GRADES 10-12: EARTH AND SPACE SCIENCE			
ESS.1 Earth in the Universe			
1st 9 Weeks **Conceptual Understanding: The planet Earth is a very small part of a very large universe that has developed over a huge expanse of time.** **Introduction**		**Term 1** 3 Days	**Term 2**
ESS.1.A	**Students will develop an understanding of the universe, its development, immense size, and composition.**		
ESS.1A.1	*Describe the Big Bang theory and summarize observations (e.g., cosmic microwave background radiation, Hubble's law, and redshift caused by the Doppler effect) as evidence to support the formation and expansion of the universe.*	**Week 1**	
ESS.1A.2	*Interpret information from the Hertzsprung -Russell diagram to differentiate types of stars, including our sun, according to size, magnitude, and classification.*	**Week 2**	
ESS.1A.3	*Organize and interpret data sets for patterns and trends to compare and contrast stellar evolution in order to explain and communicate how a star changes during its life.*	**Week 3**	
ESS.1A.4	*Research and explain how nuclear fusion in stars and supernova lead to the formation of all other elements.*	**Week 4**	
Conceptual Understanding: The sun, moon, and planets have predictable patterns that are explained by forces and laws. Patterns of motion in the solar system can be described and predicted based on observations and an understanding of gravity.		**Term 1**	**Term 2**
ESS.1.B	**Students will develop an understanding of Earth, the solar system, and the laws that predict the motion of celestial bodies.**		
ESS.1B.1	*Read and evaluate scientific information for mechanisms/results (e.g., the solar nebular theory) to explain how the solar system was formed. Cite evidence and develop a logical argument.*	**Week 5**	
ESS.1B.2	*Compare and contrast celestial bodies (e.g., planets, natural satellites, comets, asteroids, and the Oort cloud) and their motion in our solar system (e.g., revolution and rotation). Build an Analemma calendar.*	**Week 6**	
ESS.1B.3	*Design a model (e.g., a gravity simulation using PVC and a neoprene screen) to demonstrate Kepler's laws and the relationships of the orbits of objects in our solar system. Relate them to Newton's law of universal gravitation and laws of motion.*	**Week 7**	
ESS.2 Earth Structure and History			
Conceptual Understanding: Earth's interior is divided into a solid inner core, a liquid outer core, a pliable mantle, and a solid crust. Even though the crust is solid, it is always in motion and is recycled through time.		**Term 1**	**Term 2**
ESS.2.A	**Students will develop an understanding of the structure and composition of Earth and its materials.**		

ESS.2A.1	*Analyze and interpret data to explain and communicate the differentiation of Earth's internal chemical structure (e.g., core, mantle, and crust) using the production of internal heat from the radioactive decay of unstable isotopes and gravitational energy.*	**Week 8**	
ESS.2A.2	Review and take 1st 9 Weeks Test **2nd 9 Weeks** *Analyze and interpret data to explain and communicate the differentiation of Earth's physical divisions (e.g., lithosphere and asthenosphere) using data from seismic waves and Earth's magnetic field.*	**Week 9** **Week 10**	
ESS.2A.3	*Investigate the physical and/or chemical characteristics of mineral specimens to identify minerals and mineral deposits/groups (e.g., oxides, carbonates, halides, sulfides, sulfates, silicates, and phosphates). Include the relationship between chemical bonds, chemical formulas, mineral use, and mineral properties.*	**Week 11**	
ESS.2A.4	*Investigate the physical and/or chemical characteristics of rock specimens to identify and categorize igneous, sedimentary, and metamorphic rocks. Include the processes that generate the transformation of rocks*	**Week 12**	
Conceptual Understanding: Radioactive decay lifetimes and isotopic content in rocks provide a way of dating rock formations and thereby fixing the scale of geological time. Plate tectonics is the unifying theory that explains the movements of rocks on Earth's surface and provides a comprehensive account of its geological history. Physical and chemical weathering is a result of the interactions of Earth's geosphere, hydrosphere, atmosphere, and biosphere.		**Term 1**	**Term 2**
ESS.2.B	**Students will develop an understanding of the history and evolution of the earth.**		
ESS.2B.1	*Research, analyze, and evaluate the contributions of William Smith, James Hutton, Nicolaus Steno, Charles Lyell, and others to physical geology.*	**Week 13**	
ESS.2B.2	*Apply different techniques (e.g., superposition, original horizontality, cross-cutting relationships, lateral continuity, principle of inclusions, fossil succession, and unconformities) to analyze and interpret the relative age of actual sequences, models, or photographs.*	**Week 14**	
ESS.2B.3	*Use mathematical concepts to calculate the absolute age of earth materials using actual or simulated isotope ratios.*	**Week 15**	
ESS.2B.4	*Research, analyze, and explain the origin of geologic features and processes that result from plate tectonics, including sea floor spreading, earthquake activity, volcanic activity, mountain building, and location of natural resources.*	**Week 16**	
ESS.2B.5	*Use mathematical representations to interpret seismic graphs to triangulate the location of an earthquake's epicenter and magnitude and to correlate the frequency and magnitude of an earthquake.*	**Week 17**	

