

Earth Space Science Overview

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Earth Space Science		
ESS1– The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.		
	K-2	3-4
1. ATMOSPHERE, CLIMATE, AND WEATHER	<p>S:ESS1:2:1.1 Recognize that weather conditions change frequently, and that weather patterns change over the seasons.</p> <p>S:ESS1:2:1.2 Describe and compare weather using observations and measurements of local weather conditions.</p>	<p>S:ESS1:4:1.1 Explain how water exists in the atmosphere in different forms and describe how it changes from one form to another through various processes such as freezing, condensation, precipitation and evaporation.</p> <p>S:ESS1:4:1.2 Explain that air surrounds the Earth, it takes up space, and it moves around as wind.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:4:1.3 Based on data collected from daily weather observations, describe weather changes or weather patterns. [ESS1(K-4)POC-5]</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:4:1.4 Explain how the use of scientific tools helps to extend senses and gather data about weather (i.e., weather/wind vane– direction; wind sock– wind intensity; anemometer– speed; thermometer– temperature; meter sticks/rulers– snow depth; rain gauges– rain amount in inches). [ESS1(K-4)NOS-3]</p> </div>
2. COMPOSITION AND FEATURES	<p>S:ESS1:2:2.1 Recognize that solid rocks, soils, and water in its liquid and solid states can be found on the Earth’s surface.</p> <p>S:ESS1:2:2.2 Use observable properties, such as color and texture, to classify and organize rocks and minerals.</p> <p>S:ESS1:2:2.3 Recognize that Earth materials have a variety of properties, including size, shape, color and texture.</p>	<p>S:ESS1:4:2.1 Describe Earth materials such as gases found in the atmosphere, rocks, soils, and water in its liquid and solid states.</p> <p>S:ESS1:4:2.2 Describe rock as being composed of different combinations of minerals.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:4:2.3 Given information about Earth materials, explain how their characteristics lend themselves to specific uses. [ESS1(K-4)FAF-6]</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:4:2.4 Given certain Earth materials (soils, rocks, or minerals) use physical properties to sort, classify, and/or describe them. [ESS1(K-4)INQ-1]</p> </div>

Earth Space Science		
ESS1– The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.		
	K-2	3-4
3. FOSSILS	<i>None at this grade span.</i>	S:ESS1:4:3.1 Recognize and explain that fossils offer evidence of plants, animals and the nature of environments that existed long ago.
4. OBSERVATION OF THE EARTH FROM SPACE	<i>None at this grade span.</i>	S:ESS1:4:4.1 Recognize features of the Earth as viewed by astronauts in orbit and as transmitted by scientific instruments on satellites and spacecraft.
5. PROCESSES AND RATES OF CHANGE	S:ESS1:2:5.1 Recognize that some changes are too slow or too fast to be easily observed.	S:ESS1:4:5.1 Identify and describe processes that affect the features of the Earth’s surface, including weathering, erosion, deposition of sediment. S:ESS1:4:5.2 Explain how wind, water, or ice shape and reshape the Earth’s surface. [ESS1(K-4)INQ+SAE-4]
6. ROCK CYCLE	S:ESS1:2:6.1 Explain that large rocks can be broken down into smaller rocks. S:ESS1:2:6.2 Describe rocks and soils in terms of their physical properties.	S:ESS1:4:6.1 Explain that smaller rocks come from the breaking and weathering of larger rocks and bedrock. S:ESS1:4:6.2 Distinguish between the three categories of rocks (metamorphic, igneous and sedimentary) and describe the processes that create them. S:ESS1:4:6.3 Identify minerals by their physical properties, such as color, texture and cleavage, and describe simple tests used in the identification process. S:ESS1:4:6.4 Use results from an experiment to draw conclusions about how water interacts with earth materials (e.g., percolation, erosion, frost heaves). [ESS1(K-4)INQ-2]
7. WATER	S:ESS1:2:7.1 Recognize that water can be a liquid or a solid; and explain that it can be made to change from one state to the other, but the amount (mass) of water always remains the same in either state.	S:ESS1:4:7.1 Recognize and describe the Earth’s surface as mostly covered by water. S:ESS1:4:7.2 Explain that most of Earth’s water is salt water, which is found in the oceans, and that fresh water is found in rivers, lakes, underground sources, and glaciers.

