radioactive decay o Geological time scale o Mass Extinction o Glaciation o Climatic changes o Principle of superposition

Physical Science	Vocabulary
4.1.2 b, d, e (Mastered) ▲ Understands the theory of Plate Tectonics explains that internal energy drives the earth's ever changing structure. b. Essentially all energy on earth originates with the sun, is generated by radioactive decay in earth's interior, or is left over from earth's formation. d. Systems on earth's surface are powered principally by the sun and contain an essentially fixed amount of each stable chemical atom or element. e. Rocks, water, CO_2/O_2, carbon and other nutrients cycle through different forms as a result of cycle biological and geologic processes.	o Rock cycle o Water cycle o CO_2/O_2 cycle o Carbon cycle o Nutrient cycle o Radioactive decay
4.3.1 Understands gravitational attraction of objects in the solar system keeps solar system objects in orbit. a. Kepler's laws describe planetary motion. b. Newton's laws of inertia and gravity explain orbital motion. c. Because of the sun's large mass, the sun is the primary gravitational force in the solar system.	o Gravitational force o Kepler's Laws of Planetary Motion o Orbital motion
4.3.2 ▲ Understands the relationship between the earth, moon, and sun explains the seasons, tides and moon phases. a. The angle of incidence of solar energy striking earth's surface effect the amount of heat energy absorbed at earth's surface. b. The gravitational relationship between the earth, moon, and sun causes tides.	o Seasons o Tides o Moon phases (new, crescent, waxing, waning, new, old, first, third, quarter, gibbous, full) o Lunar eclipse o Solar eclipse o Earth o Moon o Sun o Angle of incidence
4.3.3 Understands the relative sizes and distances of objects in the solar system.	
4.3.4 Understands the sun, earth, and other objects in the solar system formed from a nebular cloud of dust and gas.	

4.4.1 ▲ Understands stellar evolution. a. Condensation of gases, due to gravity, is a foundation for the formation of stars b. The life cycle of the star begins with the nebula, which contains mostly hydrogen and helium. Heavier elements were, and continue to be, made by the nuclear fusion reactions in stars. c. The Hertzsprung-Russell (H-R) diagram is used to classify stars. The sun is a main sequence star. d. Stars are classified by their color, temperature, age, apparent brightness and distance from earth.	o Stellar evolution o Nebula o Hertzsprung-Russell (H-R) diagram o Brightness – apparent o Nuclear fusion o Main sequence o Giants o Dwarfs
4.4.2 Understands the current scientific explanation of the origin and structure of the universe. a. The formation of the universe began with an expansion of gases from a hot, dense state. By studying the light emitted from distant galaxies, it has been found that galaxies are moving apart from one another. b. The red shift of light, within the Doppler effect, emitted by distance galaxies supports the conclusion that the universe is expanding. c. Galaxies are a level of organization of the universe. There are at least 100 billion galaxies in the observable universe. Galaxies are organized into superclusters with large voids between them. d. The sun is a second-generation star, which, along with our galaxy (The Milky Way which includes about 100 billion stars) formed billions of years after the Big Bang.	o Doppler Effect o Red shift o Clusters o Superclusters o Levels of organization (sun, solar system, galaxy, cluster, supercluster, universe) o Big Bang theory
4.4.3 Understand how the tools of astronomy have revolutionized the study of the universe. a. Current telescopes can measure across the Electromagnetic-Spectrum. b. Spectral analysis is used to determine chemical composition and energy of stars. c. Relative mass of objects can be determined by observing motion of objects in space and the effect one object's gravity has on another. d. The tools and skills of astronomers have changed through time: ancient astronomy (Stonehenge, Greeks, Chinese, Aristotle) through modern astronomy (Copernicus to present). e. Astronomical tools and skills allow astronomers to research phenomena and objects that cannot be observed and measured directly.	o Telescope o Spectral analysis o Galaxies o Electromagnetic-Spectrum o Space shuttle o Space probe o Space station