

# Earth and Space K-12 Vertical Alignment



Topic	Kinder §112.2	1st §112.3	2nd §112.4	3rd §112.5	4th §112.6	5th §112.7	6th §112.26	7th §112.27	8th §112.28	Biology §112.42	IPC §112.44	Chemistry §112.43	Physics §112.45	Earth Systems §112.49	Environmental Science §112.50	Aquatic Science §112.47	Astronomy §112.48	
Day and Night	K.9.A identify, describe, and predict the patterns of day and night and their observable characteristics;					5.9.A demonstrate that Earth rotates on its axis once approximately every 24 hours and explain how that causes the day/night cycle and the appearance of the Sun moving across the sky, resulting in changes in shadow positions and shapes.												<p>Astro.9.A observe, record, and analyze the apparent movement of the Sun, Moon, and stars and predict sunrise and sunset;</p> <p>Astro.9.B predict how changing latitudinal position affects the length of day and night throughout a planet's orbital year;</p>
Observing Objects in the Sky	K.9.B observe, describe, and illustrate the Sun, Moon, stars, and objects in the sky such as clouds.		2.9.B observe objects in the sky using tools such as a telescope and compare how objects in the sky are more visible and can appear different with a tool than with an unaided eye.															<p>Astro.5.A evaluate and communicate how ancient civilizations developed models of the universe using astronomical structures, instruments, and tools such as the astrolabe, gnomons, and charts and how those models influenced society, time keeping, and navigation;</p> <p>Astro.5.C describe and explain the historical origins of the perceived patterns of constellations and the role of constellations in ancient and modern navigation.</p> <p>Astro.6.C identify constellations such as Ursa Major, Ursa Minor, Orion, Cassiopeia, and constellations along the ecliptic and describe their importance;</p> <p>Astro.10.B calculate the relative light-gathering power of different-sized telescopes to compare telescopes for different applications;</p> <p>Astro.10.C analyze the importance and limitations of optical, infrared, and radio telescopes, gravitational wave detectors, and other ground-based technology;</p> <p>Astro.10.D analyze the importance and limitations of space telescopes in the collection of astronomical data across the electromagnetic spectrum.</p>
Seasons	K.10.B observe and describe weather changes from day to day and over seasons;	1.9.A The student is expected to describe and predict the patterns of seasons of the year such as order of occurrence and changes in nature.			4.9.A collect and analyze data to identify sequences and predict patterns of change in seasons such as change in temperature and length of daylight;		6.9.A model and illustrate how the tilted Earth revolves around the Sun, causing changes in seasons;											<p>Astro.9.A examine the relationship of a planet's axial tilt to its potential seasons;</p>
			2.9.A describe the Sun as a star that provides light and heat and explain that the Moon reflects the Sun's light;															<p>Astro.12.A identify the approximate mass, size, motion, temperature, structure, and composition of the Sun;</p>

Characteristics of the Sun																	<p>Astro.12.B distinguish between nuclear fusion and nuclear fission and identify the source of energy within the Sun as nuclear fusion of hydrogen to helium;</p> <p>Astro. 12. C describe the eleven-year solar cycle and the significance of sunspots;</p> <p>Astro.12.D analyze the origins and effects of space weather, including the solar wind, coronal mass ejections, prominences, flares, and sunspots.</p>
Sun, Earth, and Moon Relationship				<p>3.9.A construct models and explain the orbits of the Sun, Earth, and Moon in relation to each other;</p>	<p>4.9.B collect and analyze data to identify sequences and predict patterns of change in the observable appearance of the Moon from Earth.</p>		<p>6.9.B describe and predict how the positions of the Earth, Sun, and Moon cause daily, spring, and neap cycles of ocean tides due to gravitational forces.</p>	<p>7.9.C analyze the characteristics of Earth that allow life to exist such as the proximity of the Sun, presence of water, and composition of the atmosphere.</p>									<p>Astro.8.A model how the orbit and relative position of the Moon cause lunar phases and predict the timing of moonrise and moonset during each phase;</p> <p>Astro.8.B model how the orbit and relative position of the Moon cause lunar and solar eclipses;</p> <p>Astro.8.C examine and investigate the dynamics of tides using the Sun, Earth, and Moon model.</p> <p>Astro.9.C investigate the relationship between a planet's axial tilt, angle of incidence of sunlight, and concentration of solar energy;</p> <p>Astro. 9.D explain the significance of Earth's solstices and equinoxes.</p> <p>Astro.11.D compare the factors essential to life on Earth such as temperature, water, gases, and gravitational and magnetic fields to conditions on other planets and their satellites.</p>
				<p>3.9.B identify the order of the planets in Earth's solar system in relation to the Sun.</p>				<p>7.9.A describe the physical properties, locations, and movements of the Sun, planets, moons, meteors, asteroids, comets, Kuiper belt, and Oort cloud;</p>					<p>Earth.5.B identify comets, asteroids, meteoroids, and planets in the solar system and describe how they affect the Earth and Earth's systems;</p>				<p>Astro.6.B observe the movement of planets throughout the year and measure how their positions change relative to the constellations;</p> <p>Astro.7.A demonstrate the use of units of measurement in astronomy, including astronomical units and light years, minutes, and seconds;</p> <p>Astro.7.B model the scale, size, and distances of the Sun, Earth, and Moon system and identify the limitations of physical models;</p> <p>Astro.7.C model the scale, sizes, and distances of the Sun and the planets in our solar system and identify the limitations of physical models.</p>