Earth Space Science		
ESS2– The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.		
	K-2	3-4
1. EARTH, SUN, AND MOON	<p>S:ESS2:2:1.1 Recognize the basic patterns of the Sun, including its appearance during the daytime, and how its position in the sky changes through the seasons.</p> <p>S:ESS2:2:1.2 Recognize the basic patterns of the Moon, including its appearance sometimes at night and sometimes during the day; and how it appears to change shape through the month.</p>	<p>S:ESS2:4:1.1 Explain that night and day are caused by the Earth’s rotation on its axis; and that the Earth rotates approximately once, every 24 hours.</p> <p>S:ESS2:4:1.2 Describe the Sun as a star.</p>
2. ENERGY	<p>S:ESS2:2:2.1 Recognize that the light and heat the Sun provides to the Earth is necessary for life.</p>	<p>S:ESS2:4:2.1 Recognize that the Sun provides the light and heat necessary to maintain the temperature of the Earth.</p>
3. SOLAR SYSTEM	<p><i>None at this grade span.</i></p>	<p>S:ESS2:4:3.1 Recognize that the Moon orbits the Earth.</p> <p>S:ESS2:4:3.2 Recognize that the Earth is one of a number of planets that orbit the Sun.</p>
4. VIEW FROM EARTH	<p>S:ESS2:2:4.1 Recognize that the Sun, Moon and stars all appear to move slowly across the sky.</p> <p>S:ESS2:2:4.2 Recognize that as the position of the Sun changes in relation to the Earth it creates shadows of varying length and direction.</p> <p>S:ESS2:2:4.3 Explain that people should not look directly at the Sun because it is dangerous and may cause injury to the eyes.</p>	<p>S:ESS2:4:4.1 Recognize that although star patterns seen in the sky appear to move slowly each night from east to west they actually remain the same, and explain why different stars can be seen during different seasons.</p> <p>S:ESS2:4:4.2 Explain why the planets look like stars, and why, over a period of time, they appear to wander among the constellations.</p>

Earth Space Science		
ESS3– The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.		
	K-2	3-4
1. SIZE AND SCALE	<i>None at this grade span.</i>	<p>S:ESS3:4:1.1 Recognize that astronomical objects in space are massive in size and are separated from one another by vast distances.</p> <p>S:ESS3:4:1.2 Explain that telescopes magnify the size of distant objects and significantly increase the number of these objects that can be viewed from Earth.</p>
2. STARS AND GALAXIES	S:ESS3:2:2.1 Recognize there are too many stars to count, and that they are unequal in their brightness.	<p>S:ESS3:4:2.1 Recognize and describe the stars, like the Sun, as spherical in nature.</p> <p>S:ESS3:4:2.2 Recognize that stars come in different colors, and that the Sun is a yellow star.</p>
3. UNIVERSE	<i>None at this grade span.</i>	<i>None at this grade span.</i>

