

Environmental Science: Your World, Your Turn (Withgott) © 2011
Correlated to:
NJ Standards for Science – Standards 5.1 and 5.4
(By the end of Grade 12)

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Content Area – Science	
Standard 5.1 Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.	
Strand A. Understand Scientific Explanations: Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.	
By the end of grade 12	
Content Statement	
Mathematical, physical, and computational tools are used to search for and explain core scientific concepts and principles.	
CPI's	
5.1.12.A.1 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations.	SE/TE: 22, 37, 51, 80, 112, 144, 152, 179, 214, 230, 237, 263, 302, 332, 334, 431, 437, 459, 471, 486, 493, 520, 530, 552, 591, 601, SH18-SH25
Content Statement	
Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.	
CPI's	
5.1.12.A.2 Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories.	SE/TE: 16, 51, 112, 144, 179, 214, 230, 302, 332, 431, 471, 493, 530, 552, 601, SH2-SH13
Content Statement	
Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence.	
CPI's	
5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.	SE/TE: 17-18, 22, 37, 51, 80, 112, 144, 152, 179, 214, 230, 237, 263, 302, 332, 334, 431, 437, 459, 471, 486, 493, 520, 530, 552, 591, 601, SH9-SH13, SH18-SH25

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Strand B. Generate Scientific Evidence Through Active Investigations: Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.	
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Content Statement	
Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations.	
CPI's	
5.1.12.B.1 Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.	SE/TE: 17-20, 22, 37, 80, 152, 237, 263, 334, 437, 459, 486, 520, 591, SH18-SH25
Content Statement	
Mathematical tools and technology are used to gather, analyze, and communicate results.	
CPI's	
5.1.12.B.2 Build, refine, and represent evidence-based models using mathematical, physical, and computational tools.	SE/TE: 16, 51, 112, 144, 179, 214, 230, 302, 332, 431, 471, 493, 530, 552, 601, SH2-SH13
Content Statement	
Empirical evidence is used to construct and defend arguments.	
CPI's	
5.1.12.B.3 Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories.	SE/TE: 23, 51, 112, 144, 179, 214, 230, 302, 332, 431, 471, 493, 530, 552, 601, SH22
Content Statement	
Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions.	
CPI's	
5.1.12.B.4 Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.	SE/TE: 18, 51, 112, 144, 179, 214, 230, 302, 332, 431, 471, 493, 530, 552, 601, SH20-SH21

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Strand C. Reflect on Scientific Knowledge: Scientific knowledge builds on itself over time.	
By the end of grade 12	
Content Statement	
Refinement of understandings, explanations, and models occurs as new evidence is incorporated.	
CPI's	
5.1.12.C.1 Reflect on and revise understandings as new evidence emerges.	SE/TE: 23, SH22
Content Statement	
Data and refined models are used to revise predictions and explanations.	
CPI's	
5.1.12.C.2 Use data representations and new models to revise predictions and explanations.	SE/TE: 16, 19, 23, 51, 112, 144, 179, 214, 230, 302, 332, 431, 471, 493, 530, 552, 601, SH9-SH13, SH21-SH22
Content Statement	
Science is a practice in which an established body of knowledge is continually revised, refined, and extended as new evidence emerges.	
CPI's	
5.1.12.C.3 Consider alternative theories to interpret and evaluate evidence-based arguments.	SE/TE: 3, 22-23, 35, 63, 99, 125, 163, 199, 227, 291, 323, 351, 391, 419, 451, 483, 515, 549, 581, SH22
Strand D. Participate Productively in Science: The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.	
By the end of grade 12	
Content Statement	
Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work.	
CPI's	
5.1.12.D.1 Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.	SE/TE: 3, 22-23, 35, 63, 99, 125, 163, 199, 227, 291, 323, 351, 391, 419, 451, 483, 515, 549, 581, SH22

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Content Statement	
Science involves using language, both oral and written, as a tool for making thinking public.	
CPI's	
5.1.12.D.2 Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams.	SE/TE: 51, 112, 144, 179, 214, 230, 302, 332, 431, 471, 493, 530, 552, 601, SH9-SH17, SH22-SH25
Content Statement	
Ensure that instruments and specimens are properly cared for and that animals, when used, are treated humanely, responsibly, and ethically.	
CPI's	
5.1.12.D.3 Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare.	SE/TE: 22, 37, 80, 152, 237, 263, 334, 437, 459, 486, 520, 591, SH21-SH25
Standard 5.4 Earth Systems Science: All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.	
Strand A. Objects in the Universe: Our universe has been expanding and evolving for 13.7 billion years under the influence of gravitational and nuclear forces. As gravity governs its expansion, organizational patterns, and the movement of celestial bodies, nuclear forces within stars govern its evolution through the processes of stellar birth and death. These same processes governed the formation of our solar system 4.6 billion years ago.	
By the end of grade 12	
Content Statement	
Prior to the work of 17th-century astronomers, scientists believed the Earth was the center of the universe (geocentric model).	
CPI's	
5.4.12.A.1 Explain how new evidence obtained using telescopes (e.g., the phases of Venus or the moons of Jupiter) allowed 17th-century astronomers to displace the geocentric model of the universe.	Opportunities to address this standard appear on the following page: SE/TE: 4, 48