Solar System Components Positions and Locations																		<p>Astro.11.A relate Newton's law of universal gravitation and Kepler's laws of planetary motion to the formation and motion of the planets and their satellites;</p> <p>Astro.11.B explore and communicate the origins and significance of planets, planetary rings, satellites, asteroids, comets, Oort cloud, and Kuiper belt objects;</p> <p>Astro.11.C compare the planets in terms of orbit, size, composition, rotation, atmosphere, natural satellites, magnetic fields, and geological activity;</p> <p>Astro.13.G illustrate how astronomers use geometric parallax to determine stellar distances and intrinsic luminosities;</p> <p>Astro.13.H describe how stellar distances are determined by comparing apparent brightness and intrinsic luminosity when using spectroscopic parallax and the Leavitt relation for variable stars.</p> <p>Astro.15.B evaluate the limits of observational astronomy methods used to formulate the distance ladder;</p> <p>Astro.16.C evaluate the evidence of the existence of habitable zones and potentially habitable planetary bodies in extrasolar planetary systems;</p>
Stars									8.9.A describe the life cycle of stars and compare and classify stars using the Hertzsprung-Russell diagram;				Earth.5A analyze how gravitational condensation of solar nebular gas and dust can lead to the accretion of planetesimals and protoplanets;					<p>Astro.13.A identify the characteristics of main sequence stars, including surface temperature, age, relative size, and composition;</p> <p>Astro.13.B describe and communicate star formation from nebulae to protostars to the development of main sequence stars;</p> <p>Astro.13.C evaluate the relationship between mass and fusion on stellar evolution;</p> <p>Astro.13.D compare how the mass of a main sequence star will determine its end state as a white dwarf, neutron star, or black hole;</p> <p>Astro.13.E describe the use of spectroscopy in obtaining physical data on celestial objects such as temperature, chemical composition, and relative motion;</p>



Theories of Origins																Earth.6.D evaluate scientific hypotheses for the origin of life through abiotic chemical processes;				
Rocks	K.10.A describe and classify rocks by the observable properties of size, shape, color, and texture;				4.11.C determine the physical properties of rocks that allow Earth's natural resources to be stored there.	5.10.B model and describe the processes that led to the formation of sedimentary rocks and fossil fuels;	6.10.C describe how metamorphic, igneous, and sedimentary rocks form and change through geologic processes in the rock cycle.									Earth.7.E describe how evidence of biozones and faunal succession in rock layers reveal information about the environment at the time those rocks were deposited and the dynamic nature of the Earth;				
																Earth.7.A describe the development of multiple radiometric dating methods and analyze their precision, reliability, and limitations in calculating the ages of igneous rocks from Earth, the Moon, and meteorites;				
Soil		1.10.A investigate and document the properties of particle size, shape, texture, and color and the components of different types of soils such as topsoil, clay, and sand;		3.10.B investigate and explain how soils such as sand and clay are formed by weathering of rock and by decomposition of plant and animal remains; and													Env.10.A identify sources of emissions in air, soil, and water, including point and nonpoint sources;			
Hydrosphere		1.10.C compare the properties of puddles, ponds, streams, rivers, lakes, and oceans, including color, clarity, size, shape, and whether it is freshwater or saltwater;			4.10.A describe and illustrate the continuous movement of water above and on the surface of Earth through the water cycle and explain the role of the Sun as a major source of energy in this process;	5.10.A explain how the Sun and the ocean interact in the water cycle and affect weather;	7.11.B describe human dependence and influence on ocean systems and explain how human activities impact these systems.									Earth.9.D evaluate how weather and human activity affect the location, quality, and supply of available freshwater resources.	Env.6.B relate how water sources, management, and conservation affect water uses and quality;	Aqua.10.C analyze water quantity and quality in a local watershed or aquifer;		
							7.11.A analyze the beneficial and harmful influences of human activity on groundwater and surface water in a watershed;									Earth.10.A describe how the composition and structure of the oceans leads to thermohaline circulation and its periodicity;	Env.10.A identify sources of emissions in air, soil, and water, including point and nonpoint sources;	Aqua.12.A differentiate among freshwater, brackish, and marine ecosystems;		
															Earth.9.B investigate and model how surface water and ground water change the lithosphere through chemical and physical weathering and how they serve as valuable natural resources;		Aqua.12.B identify the major properties and components of different marine and freshwater life zones.			
															Earth.10.B model and explain how changes to the composition, structure, and circulation of deep oceans affect thermohaline circulation using data on energy flow, ocean basin structure, and changes in polar ice caps and glaciers;		Aqua.10.A identify sources of water in a watershed, including rainfall, groundwater, and surface water;			