Earth Space Science		
ESS4– The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.		
	K-2	3-4
1. DESIGN TECHNOLOGY	<i>None at this grade span.</i>	S:ESS4:4:1.1 Recognize that man uses various mechanical devices to record changes in the weather and the Earth.
2. TOOLS	S:ESS4:2:2.1 Recognize, and with assistance, safely demonstrate the use of tools to gather data and extend the senses, such as thermometers, hand lenses and balances.	S:ESS4:4:2.1 Demonstrate the use of simple instruments to collect weather data, including thermometers, windsocks, meter sticks, and rain gauges.
3. LOCAL AND GLOBAL ENVIRONMENTAL ISSUES	<p>S:ESS4:2:3.1 Differentiate between natural and man-made materials.</p> <p>S:ESS4:2:3.2 Identify environments that are natural, such as a forest, meadow, or mountains and those that have been built or modified by people, including cities, roads, farms, and houses.</p> <p>S:ESS4:2:3.3 Describe actions that can help the environment, such as recycling and proper disposal of waste materials.</p>	<p>S:ESS4:4:3.1 Distinguish between and provide examples of materials that can be recycled/reused and those that cannot.</p> <p>S:ESS4:4:3.2 Provide examples of technology that have changed the environment and explain whether the effect had a positive or negative impact.</p> <p>S:ESS4:4:3.3 Explain how to dispose of waste so that it does not harm the environment.</p> <p>S:ESS4:4:3.4 Recognize there are pros and cons to using different types of energy, such as solar energy and fossil fuels, and compare the differences.</p>
4. CAREER TECHNICAL EDUCATION CONNECTIONS	S:ESS4:2:4.1 Recognize that some jobs/careers require knowledge and use of Earth science content and/or skills.	S:ESS4:4:4.1 Identify some jobs/careers that require knowledge and use of Earth science content and/or skills.

Earth Space Science		
ESS1– The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.		
	5-6	7-8
1. ATMOSPHERE, CLIMATE, AND WEATHER	<p>S:ESS1:6:1.1 Describe and make predictions about local and regional weather conditions using observation and data collection methods.</p> <p>S:ESS1:6:1.2 Identify weather patterns by tracking weather related events, such as hurricanes.</p> <p>S:ESS1:6:1.3 Explain the composition and structure of the Earth’s atmosphere.</p> <p>S:ESS1:6:1.4 Describe weather in terms of temperature, wind speed and direction, precipitation, and cloud cover.</p> <p>S:ESS1:6:1.5 Describe how clouds affect weather and climate, including precipitation, reflecting light from the sun, and retaining heat energy emitted from the Earth’s surface.</p>	<p>S:ESS1:8:1.1 Identify and describe the processes of the water cycle and explain their effects on climatic patterns.</p> <p>S:ESS1:8:1.2 Identify and describe the impact certain factors have on the Earth’s climate, including changes in the oceans’ temperature, changes in the composition of the atmosphere, and geological shifts due to events such as volcanic eruptions and glacial movements.</p>
2. COMPOSITION AND FEATURES	<p>S:ESS1:6:2.1 Differentiate between renewable and non-renewable resources.</p> <p>S:ESS1:6:2.2 Describe and define the different landforms on the Earth’s surface, such as coastlines, rivers, mountains, deltas, canyons, etc.</p> <p>S:ESS1:6:2.3 Identify and distinguish between various landforms using a map and/or digital images.</p>	<p>S:ESS1:8:2.1 Describe the layers of the Earth, including the core, mantle, lithosphere, hydrosphere, and atmosphere.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:8:2.2 Use geological evidence provided to support the idea that Earth’s crust/lithosphere is composed of plates that move. [ESS1(5-8)INQ+POC-1]</p> </div>
3. FOSSILS	<p>S:ESS1:6:3.1 Recognize that fossils offer important evidence relating to changes in life forms and environmental conditions over geologic time.</p> <p>S:ESS1:6:3.2 Identify connections between fossil evidence and geological events, such as changes in atmospheric composition, movement of tectonic plates, and asteroid/comet impact; and develop a means of sequencing this evidence.</p>	<p>S:ESS1:8:3.1 Explain how fossils found in sedimentary rock can be used to support the theories of Earth’s evolution over geologic time; and describe how the folding, breaking, and uplifting of the layers affects the evidence.</p>

