



## Coordinated Science for the 21<sup>st</sup> Century Correlation to the Pennsylvania Science Grade 11 Assessment Anchors and Eligible Content

### S11.A The Nature of Science

Standard	Location/Page where Standard is found
S11.A.1 Reasoning and Analysis	
S11.A.1.1 Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.	
S11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs (e.g., the universal law of gravitation, how light travels, formation of moons, stages of ecological succession).	632-635, 647-653, 298-299
S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws.	96-100, 119-123, 296-301, 320-327, 647-653
S11.A.1.1.3 Evaluate the appropriateness of research questions (e.g., testable vs. not-testable).	Throughout, for example: 113-118, 119-123, 296-301, 328-337, 647-652, 862-871, 872-883, 888-897, 898-906, 958-968, 979-988
S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g., momentum, Newton’s universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur’s germ theory, relativity, heliocentric theory, ideal gas laws).	792-799, 703-713, 804-815, 825-834, 835-842, 843-852, 530 - 543

S11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g., behavior of atoms, functions of cells, birth of stars).	<b>113-118, 119-123, 296-301, 328-337, 647-652, 862-871, 872-883, 888-897, 898-906, 958-968, 979-988</b>
S11.A.1.2 Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.	
S11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy).	<b>113-118, 396-406, 407-414, 647-653, 660-669</b>
S11.A.1.2.2 Use case studies (e.g., Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petroski's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for realworld problems.	<b>77, 137, 209, 244, 313, 526, 606, 654, 736, 800, 884, 942, 1002</b>
S11.A.2 Processes, Procedures, and Tools of Scientific Investigations	
S11.A.2.1 Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.	
S11.A.2.1.1 Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design.	<b>113-118, 119-123, 296-301, 328-337, 647-652, 862-871, 872-883, 888-897, 898-906, 958-968, 979-988</b>
S11.A.2.1.2 Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design.	<b>113-118, 119-123, 296-301, 328-337, 647-652, 862-871, 872-883, 888-897, 898-906, 958-968, 979-988</b>
S11.A.2.1.3 Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.	<b>82-87, 96-100, 119-123, 328-337, 752-760, 781-791, 907-914, 946-957, 958-968</b>
S11.A.2.1.4 Critique the results and conclusions of scientific inquiry for consistency and logic.	<b>96-100, 296-301, 647-653, 989-1001</b>
S11.A.2.1.5 Communicate results of investigations using multiple representations.	<b>119-123, 131-136, 274-280, 350-359, 693-702, 703-713, 781-791, 862-871, 328-337</b>

S11.A.2.2 Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide.	
S11.A.2.2.1 Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).	<b>88-95, 131-136, 274-280, 119-123, 350-359, 693-702, 703-713, 781-791, 862-871, 113-118, 119-123, 296-301, 328-337, 647-652, 872-883, 888-897, 898-906, 958-968, 979-988</b>
S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision.	<b>792-799, 703-713, 804-815, 825-834, 835-842, 843-852, 540 - 543</b>
S11.A.3 Systems, Models, and Patterns	
S11.A.3.1 Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.	
S11.A.3.1.1 Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts.	<b>781-791, 792-799, 591-596, 597-605</b>
S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole.	<b>559-562, 563-567, 544-551</b>
S11.A.3.1.3 Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	<b>559-562, 563-567, 544-551, 781-791, 792-799, 591-596, 597-605</b>
S11.A.3.1.4 Apply the universal systems model of inputs, processes, outputs, and feedback to a working system (e.g., heating, motor, food production) and identify the resources necessary for operation of the system.	<b>559-562, 563-567, 544-551, 781-791, 792-799, 591-596, 597-605</b>
S11.A.3.2 Compare observations of the real world to observations of a constructed model.	
S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior.	<b>328-337, 591-596, 597-605, 693-702, 781-791, 843-852</b>

S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes.	328-337, 591-596, 597-605, 693-702, 781-791, 843-852
S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps).	583-590, 761-772, 591-596, 597-605, 637-646, 647-653, 328-337, 693-702, 781-791, 843-852
<b>S11.A.3 Systems, Models, and Patterns</b>	
<b>S11.A.3.3 Compare and analyze repeated processes or recurring elements in patterns.</b>	
S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.	250-257, 927-934, 946-957, 958-968, 989-1001, 637-646, 647-653, 843-852, 915-921, 559-567, 258-264
S11.A.3.3.2 Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties.	532 – 543, 544 – 551, 753 – 760, 781 – 791, 792 – 799, 503 – 509, 328 – 337, 935 - 941
S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).	532 – 543, 544 – 551, 753 – 760, 781 – 791, 792 – 799, 503 – 509, 328 – 337, 935 - 941