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Content Statement	
The properties and characteristics of solar system objects, combined with radioactive dating of meteorites and lunar samples, provide evidence that Earth and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago.	
CPI's	
5.4.12.A.2 Collect, analyze, and critique evidence that supports the theory that Earth and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago.	Opportunities to address this standard appear on the following page: SE/TE: 4, 48
Content Statement	
Stars experience significant changes during their life cycles, which can be illustrated with an Hertzsprung-Russell (H-R) Diagram.	
CPI's	
5.4.12.A.3 Analyze an H-R diagram and explain the life cycle of stars of different masses using simple stellar models.	
Content Statement	
The Sun is one of an estimated two hundred billion stars in our Milky Way galaxy, which together with over one hundred billion other galaxies, make up the universe.	
CPI's	
5.4.12.A.4 Analyze simulated and/or real data to estimate the number of stars in our galaxy and the number of galaxies in our universe.	
Content Statement	
The Big Bang theory places the origin of the universe at approximately 13.7 billion years ago. Shortly after the Big Bang, matter (primarily hydrogen and helium) began to coalesce to form galaxies and stars.	
CPI's	
5.4.12.A.5 Critique evidence for the theory that the universe evolved as it expanded from a single point 13.7 billion years ago.	

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Content Statement	
According to the Big Bang theory, the universe has been expanding since its beginning, explaining the apparent movement of galaxies away from one another.	
CPI's	
5.4.12.A.6 Argue, citing evidence (e.g., Hubble Diagram), the theory of an expanding universe.	
Strand B. History of Earth: From the time that Earth formed from a nebula 4.6 billion years ago, it has been evolving as a result of geologic, biological, physical, and chemical processes.	
By the end of grade 12	
Content Statement	
The evolution of life caused dramatic changes in the composition of Earth's atmosphere, which did not originally contain oxygen gas.	
CPI's	
5.4.12.B.1 Trace the evolution of our atmosphere and relate the changes in rock types and life forms to the evolving atmosphere.	Opportunities to address this standard can be found on the following pages: SE/TE: 79, 452-460
Content Statement	
Relative dating uses index fossils and stratigraphic sequences to determine the sequence of geologic events.	
CPI's	
5.4.12.B.2 Correlate stratigraphic columns from various locations by using index fossils and other dating techniques.	Opportunities to address this standard can be found on the following pages: SE/TE: 522-526, 532
Content Statement	
Absolute dating, using radioactive isotopes in rocks, makes it possible to determine how many years ago a given rock sample formed.	
CPI's	
5.4.12.B.3 Account for the evolution of species by citing specific absolute-dating evidence of fossil samples.	Opportunities to address this standard can be found on the following pages: SE/TE: 126-132, 137, 139, 158-161

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Strand C. Properties of Earth Materials: Earth's composition is unique, is related to the origin of our solar system, and provides us with the raw resources needed to sustain life.	
By the end of grade 12	
Content Statement	
Soils are at the interface of the Earth systems, linking together the biosphere, geosphere, atmosphere, and hydrosphere.	
CPI's	
5.4.12.C.1 Model the interrelationships among the spheres in the Earth systems by creating a flow chart.	SE/TE: 81, 84, 86-87, SH14
Content Statement	
The chemical and physical properties of the vertical structure of the atmosphere support life on Earth.	
CPI's	
5.4.12.C.2 Analyze the vertical structure of Earth's atmosphere, and account for the global, regional, and local variations of these characteristics and their impact on life.	SE/TE: 455-460, 476-477
Strand D. Tectonics: The theory of plate tectonics provides a framework for understanding the dynamic processes within and on Earth.	
By the end of grade 12	
Content Statement	
Convection currents in the upper mantle drive plate motion. Plates are pushed apart at spreading zones and pulled down into the crust at subduction zones.	
CPI's	
5.4.12.D.1 Explain the mechanisms for plate motions using earthquake data, mathematics, and conceptual models.	SE/TE: 77-78, 277-279, 286