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	5-6	7-8
4. OBSERVATION OF THE EARTH FROM SPACE	<p>S:ESS1:6:4.1 Recognize that images taken of the Earth from space can show its features and any changes in those features that appear over time.</p> <p>S:ESS1:6:4.2 Explain that satellites can be used to view and track storms and Earth events, such as hurricanes and wild fires.</p>	<p>S:ESS1:8:4.1 Describe how catastrophic changes that have taken place on the Earth’s surface can be revealed by satellite images.</p>
5. PROCESSES AND RATES OF CHANGE	<p>S:ESS1:6:5.1 Recognize that things change in steady, repetitive, or irregular ways, or sometimes in more than one way at the same time.</p> <p>S:ESS1:6:5.2 Explain how some changes to the Earth’s surface happen abruptly, as a result of landslides, earthquakes and volcanic eruptions; while other changes happen very slowly as a result of weathering, erosions and deposition of sediment caused by waves, wind, water and ice.</p> <p>S:ESS1:6:5.3 Recognize that vibrations in materials set up wavelike disturbances that spread away from the source, as with earthquakes.</p>	<p>S:ESS1:8:5.1 Explain that the Earth’s crust is divided into plates which move at extremely slow rates in response to movements in the mantle.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:8:5.2 Explain how Earth events, abruptly and over time, can bring about changes on Earth’s surface (e.g., landforms, ocean floor, rock features, climate). [ESS1(5-8)POC-3]</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:8:5.3 Explain the role of differential heating or convection in ocean currents, winds, weather and weather patterns, atmosphere, or climate. [ESS1(5-8)SAE+POC-4]</p> </div>
6. ROCK CYCLE	<p>S:ESS1:6:6.1 Explain how soil is formed from combinations of weathered rock and decomposed plant and animal remains, and that it contains living organisms.</p> <p>S:ESS1:6:6.2 Identify the components of soil and other factors, such as bacteria, fungi and worms, which influence its texture, fertility, and resistance to erosion.</p> <p>S:ESS1:6:6.3 Describe the properties of soil, such as color, texture, capacity to retain water, and its ability to support plant life.</p>	<p>S:ESS1:8:6.1 Describe the processes of the rock cycle.</p> <p>S:ESS1:8:6.2 Explain that sedimentary, igneous, and metamorphic rocks contain evidence of the minerals, temperatures, and forces that created them.</p> <p>S:ESS1:8:6.3 Explain how sediments of sand and smaller particles, which may contain the remains of organisms, are gradually buried and cemented together by dissolved minerals to form solid rock.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:8:6.4 Using data about a rock’s physical characteristics, make and support an inference about the rock’s history and connection to the rock cycle. [ESS1(5-8)SAE+POC-5]</p> </div>

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ESS1– The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.		
	5-6	7-8
7. WATER	<p>S:ESS1:6:7.1 Explain the properties that make water an essential component of the Earth’s system, including solvency and its ability to maintain a liquid state at most temperatures.</p> <p>S:ESS1:6:7.2 Explain that water quality has a direct effect on Earth’s life forms.</p>	<p>S:ESS1:8:7.1 Describe how water flows into and through a watershed, falling on the land, collecting in rivers and lakes, soil, and porous layers of rock, until much of it flows back into the ocean.</p> <p>S:ESS1:8:7.2 Identify the physical and chemical properties that make water an essential component of the Earth’s system.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:8:7.3 Explain the processes that cause cycling of water into and out of the atmosphere and their connections to our planet’s weather patterns. [ESS1(5-8)SAE-2]</p> </div>