## S11.B Biological Sciences

<b>Standard</b>	<b>Location/Page where Standard is found</b>
<b>S11.B.1 Structure and Function of Organisms</b>	
<b>S11.B.1.1 Explain structure and function at multiple levels of organization.</b>	

S11.B.1.1.1 Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical).	532 – 543, 610 – 619, 620 - 626
S11.B.1.1.2 Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into classification groups, compare systems).	568 – 575, 576 – 582, 532 – 543, 610 – 619, 620 - 626
S11.B.1.1.3 Compare and contrast cellular processes (e.g., photosynthesis and respiration, meiosis and mitosis, protein synthesis and DNA replication).	591-596, 597-605, 825-834, 544-551, 552-558
<b>S11.B.2 Continuity of Life</b>	
<b>S11.B.2.1 Explain the mechanisms of the theory of evolution.</b>	
S11.B.2.1.1 Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, or DNA studies that are relevant to the theory of evolution.	620 – 626, 627 - 636
S11.B.2.1.2 Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population.	627 – 636, 532 - 543
S11.B.2.1.3 Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population.	627 – 636, 532 - 543
S11.B.2.1.4 Explain why natural selection can act only on inherited traits.	627 – 636, 532 - 543
<b>S11.B.2.2 Describe how genetic information is inherited and expressed.</b>	
S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication).	620 - 626
S11.B.2.2.2 Compare and contrast mitosis and meiosis in passing on genetic information.	620 - 626
S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits).	620 – 626, 627 – 636, 532 - 543
<b>S11.B.3 Ecological Behavior and Systems</b>	
<b>S11.B.3.1 Use evidence or examples to explain the characteristics of and interactions within an ecosystem.</b>	

S11.B.3.1.1 Explain the significance of diversity in ecosystems.	568-575, 576-582, 532-543, 627-636
S11.B.3.1.2 Explain the biotic (i.e., plant, animal, and microbial communities) and abiotic (i.e., soil, air, temperature, and water) components of an ecosystem and their interaction.	532 – 543, 544 – 551, 552 – 558, 559 – 567, 588 – 590, 804 – 815, 568 - 590
S11.B.3.1.3 Describe how living organisms affect the survival of one another.	610-619, 627-636, 568-575, 576-582, 576-582, 591-596, 597-605, 907-914, 915-921, 922-926, 804- 815
S11.B.3.1.4 Compare the similarities and differences in the major biomes (e.g., desert, tropical rain forest, temperate forest, coniferous forest, tundra) and the communities that inhabit them.	740 – 751, 752- 760, 552 - 558
S11.B.3.1.5 Predict how limiting factors (e.g., physical, biological, chemical) can affect organisms.	544-551, 552-538, 559-567, 568-575, 647 – 653, 804 - 815
S11.B.3.2 Analyze patterns of change in natural or human-made systems over time.	
S11.B.3.2.1 Use evidence to explain how cyclical patterns in population dynamics affect natural systems.	532-543, 544-551
S11.B.3.2.2 Explain biological diversity as an indicator of a healthy environment.	568-575, 576-582, 532-543, 627-636
S11.B.3.2.3 Explain how natural processes (e.g., seasonal change, catastrophic events, habitat alterations) impact the environment over time.	576-582, 591-596, 597-605, 907-914, 915-921, 922-926
<b>S11.B.3 Ecological Behavior and Systems</b>	
<b>S11.B.3.3 Explain how human-made systems impact the management and distribution of natural resources.</b>	
S11.B.3.3.1 Describe different human-made systems and how they use renewable and nonrenewable natural resources (i.e., energy, transportation, distribution, management, and processing).	816- 824, 825 – 834, 835 – 842, 843 – 852, 853 – 861, 532-543, 544-551, 583-590, 703-713, 781-791, 804-815
S11.B.3.3.2 Compare the impact of management practices (e.g., production, processing, research, development, marketing, distribution, consumption, byproducts) in meeting the need for commodities locally and globally.	576-582, 583-590, 843-852
S11.B.3.3.3 Explain the environmental benefits and risks associated with humanmade systems (e.g., integrated pest management, genetically	576-582, 583-590, 907-914, 915-921, 781-791, 792-799,

engineered organisms, organic food production).	835-842, 843-852, 872-883
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### S11.C Physical Sciences