Resource Management		1.11.C describe ways to conserve water such as turning off the faucet when brushing teeth and protect natural sources of water such as keeping trash out of bodies of water.		3.11.C identify ways to conserve natural resources through reducing, reusing, or recycling.			6.11.B explain how conservation, increased efficiency, and technology can help manage air, water, soil, and energy resources.							Earth.13.B explore global and Texas-based careers that involve the exploration, extraction, production, use, disposal, regulation, and protection of Earth's resources.	Env.6.A compare and contrast land use and management methods and how they affect land attributes such as fertility, productivity, economic value, and ecological stability Env.12.A evaluate cost-benefit trade-offs of commercial activities such as municipal development, food production, deforestation, over-harvesting, mining, and use of renewable and non-renewable energy sources; Env.12.B evaluate the economic impacts of individual actions on the environment such as overbuilding, habitat destruction, poaching, and improper waste disposal; Env.12.C analyze how ethical beliefs influence environmental scientific and engineering practices such as methods for food production, water distribution, energy production, and the extraction of minerals;		
Earth's Changing Surface		1.10.B investigate and describe how water can move rock and soil particles from one place to another;	2.10.A investigate and describe how wind and water move soil and rock particles across the Earth's surface such as wind blowing sand into dunes on a beach or a river carrying rocks as it flows;	3.10.C model and describe rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides.	4.10.B model and describe slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice;	5.10.C model and identify how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including deltas, canyons, and sand dunes.	7.10.A describe the evidence that supports that Earth has changed over time, including fossil evidence, plate tectonics, and superposition;						Earth.9.C model the processes of mass wasting, erosion, and deposition by water, wind, ice, glaciation, gravity, and volcanism in constantly reshaping Earth's surface; Earth.12.A evaluate the impact on humans of natural changes in Earth's systems such as earthquakes, tsunamis, and volcanic eruptions; Earth.9.A interpret Earth surface features using a variety of methods such as satellite imagery, aerial photography, and topographic and geologic maps using appropriate technologies;		Aqua.11.D describe how erosion and deposition in river systems lead to formation of geologic features;		
Climate					4.10.C differentiate between weather and climate.				8.10.A describe how energy from the Sun, hydrosphere, and atmosphere interact and influence weather and climate;		IPC.8.D construct and communicate an evidence-based explanation of the environmental impact of the end-products of chemical reactions such as those that may result in degradation of water, soil, air quality, and global climate change.		Earth.11.A analyze how energy transfer through Milankovitch cycles, albedo, and differences in atmospheric and surface absorption are mechanisms of climate; Earth.11.G describe how changing surface-ocean conditions, including El Niño-Southern Oscillation, affect global weather and climate patterns.	Env.10.E distinguish between the causes and effects of global warming and ozone depletion, including the causes, the chemicals involved, the atmospheric layer, the environmental effects, the human health effects, and the relevant wavelengths on the electromagnetic spectrum (IR and UV). Env.9.D describe how temperature inversions have short-term and long-term effects, including El Niño and La Niña oscillations, ice cap and glacial melting, and changes in ocean surface temperatures; and			

								8.11.B use scientific evidence to describe how human activities, including the release of greenhouse gases, deforestation, and urbanization, can influence climate;					Earth.11.D evaluate how the combination of multiple feedback loops alter global climate;	Env.9.E analyze the impact of natural global climate change on ice caps, glaciers, ocean currents, and surface temperatures.
													Earth.11.E investigate and analyze evidence for climate changes over Earth's history using paleoclimate data, historical records, and measured greenhouse gas levels;	
													Earth.11.C model how greenhouse gases trap thermal energy near Earth's surface;	
Earth's Layers							6.10.B model and describe the layers of Earth, including the inner core, outer core, mantle, and crust;						Earth.7.B apply relative dating methods, principles of stratigraphy, and index fossils to determine the chronological order of rock layers;	
													Earth.8.D describe how heat and rock composition affect density within Earth's interior and how density influences the development and motion of Earth's tectonic plates;	
													Earth.6.A describe how impact accretion, gravitational compression, radioactive decay, and cooling differentiated proto-Earth into layers;	
													Earth.8.B develop a model of the physical, mechanical, and chemical composition of Earth's layers using evidence from Earth's magnetic field, the composition of meteorites, and seismic waves;	
Plate Tectonics							7.10.B describe how plate tectonics causes ocean basin formation, earthquakes, mountain building, and volcanic eruptions, including super volcanoes and hot spots.						Earth.8.E explain how plate tectonics accounts for geologic processes, including sea floor spreading and subduction, and features, including ocean ridges, rift valleys, earthquakes, volcanoes, mountain ranges, hot spots, and hydrothermal vents;	
													Earth.8.C investigate how new conceptual interpretations of data and innovative geophysical technologies led to the current theory of plate tectonics;	
													Earth.8.F calculate the motion history of tectonic plates using equations relating rate, time, and distance to predict future motions, locations, and resulting geologic features;	