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Content Statement	
Evidence from lava flows and ocean-floor rocks shows that Earth's magnetic field reverses (North – South) over geologic time.	
CPI's	
5.4.12.D.2 Calculate the average rate of seafloor spreading using archived geomagnetic-reversals data.	Opportunities to address this standard can be found on the following pages: SE/TE: 77-78, 278
Strand E. Energy in Earth Systems: Internal and external sources of energy drive Earth systems.	
By the end of grade 12	
Content Statement	
The Sun is the major external source of energy for Earth's global energy budget.	
CPI's	
5.4.12.E.1 Model and explain the physical science principles that account for the global energy budget.	SE/TE: 84-85, 89, 142-148, 159-161, 167, 458, 517-521, 541
Content Statement	
Earth systems have internal and external sources of energy, both of which create heat.	
CPI's	
5.4.12.E.2 Predict what the impact on biogeochemical systems would be if there were an increase or decrease in internal and external energy.	SE/TE: 83-89, 92-94

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Strand F. Climate and Weather: Earth's weather and climate systems are the result of complex interactions between land, ocean, ice, and atmosphere.	
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Content Statement	
Global climate differences result from the uneven heating of Earth's surface by the Sun. Seasonal climate variations are due to the tilt of Earth's axis with respect to the plane of Earth's nearly circular orbit around the Sun.	
CPI's	
5.4.12.F.1 Explain that it is warmer in summer and colder in winter for people in New Jersey because the intensity of sunlight is greater and the days are longer in summer than in winter. Connect these seasonal changes in sunlight to the tilt of Earth's axis with respect to the plane of its orbit around the Sun.	SE/TE: 486
Content Statement	
Climate is determined by energy transfer from the Sun at and near Earth's surface. This energy transfer is influenced by dynamic processes, such as cloud cover and Earth's rotation, as well as static conditions, such as proximity to mountain ranges and the ocean. Human activities, such as the burning of fossil fuels, also affect the global climate.	
CPI's	
5.4.12.F.2 Explain how the climate in regions throughout the world is affected by seasonal weather patterns, as well as other factors, such as the addition of greenhouse gases to the atmosphere and proximity to mountain ranges and to the ocean.	SE/TE: 486, 495-513
Content Statement	
Earth's radiation budget varies globally, but is balanced. Earth's hydrologic cycle is complex and varies globally, regionally, and locally.	
CPI's	
5.4.12.F.3 Explain variations in the global energy budget and hydrologic cycle at the local, regional, and global scales.	Opportunities to address this standard can be found on the following pages: SE/TE: 81-82, 420, 487

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Strand G. Biogeochemical Cycles: The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.	
By the end of grade 12	
Content Statement	
Natural and human-made chemicals circulate with water in the hydrologic cycle.	
CPI's	
5.4.12.G.1 Analyze and explain the sources and impact of a specific industry on a large body of water (e.g., Delaware or Chesapeake Bay).	SE/TE: 274, 302, 435-443, 446-449, 468
Content Statement	
Natural ecosystems provide an array of basic functions that affect humans. These functions include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients.	
CPI's	
5.4.12.G.2 Explain the unintended consequences of harvesting natural resources from an ecosystem.	SE/TE: 242-247, 250, 296, 503, 528, 530-535, 544, 546-547
Content Statement	
Movement of matter through Earth's system is driven by Earth's internal and external sources of energy and results in changes in the physical and chemical properties of the matter.	
CPI's	
5.4.12.G.3 Demonstrate, using models, how internal and external sources of energy drive the hydrologic, carbon, nitrogen, phosphorus, sulfur, and oxygen cycles.	SE/TE: 81-89, 92-94, 487
Content Statement	
Natural and human activities impact the cycling of matter and the flow of energy through ecosystems.	
CPI's	
5.4.12.G.4 Compare over time the impact of human activity on the cycling of matter and energy through ecosystems.	SE/TE: 82, 86, 88, 92, 94

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Content Statement	
Human activities have changed Earth's land, oceans, and atmosphere, as well as its populations of plant and animal species.	
CPI's	
5.4.12.G.5 Assess (using maps, local planning documents, and historical records) how the natural environment has changed since humans have inhabited the region.	SE/TE: 10, 20, 201, 335
Content Statement	
Scientific, economic, and other data can assist in assessing environmental risks and benefits associated with societal activity.	
CPI's	
5.4.12.G.6 Assess (using scientific, economic, and other data) the potential environmental impact of large-scale adoption of emerging technologies (e.g., wind farming, harnessing geothermal energy).	SE/TE: 550-579
Content Statement	
Earth is a system in which chemical elements exist in fixed amounts and move through the solid Earth, oceans, atmosphere, and living things as part of geochemical cycles.	
CPI's	
5.4.12.G.7 Relate information to detailed models of the hydrologic, carbon, nitrogen, phosphorus, sulfur, and oxygen cycles, identifying major sources, sinks, fluxes, and residence times.	SE/TE: 81-89, 92-94, 487
http://www.state.nj.us/education/aps/cccs/science/standards.htm	