Standard	Location/Page where Standard is found
<b>S11.C.1 Structure, Properties, and Interaction of Matter and Energy</b>	
<b>S11.C.1.1 Explain the relationship between the structure and properties of matter.</b>	
S11.C.1.1.1 Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., protons, neutrons, electrons).	396 – 406, 407 – 414, 415 – 424, 425 – 433, 434 - 441
S11.C.1.1.2 Explain the relationship between the physical properties of a substance and its molecular or atomic structure.	320-327, 328-338, 344-349, 350-359, 360-366, 367-371, 377-382, 390-395
S11.C.1.1.3 Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.	475 – 489, 344-349, 372-376, 390-395, 446-472, 473-478
S11.C.1.1.4 Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.	360-366, 372-376, 390-395, 425-433, 434-441
S11.C.1.1.5 Predict the behavior of gases through the application of laws (e.g., Boyle’s law, Charles’ law, or ideal gas law).	328 – 337, 350 – 359, 439 – 440, 476 - 477
S11.C.1.1.6 Describe factors that influence the frequency of collisions during chemical reactions that might affect the reaction rates (e.g., surface area, concentration, temperature).	503-509, 328-337
<b>S11.C.2 Forms, Sources, Conversion, and Transfer of Energy</b>	
<b>S11.C.2.1 Analyze energy sources and transfer of energy, or conversion of energy.</b>	

S11.C.2.1.1 Compare or analyze waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, Xrays, microwaves) as well as their properties, energy levels, and motion.	714 – 724, 415 - 424
S11.C.2.1.2 Describe energy changes in chemical reactions.	496 – 502, 415 – 424, 486 - 495
S11.C.2.1.3 Apply the knowledge of conservation of energy to explain common systems (e.g., refrigeration, rocket propulsion, heat pump).	328 – 337, 33-46, 58-62, 63-70, 214-218, 449-460, 703-713, 804-815, 816-824, 843-852, 872-883, 101 - 106
S11.C.2.1.4 Use Ohm’s Law to explain relative resistances, currents, and voltage.	214– 218, 219 – 222, 223 – 227, 228 - 234
<b>S11.C.2.2 Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences.</b>	
S11.C.2.2.1 Explain the environmental impacts of energy use by various economic sectors (e.g., mining, logging, transportation) on environmental systems.	576-582, 583-590, 843-852
S11.C.2.2.2 Explain the practical use of alternative sources of energy (i.e., wind, solar, and biomass) to address environmental problems (e.g., air quality, erosion, resource depletion).	872 - 883
S11.C.2.2.3 Give examples of renewable energy resources (e.g., wind, solar, biomass) and nonrenewable resources (e.g., coal, oil, natural gas) and explain the environmental and economic advantages and disadvantages of their use.	804 – 815, 816- 824, 825 – 834, 835 – 842, 843 – 852, 853 – 861, 862 – 871, 872 – 883, 781 – 791, 792 - 799
<b>S11.C.3 Principles of Motion and Force</b>	
<b>S11.C.3.1 Use the principles of motion and force to solve real-world challenges.</b>	

S11.C.3.1.1 Explain common phenomena (e.g., a rock in a landslide, an astronaut during a space walk, a car hitting a patch of ice on the road) using an understanding of conservation of momentum.	58-62, 63-70, 101-106, 113-118, 124-130, 131-136
S11.C.3.1.2 Design or evaluate simple technological or natural systems that incorporate the principles of force and motion (e.g., simple machines, compound machines).	17-27, 33-46, 47-51, 71-76, 88-95, 101-106, 107-112, 113-118, 119-123, 124-130, 258-264, 969-978
S11.C.3.1.3 Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).	6-16, 17-27, 37-46, 47-51, 82-87, 88-95, 280-288, 289-295, 296-301, 969-978
S11.C.3.1.4 Explain how electricity induces magnetism and how magnetism induces electricity as two aspects of a single electromagnetic force.	214 – 218, 219 – 222, 223 – 227, 228 – 234, 235 – 240, 241 - 243
S11.C.3.1.5 Calculate the mechanical advantage for moving an object by using a simple machine.	811 - 813
S11.C.3.1.6 Identify elements of simple machines in compound machines.	811 - 813