Earth Space Science		
ESS2– The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.		
	5-6	7-8
1. EARTH, SUN, AND MOON	<p>S:ESS2:6:1.1 Recognize and describe how the regular and predictable motions of the Earth and Moon explain certain Earth phenomena, such as day and night, the seasons, the year, shadows and the tides.</p> <p>S:ESS2:6:1.2 Recognize that of all the known planets, Earth appears to be somewhat unique; and describe the conditions that exist on Earth that allow it to support life.</p>	<p>S:ESS2:8:1.1 Identify the characteristics of the Sun and its position in the universe.</p> <p>S:ESS2:8:1.2 Recognize and describe how the regular and predictable motions of the Earth and Moon account for phenomena, such as the phases of the Moon and eclipses.</p> <p>S:ESS2:8:1.3 Recognize the relationships between the tides and the phases of the moon; and use tide charts and NOAA information to describe them.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS2:8:1.4 Explain the temporal or positional relationships between or among the Earth, Sun and Moon (e.g., night/day, seasons, year, tide). [ESS2(5-8)SAE+POC-8]</p> </div>
2. ENERGY	<p>S:ESS2:6:2.1 Recognize how the tilt of the Earth’s axis and the Earth’s revolution around the Sun affect seasons and weather patterns.</p> <p>S:ESS2:6:2.2 Identify and describe seasonal, daylight and weather patterns as they relate to energy.</p>	<p>S:ESS2:8:2.1 Describe the Sun as the principle energy source for phenomena on the Earth’s surface.</p>

Earth Space Science		
ESS2– The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.		
	5-6	7-8
3. SOLAR SYSTEM	<i>Districts may choose to work on End of Grade 8 standards in grades 5-8.</i>	<p>S:ESS2:8:3.1 Identify the characteristics and movement patterns of the planets in our Solar System and differentiate between them.</p> <p>S:ESS2:8:3.2 Explain the effects of gravitational force on the planets and their moons.</p> <p>S:ESS2:8:3.3 Explain why Earth and our Solar System appear to be somewhat unique, while acknowledging recent evidence that suggests similar systems exist in the universe.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS2:8:3.4 Compare and contrast planets based on data provided about size, composition, location, orbital movement, atmosphere, or surface features (includes moons). [ESS2(5-8)MAS-6]</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS2:8:3.5 Explain how gravitational force affects objects in the Solar System (e.g., moons, tides, orbits, satellites). [ESS2(5-8)SAE+POC-8]</p> </div>
4. VIEW FROM EARTH	<p>S:ESS2:6:4.1 Explain the historical perspective of planetary exploration and man’s achievements in space, beginning with Russia’s Sputnik mission in 1957.</p> <p>S:ESS2:6:4.2 Describe man’s perception of the constellations throughout history; and explain how he has used them to his advantage, including navigational purposes and to explain historical events.</p>	<div style="border: 1px solid black; padding: 5px;"> <p>S:ESS2:8:4.1 Explain how technological advances have allowed scientists to re-evaluate or extend existing ideas about the Solar System. [ESS2(5-8)NOS-7]</p> </div>

Earth Space Science		
ESS3– The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.		
	5-6	7-8
1. SIZE AND SCALE	<i>Districts may choose to work on End of Grade 8 standards in grades 5-8.</i>	<p>S:ESS3:8:1.1 Define an astronomical unit as the distance from the Earth to the Sun.</p> <p>S:ESS3:8:1.2 Explain that special units of measure, such as light years and astronomical units, are used to calculate distances in space.</p>
2. STARS AND GALAXIES	<i>Districts may choose to work on End of Grade 8 standards in grades 5-8.</i>	S:ESS3:8:2.1 Describe objects such as asteroids, comets and meteors in terms of their characteristics and movement patterns.
3. UNIVERSE	<i>Districts may choose to work on End of Grade 8 standards in grades 5-8.</i>	S:ESS3:8:3.1 Describe the universe as being comprised of billions of galaxies, each containing many billions of stars; and explain that there are vast distances separating these galaxies and stars from one another and from the Earth.