ESS.2B.6	*Plan and conduct a scientific investigation to determine how factors (e.g., wind velocity, water velocity, ice, and temperature) may affect the rate of weathering.*	**Week 17**	
	Review and take 2nd 9 weeks test	**Week 18**	
ESS.3 Earth's Systems and Cycles			
3rd 9 Weeks **Conceptual Understanding: Earth's surface is comprised of the geosphere, hydrosphere, atmosphere, and biosphere, all of which are interconnected. The complex and dynamic interactions between these systems have shaped Earth, influenced climate, and shaped the evolution of life.**		**Term 1**	**Term 2**
ESS.3	**Students will develop an understanding of Earth's systems and cycles.**		
ESS.3.1	*Use mathematical representations (e.g., latitude, longitude, and maps) to calculate the angle of noon solar incidence and relate the value to day length, distribution of sunlight, and seasonal change.*		**Week 19**
ESS.3.2	*Enrichment: Use an engineering design process to explore the concepts of passive solar architecture to design a structure that best utilizes solar incidence.**		**Week 20**
ESS.3.3	*Explain how temperature and density of ocean water influence circulation.*		**Week 21**
ESS.3.4	*Research and communicate information to explain the importance of the transfer of thermal energy among the hydrosphere, geosphere, and atmosphere. Include the unique physical and chemical properties of water, the water cycle, and energy transfer within the rock cycle.*		**Week 22**
ESS.3.5	*Analyze and interpret weather data using maps and global weather systems to explain and communicate the relationships among air masses, pressure systems, and frontal boundaries.*		**Week 23**
ESS.3.6	*Construct an explanation from data sets to obtain and evaluate scientific information to construct scientific arguments on changes in climate caused by various natural factors (e.g., plate tectonics and continent location and Milankovitch cycles) versus anthropogenic factors (e.g., fossil fuel use and agricultural factors).*		**Week 24**
ESS.3.7	*Cite evidence and develop logical arguments to identify the cause and effect relationships of the evolutionary milestones (e.g., photosynthesis and the atmosphere, the evolution of multicellular animals, the development of shells, and the colonization of terrestrial environments by plants and animals) that most profoundly shaped Earth's systems.*		**Week 25**
ESS.3.8	*Analyze and interpret the record of shared ancestry, evolution, and extinction as related to natural selection using fossils.*		**Week 26**

Review and Take 3rd 9 Weeks Test **Week 27**

4th 9 Weeks

ESS.4 Earth's Resources and Human Activity			
Conceptual Understanding: The dynamic Earth impacts human society. Natural hazards and other geologic events have shaped the course of human history. In addition, humans also impact the Earth through resource extraction and land use.		**Term 1**	**Term 2**
ESS.4	**Students will develop an understanding of Earth's resources and the impact of human activities.**		
ESS.4.1	*Research, evaluate, and communicate about how human life on Earth shapes Earth's systems and responds to the interaction of Earth's systems (e.g., geosphere, hydrosphere, atmosphere, and biosphere). Examine how geochemical and ecological processes interact through time to cycle matter and energy and how human activity alters the rates of these processes*		**Week 28** **Week 29**
ESS.4.2	*Research, assess, and communicate how Earth's systems influence the distribution of life, including how various natural hazards and geologic events (e.g., volcanic eruptions, earthquakes, landslides, tornadoes, and hurricanes) have shaped the course of human history.*		**Week 30** **Week 31**
ESS.4.3	*Analyze earthquake and volcanic data to determine patterns that can lead to predicting such hazards and mitigating impact to humans.*		**Week 32**
ESS.4.4	*Enrichment: Use an engineering design process to research, develop, and test models to aid in the responsible management of natural resources (e.g., recycling, composting, and energy usage).**		**Week 33**
ESS.4.5	*Enrichment: Research and communicate regarding geoscience career options (e.g., geologist, petroleum engineer, meteorologist, paleontologist, astronomer, and oceanographer*		**Week 34**

Review and take 4th 9 Weeks Test **Week 35**

Week 36