### S11.D Earth and Space Sciences

Standard	Location/Page where Standard is found
<b>S11.D.1 Earth Features and Processes that Change Earth and Its Resources</b>	
<b>S11.D.1.1 Explain and analyze the forces in the lithosphere that continually shape Earth.</b>	

S11.D.1.1.1 Classify and describe major types of rocks (i.e., igneous – granite, basalt, obsidian, pumice; sedimentary – limestone, sandstone, shale, coal; and metamorphic – slate, quartzite, marble, gneiss) and minerals (e.g., quartz, calcite, dolomite, clay, feldspar, mica, halite, pyrite) by their origin and formation.	<b>958-968, 969-978, 979-988</b>
S11.D.1.1.2 Explain the processes that take place at plate boundaries and how these processes continue to shape Earth (e.g., volcanic activity, earthquakes, mountain building, mid-ocean ridges, deep-sea trenches, new land being formed).	<b>969-978, 979-988, 989-1001</b>
S11.D.1.1.3 Analyze features caused by the interaction of processes that change Earth’s surface (e.g., wind and moving water help break down rock into soil; plate movement, earthquakes, and volcanic activity help cause mountains and valleys to form; flowing water and deposition of material help form deltas).	<b>825-834, 898-906, 927-934</b>
S11.D.1.2 Analyze how human-made systems impact the management and distribution of natural resources.	
S11.D.1.2.1 Evaluate factors affecting availability, location, extraction, and use of natural resources.	<b>816- 824, 825 – 834, 835 – 842, 843 – 852, 853 – 861, 927 - 934</b>
S11.D.1.2.2 Explain the impact of obtaining and using natural resources for the production of energy and materials (e.g., resource renewal, amount of pollution, deforestation).	<b>647-653, 922-926, 946-957, 989-1001</b>
S11.D.1.3 Explain the significance and contribution of water as a resource to living things and the shaping of the land.	
S11.D.1.3.1 Explain the multiple functions of different water systems in relation to landforms (e.g., buffer zones, nurseries, food production areas, habitat, water quality control, biological indicators).	<b>583 – 590, 773 - 780</b>
S11.D.1.3.2 Explain relationships among physical characteristics, vegetation, topography, and flow as it relates to water systems.	<b>583 – 590, 773 – 780, 740 - 752</b>
S11.D.1.3.3 Explain factors (e.g., nutrient loading, turbidity, rate of flow, rate of deposition, biological diversity) that affect water quality and flow through a water system.	<b>583 – 590, 843 - 852</b>
<b>S11.D.2 Weather, Climate, and Atmospheric Processes</b>	

S11.D.2.1 Analyze how the transfer of energy and substances between Earth's atmosphere and its surface influences regional or global weather or climate.	
S11.D.2.1.1 Describe how changes in concentration of minor components (e.g., O <sub>2</sub> , CO <sub>2</sub> , dust, pollution) in Earth's atmosphere may be linked to climate change.	<b>781-791, 792-799, 915-921, 922-926</b>
S11.D.2.1.2 Compare the transmission, reflection, absorption, and radiation of solar energy to and by Earth's surface under different environmental conditions (e.g., major volcanic eruptions, greenhouse effect, reduction of ozone layer, increased global cloud cover).	<b>703-713, 761-772, 773-780, 781-791, 792-799, 915-921, 922-926</b>
S11.D.2.1.3 Explain weather patterns and seasonal changes using the concepts of heat and density.	<b>740-751, 761-772, 773-780, 781-791</b>
S11.D.2.1.4 Analyze weather maps and weather data (e.g., air masses, fronts, temperature, air pressure, wind speed, wind direction, precipitation) to predict regional or global weather events.	<b>761 – 772, 792 - 799</b>
<b>S11.D.3 Composition and Structure of the Universe</b>	
<b>S11.D.3.1 Explain the composition, structure, and origin of the universe.</b>	
S11.D.3.1.1 Describe planetary motion and the physical laws that explain planetary motion.	<b>684 – 692, 693 – 702, 660 – 669, 670 – 683, 703 - 713</b>
S11.D.3.1.2 Describe the structure, formation, and life cycle of stars.	<b>725 – 735, 703 - 713</b>
S11.D.3.1.3 Explain the current scientific theories of the origin of the solar system and universe (e.g., big bang theory, solar nebular theory, stellar evolution).	<b>660 – 669, 693 - 702</b>