Earth Space Science		
ESS4–The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.		
	5-6	7-8
1. DESIGN TECHNOLOGY	S:ESS4:6:1.1 Understand that technology is used to design tools that improve our ability to measure and observe the world.	S:ESS4:8:1.1 Describe ways in which technology has increased our understanding of the world in which we live. S:ESS4:8:1.2 Recognize the importance of technology as it relates to science, for purposes such as: access to space and other remote locations, sample collection and treatment, measurement, data collection, and storage, computation, and communication of information.
2. TOOLS	S:ESS4:6:2.1 Recognize that satellites and Doppler radar can be used to observe or predict the weather. S:ESS4:6:2.2 Employ knowledge of basic weather symbols to read and interpret weather and topographic maps. S:ESS4:6:2.3 Read and interpret data from barometers, sling psychrometers and anemometers.	S:ESS4:8:2.1 Calculate temperature in degrees Celsius. S:ESS4:8:2.2 Perform calculations using metric measurements. S:ESS4:8:2.3 Describe how man uses land-based light telescopes, radio telescopes, satellites, manned exploration, probes and robots to collect data.
3. LOCAL AND GLOBAL ENVIRONMENTAL ISSUES	S:ESS4:6:3.1 Provide examples of products that man has developed which allow humans to do things that they could not do otherwise; and identify the natural materials used to produce these products. S:ESS4:6:3.2 Identify the most appropriate materials for a given design task with requirements for specific properties, such as weight, strength, hardness, and flexibility. S:ESS4:6:3.3 Provide examples of how to reduce waste through conservation, recycling, and reuse.	S:ESS4:8:3.1 Provide examples of how creative thinking and economic need has shaped the way people use natural materials, such as the use of metal ores, petroleum, and fresh water. S:ESS4:8:3.2 Explain how to test natural materials to measure and compare their properties. S:ESS4:8:3.3 Explain how technologies can reduce the environmental impact of natural disasters. S:ESS4:8:3.4 Identify the potential impact of converting forested land to uses such as farms, homes, factories, or tourist attractions.
4. CAREER TECHNICAL EDUCATION CONNECTIONS	S:ESS4:6:4.1 Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of Earth science.	S:ESS4:8:4.1 Understand that some scientific jobs/careers involve the application of Earth Space science content knowledge and experience in specific ways that meet the goals of the job.

Earth Space Science		
ESS1– The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.		
	9-11	11-12 (Advanced)
1. ATMOSPHERE, CLIMATE, AND WEATHER	<p>S:ESS1:11:1.1 Explain how winds and ocean currents are created on the Earth’s surface.</p> <p>S:ESS1:11:1.2 Explain how heat and energy transfer in and out of the atmosphere; and provide examples of how it is related to weather and climate.</p> <p>S:ESS1:11:1.3 Describe how Earth’s atmospheric composition has changed from the formation of the Earth through current time.</p> <p>S:ESS1:11:1.4 Explain how Earth’s features can affect wind and weather patterns by causing air to rise and increasing precipitation.</p>	<p>S:ESS1:12:1.1 Identify and describe the layers of the atmosphere.</p> <p>S:ESS1:12:1.2 Understand the effects of solar influences, such as flares and sunspots, on atmospheric conditions.</p>
2. COMPOSITION AND FEATURES	<p>S:ESS1:11:2.1 Recognize that elements exist in fixed amounts and describe how they move through the solid Earth, oceans, atmosphere, and living things as part of geochemical cycles, such as the water, carbon and nitrogen cycles.</p> <p>S:ESS1:11:2.2 Describe the conditions that enable the Earth to support life, such as the availability of water, the gravitational force, the electromagnetic field and the intensity of radiation from the Sun.</p> <p>S:ESS1:11:2.3 Explain the theory of plate tectonics.</p> <p>S:ESS1:11:2.4 Describe the movement of crustal plates and explain how the effects have altered the Earth’s features.</p>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p>

