Science and Engineering Practices

Developing and Using Models	Using Mathematical and Computational Thinking	Constructing Explanations and Designing Solutions	Obtaining, Evaluating, and Communicating Information
► Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). ► Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	► Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools	Constructing explanations and designing solutions in 9-12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ► Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. ► Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ► Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

Skills by Level

Measurement Skills	Hypothesis Skills	Conclusion Skills	Data Skills
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DRAFT

Earth Space • First Quarter Pacing Guide

Science

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Revised 8.2017

Earth Space Science First Quarter

Unit 1 **Introduction to the Universe**			Unit 2 **Planetary Motion and Formation**	
I CAN Statements				
☐ **I CAN** explain how the energy from nuclear fusion in the sun's core reaches Earth. ☐ **I CAN** explain the life span of the sun using scientific evidence.	☐ **I CAN** provide evidence and support for the Big Bang Theory and that the universe is expanding. ☐ **I CAN** explain the motion of distant galaxies and the composition of the universe. ☐ **I CAN** provide evidence that explains the age and formation of the solar system.	☐ **I CAN** explain how the different elements in the universe formed from stars.	☐ **I CAN** explain why planets orbit stars and how moons and human-made satellites orbit planets. ☐ **I CAN** use Newtonian gravitational laws to predict the motion of objects in space. ☐ **I CAN** use and explain Kepler's laws of orbital motion to explain the movement of objects in solar systems.	☐ **I CAN** provide evidence to explain Earth's formation. ☐ **I CAN** explain Earth's early history based on current available scientific knowledge.
Standards HS ESS1.1	**Standard HS ESS1.2**	**Standard HS ESS1.3**	**Standard HS ESS1.4**	**Standard HS ESS1.6**
Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation. *Clarification: Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach Earth. Examples of evidence for the model include observations of the masses and lifetimes of other stars, as well as the ways*	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. *Clarification: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).*	Communicate scientific ideas about the way stars, over their life cycle, produce elements. *Clarification: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime. Assessment Boundary: Details of the many different nucleosynthesis pathways for stars of differing masses are not assessed.*	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. *Clarification: Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons. Assessment Boundary:Mathematical representations for the gravitational attraction of bodies and Kepler's Laws of orbital motions should not deal with more than two bodies, nor involve calculus.*	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. *Clarification: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.*
Disciplinary Core Ideas				
► The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years.	► The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. ► The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. ► Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode.	► The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. ► Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode.	► Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.	► Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history.

Science and Engineering Practices

Engaging in Argument from Evidence	Developing and Using Models	Engaging in Argument from Evidence	Constructing Explanations and Designing Solutions
► Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ► Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments.	► Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). ► Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	► Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ► Construct an oral and written argument or counter-arguments based on data and evidence.	► Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ► Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Skills by Level

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Earth Space • Second Quarter

Science

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Revised 8.2017

Earth Space Science Second Quarter

Unit 3 History of Earth			Unit 4 Coevolution of Life and Earth
I CAN Statements **Standard HS ESS1.5**			
☐ **I CAN** explain the evidence used to describe past and current movements of continental and oceanic crust. ☐ **I CAN** explain the theory of plate tectonics and how it relates to the ages of crustal rocks.	☐ **I CAN** create a model to demonstrate how Earth's internal processes and surface processes form continental and ocean floor features. ☐ **I CAN** explain how the constructive forces and destructive mechanisms operate at different spatial and temporal scales.	☐ **I CAN** produce a one dimensional model of Earth's interior. ☐ **I CAN** use a model of Earth's interior to explain how thermal convection leads to cycling of matter.	☐ **I CAN** develop and organize a body of information to form a coherent scientific argument. ☐ **I CAN** use evidence to develop an argument that recognizes the coevolution of life and development of Earth's systems.
Standard HS ESS1.5	**Standard HS ESS2.1**	**Standard HS LS2.3**	**Standard HS ESS2.7**
Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. *Clarification: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion). [Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.*	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. *Clarification: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages of oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust decreasing with distance away from a central ancient core of the continental plate (a result of past plate interactions).*	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. *Clarification: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.*	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. *Clarification: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples of include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms. Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.*
Discipinary Core Ideas			
▸ Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old.	▸ Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. ▸ Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust.	▸ Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. ▸ The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection.	▸ Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ▸ The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