Earth Space Science		
ESS1– The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.		
	9-11	11-12 (Advanced)
3. FOSSILS AND GEOLOGIC TIME	<p>S:ESS1:11:3.1 Identify and describe the methods used to measure geologic time, such as fossil identification, radioactive dating, and rock sequences.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS1:11:3.2 Relate how geologic time is determined using various dating methods (e.g., radioactive decay, rock sequences, fossil records). [ESS1(9-11)INQ+POC+MAS-4]</p> </div>	<i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i>
4. OBSERVATION OF THE EARTH FROM SPACE	<div style="border: 2px solid black; padding: 5px;"> <p>S:ESS1:11:4.1 Provided with geologic data (including movement of plates) on a given locale, predict the likelihood for an earth event (e.g. volcanoes mountain ranges, islands, earthquakes, tides, tsunamis). [ESS1(9-11)INQ+POC-1]</p> </div>	<i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i>

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ESS1– The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.		
	9-11	11-12 (Advanced)
5. PROCESSES AND RATES OF CHANGE	<p>S:ESS1:11:5.1 Explain that the Earth is composed of interactive layers, which have distinct compositions, physical properties and processes.</p> <p>S:ESS1:11:5.2 Relate plate movement to earthquakes and volcanic activity, and explain how it results in tectonic uplift and mountain building.</p> <p>S:ESS1:11:5.3 Identify and describe the major external and internal sources of energy on Earth.</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;">S:ESS1:11:5.4 Provide supporting geologic/geographic evidence that supports the validity of the theory of plate tectonics. [ESS1(9-11)NOS-2]</div> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;">S:ESS1:11:5.5 Trace the development of the theory of plate tectonics. [ESS1(9-11)NOS-2]</div> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;">S:ESS1:11:5.6 Explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading). [ESS1(9-11)SAE+POC-3]</div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i></p>
6. ROCK CYCLE	<p>S:ESS1:11:6.1 Explain that throughout the rock cycle, the total amount of the material remains the same.</p>	<p>S:ESS1:12:6.1 Describe the processes that transform one type of rock into another, such as lithification, metamorphism, and weathering on a chemical level.</p> <p>S:ESS1:12:6.2 Describe the various types of igneous, sedimentary, and metamorphic rocks found on Earth.</p>
7. WATER	<p>S:ESS1:11:7.1 Explain that water quality can be affected positively or negatively by outside sources</p>	<p><i>Same as Grade 11</i></p>

Earth Space Science		
ESS2– The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.		
	9-11	11-12 (Advanced)
1. EARTH, SUN, AND MOON	S:ESS2:11:1.1 Explain how the Earth, Moon and Sun were formed.	S:ESS2:12:1.1 Understand how the Nebular Hypothesis, fusion, and the process of differentiation contributes to the structure and organization of the universe.
2. ENERGY	<p>S:ESS2:11:2.1 Identify the Earth’s major external source of energy as solar energy.</p> <p>S:ESS2:11:2.2 Explain how the inclination of incoming solar radiation can impact the amount of energy Earth receives on any given surface area.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS2:11:2.3 Explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading). [ESS1(9-11)SAE+POC-3]</p> </div>	<i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i>
3. SOLAR SYSTEM	<p>S:ESS2:11:3.1 Explain how gravitational force influenced the formations of the planets and their moons; and describe how these objects move in patterns under its continued influence.</p> <p>S:ESS2:11.3.2 Explain how the Solar System formed from a giant cloud of gas and debris about 5 billion years ago.</p>	<i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i>
4. VIEW FROM EARTH	<i>Students should have regular access and use of data gathered by space based instruments.</i>	<i>Students should have regular access and use of data gathered by space based instruments.</i>

Earth Space Science		
ESS3– The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.		
	9-11	11-12 (Advanced)
1. SIZE AND SCALE	<p>S:ESS3:11:1.1 Recognize electromagnetic waves can be used to locate objects in the universe, and track their movement.</p> <p>S:ESS3:11:1.2 Define a light year.</p>	<i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i>
2. STARS AND GALAXIES	<p>S:ESS3:11:2.1 Identify and describe the characteristics common to most stars in the universe.</p> <p>S:ESS3:11:2.2 Describe the ongoing processes involved in star formation, their life cycles and their destruction.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:ESS3:11:2.3 Explain the relationships between or among the energy produced from nuclear reactions, the origin of elements, and the life cycles of stars. [ESS3(9-11)POC+SAE-8]</p> </div>	<i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i>