Science and Engineering Practices

Using Mathematics and Computational Thinking	Planning and Carrying Out Investigations	Constructing Explanations and Designing Solutions	Analyzing and Interpreting Data
Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ► Create a computational model or simulation of a phenomenon, designed device, process, or system. ► Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations.	Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. ► Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student- generated sources of evidence consistent with scientific knowledge, principles, and theories. ► Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ► Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Skills by Level

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Earth Space • Third Quarter

Science

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Earth Space Science Third Quarter

Unit #5 Earth's Systems			Unit 6 Weather and Climate	
I CAN Statements				
☐ **I CAN** explain the properties of water and its effects on Earth's materials and surface properties based off of scientific evidence.	☐ **I CAN** explain how the availability of natural resources, the occurence of natural hazards, and changes in climate have influenced human activity.	☐ **I CAN** use a computational simulation to illustrate the relationships between natural resource management, the sustainability of human populations, and biodiversity.	☐ **I CAN** analyze geoscience data to explain how one change to Earth's surface can create feedbacks that cause changes to other Earth systems	☐ **I CAN** use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
Standard HS ESS2.5	**Standard HS ESS3.1**	**Standard HS ESS3.3**	**Standard HS ESS2.2**	**Standard HS ESS3.6**
Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. *Clarification: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrological cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).*	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. *Clarificaton: Examples of key natural resouces include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soil such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting, and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and*	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. *Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning. Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs*	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. *Clarification: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.*	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. *Clarification: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.*
Disciplinary Core Ideas				
► The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.	► Resource availability has guided the development of human society. ► Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.	► The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.	► Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. ► The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.	► Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. ► Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.

Science and Engineering Practices

Developing and Using Models	Analyzing and Interpreting Data	Constructing Explanations and Designing Solutions	Engaging in Argument from Evidence
Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). ► Develop a model based on evidence to illustrate the relationships between systems or between components of a system. ► Use a model to provide mechanistic accounts of phenomena.	Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ► Analyze data using computational models in order to make valid and reliable scientific claims.	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student- generated sources of evidence consistent with scientific knowledge, principles, and theories. ► Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ► Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).

Skills by Level

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Earth Space • Fourth Quarter

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Earth Space Science Fourth Quarter

Unit 7 Resource Management	Unit 8 Human Impact on Earth			
Standard HS ESS2.6 I CAN Statements				
☐ **I CAN** describe how carbon cycles through the hydrosphere, atmosphere, geosphere, and biosphere. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. *Clarification: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.*	☐ **I CAN** use a model to describe changes in Earth's climate. ☐ **I CAN** explain how variations in the flow of energy into and out of Earth's systems causes climate change.	☐ **I CAN** evaluate, refine, or create a technological solution that reduces impacts of human activities on natural systems.	☐ **I CAN** analyze and use geoscience data to explain global or regional climate change and its future impacts on Earth's systems. ☐ **I CAN** explain the results from global climate models to make an evidence-based forecast of the current rate of global and/or regional climate change and its impacts on Earth's systems.	☐ **I CAN** use cost-benefit ratios to evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources.
Standard HS ESS2.6	**Standard HS ESS2.4**	**Standard HS ESS3.4**	**Standard HS ESS3.5**	**Standard HS ESS3.2**
Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. *Clarification: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.*	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. *Clarification: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, open ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition. Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperature, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.*	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. *Clarification: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).*	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. *Clarification: Examples of evidence, for both data and climate output models, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition). Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.*	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. *Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems - not what should happen.*
Disciplinary Core Ideas				
► Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ► Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.	► Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. ► The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.	► Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.	► Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.	► All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.