Earth Space Science		
ESS3– The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.		
	9-11	11-12 (Advanced)
3. UNIVERSE	<p>S:ESS3:11:3.1 Explain that current scientific evidence supports the Big Bang Theory as a probable explanation of the origin of the universe, and describe the theory.</p> <p>S:ESS3:11:3.2 Explain the evidence that suggests the universe is expanding.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>S:ESS3:11:3.3 Provide scientific evidence that supports or refutes the “Big Bang” theory of how the universe was formed. [ESS3(9-11)NOS-6]</p> </div> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>S:ESS3:11:3.4 Based on the nature of electromagnetic waves, explain the movement and location of objects in the universe or their composition (e.g., red shift, blue shift, line spectra). [ESS3(9-11)SAE-7]</p> </div> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>S:ESS3:11:3.5 Explain how scientific theories about the structure of the universe have been advanced through the use of sophisticated technology (e.g., space probes and visual, radio and x-ray telescopes). [ESS3(9-11)NOS-5]</p> </div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i></p>

Earth Space Science		
ESS4– The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.		
	9-11	11-12 (Advanced)
1. DESIGN TECHNOLOGY	<p>S:ESS4:11:1.1 Describe ways in which technology has increased our understanding of the universe.</p> <p>S:ESS4:11:1.2 Understand that technology is designed with a particular function in mind; and principles of Earth Space science are useful in creating technology for the Earth space sciences.</p>	<p>S:ESS4:12:1.1 Recognize the importance of technology as it relates to science, for purposes such as: access to space and other remote locations, sample collection and treatment, measurement, data collection, and storage, computation, and communication of information.</p>
2. TOOLS	<p>S:ESS4:11:2.1 Describe the use and benefits of land-based light telescopes, radio telescopes, spectrophotometers, satellites, manned exploration, probes, and robots to the study of Earth Space Science.</p> <p>S:ESS4:11:2.2 Explain how scientists study the Earth using computer-generated models and observations from both land-based sites and satellites; and describe the value of using these tools in unison.</p>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses</i></p>
3. LOCAL AND GLOBAL ENVIRONMENTAL ISSUES	<p>S:ESS4:11:3.1 Differentiate between and provide examples of renewable and nonrenewable sources of energy; and explain the advantages and limitations of each.</p> <p>S:ESS4:11:3.2 Describe the means for transforming a natural material, such as iron ore, into useful products during different historical periods, such as the Stone Age, Iron Age, Renaissance, the Industrial Period and the current Age of Information.</p> <p>S:ESS4:11:3.3 Explain how the use of technologies at a local level, such as burning of fossil fuels for transportation or power generation, may contribute to global environmental problems.</p>	<p>S:ESS4:12:3.1 Explain the environmental effects of using both renewable and nonrenewable resources; and provide examples of how man is addressing these effects on the environment.</p> <p>S:ESS4:12:3.2 Provide examples of how man’s use of Earth materials has changed over time; and use those examples to explain how the relationship between science and technology has gradually grown closer in the past century.</p> <p>S:ESS4:12:3.3 Research and evaluate a current environmental issue within the State of New Hampshire, such as a dispute regarding the conversion of a natural environment to human use; and construct a defense that supports environmental protection.</p>
4. CAREER TECHNICAL EDUCATION CONNECTIONS	<p>S:ESS4:11:4.1 Explain the kinds of applications of knowledge and skills necessary for jobs/careers specific to Earth or space sciences.</p>	<p>S:ESS4:12:4.1 Understand the various scientific fields that use scientific content and skills; and distinguish between professional and skilled science jobs/careers in Earth or space sciences.</p>