Grade: High School Subject: Biology

Strand Key	Description	Learning	Activities		Lesson Quizzes
S11.A.1.1.1	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS411 aqps1411 PS1372 aqps1373 BI311 BI1351 ch007 aqch037 ch041 ch043 aqch044 ch046 aqch047 aqph022 ph024 ph024 ph053 ph056 ph083	PS421 PS1371 aqps1372 PS1374 aqbi311 ch005 aqch007 ch039 ch042 aqch043 ch045 ph021 ph023 ph042 ph045 ph054 ph071	PS1411 aqps1373 aqps1374 BI431 aqch005 ch037 ch040 aqch042 ch047 ph022 aqph023 ph043 ph047 ph055 ph077	BI13C01 BI13D03 BI13M05 CH13B01 CH13D01 CH13D02 CH13D03 CH13D04 CH13D05 CH13D06 CH13D07 PH13C06 PH13C07 PH13C08 PH13G02 PH13G03 PH13G03 PH13G03 PH13G04 PH13G05 PH13J01 PH13J02 PH13J01 PH13J02 PH13J02 PH13D02 PH13D02 PH13D02 PH13D02 PS13D01 PS13N01

S11.A.1.1.4	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS411 aqps911 aqps1411 BI511 aqbi512 BI521 aqbi522 ch007 aqch031 ch044 aqch045	PS421 PS1351 BI311 aqbi511 BI513 aqbi521 ch005 aqch007 ch032 aqch044 ph047	PS911 PS1411 aqbi311 BI512 aqbi513 BI522 aqch005 ch031 aqch032 ch045	BI13C01 BI13E01 BI13E02 CH13B01 CH13C03 CH13D06 PH13H02 PS13D01 PS13D02 PS13I01 PS13M05 PS13N01
S11.A.1.1.5	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS511 aqps512 BI312 aqbi321 BI331 aqbi332 BI341 aqbi342 BI351	aqps511 BI311 aqbi312 BI322 aqbi331 BI333 aqbi341 BI343	PS512 aqbi311 BI321 aqbi322 BI332 aqbi333 BI342 aqbi343	BI13C01 BI13C02 BI13C03 BI13C04 BI13C05 PS13E01
S11.A.1.2.1	Reasoning and Analysis Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications. Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy).	PS1612 aqbi611 BI1431 aqph030	aqps1612 BI612 BI1441 ph035	BI611 aqbi612 ph030	BI13F01 BI13N03 BI13N04 PH13E01 PH13E05 PS13P01

S11.A.1.3.1	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Use appropriate quantitative data to describe or interpret change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	PS1921 aqps1922 PS1924 aqps1931 ph081 aqph082 ph085 ph087	aqps1921 PS1923 aqps1924 PS1932 aqph081 ph083 ph086 aqph087	PS1922 aqps1923 PS1931 aqps1932 ph082 ph084 aqph086 ph088	PH13P01 PH13P02 PH13P03 PH13Q01 PH13Q02 PH13Q03 PS13S02 PS13S03
S11.A.1.3.2	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Describe or interpret dynamic changes to stable systems (e.g., chemical reactions, human body, food webs, tectonics, homeostasis).	PS1011 BI1321 ch029 aqch030	BI1221 ch028 aqch029	BI1311 aqch028 ch030	BI13L02 BI13M01 BI13M02 CH13C02 PS13J01
S11.A.1.3.3	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Describe how changes in physical and biological indicators (e.g., soil, plants, animals) of water systems reflect changes in these systems (e.g. changes in bloodworm populations reflect changes in pollution levels in streams).	BI1341 BI1441	BI1421	BI1431	BI13M04 BI13N02 BI13N03 BI13N04
S11.A.1.3.4	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Compare the rate of use of natural resources and their impact on sustainability.	BI1431	BI1441		BI13N03 BI13N04
S11.A.2.1.1	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. 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.	PS111 PS122 aqps123 BI111 aqbi112	PS121 aqps122 PS124 aqbi111	aqps121 PS123 aqps124 BI112	BI13A01 PS13A01 PS13A02
S11.A.2.1.3	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.	PS123 aqps124	aqps123 BI112	PS124 aqbi112	BI13A01 PS13A02

S11.A.2.1.4	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Critique the results and conclusions of scientific inquiry for consistency and logic.	PS123 aqps124	aqps123 BI112	PS124 aqbi112	BI13A01 PS13A02
S11.A.2.1.5	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Communicate results of investigations using multiple representations.	PS122 aqps123	aqps122 BI112	PS123 aqbi112	BI13A01 PS13A02
S11.A.2.2.1	Processes, Procedures, and Tools of Scientific Investigations Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide. Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).	PS111 PS311 aqps312 ch001	PS122 aqps311 BI112 aqch001	aqps122 PS312 aqbi112	BI13A01 CH13A01 PS13A01 PS13A02 PS13C01
S11.A.2.2.2	Processes, Procedures, and Tools of Scientific Investigations Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide. 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.	PS1211 aqbi311	PS1221	BI311	BI13C01 PS13L01 PS13L02
S11.A.3.1.1	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts.	BI1311	BI1321		BI13M01 BI13M02
S11.A.3.1.2	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Analyze and predict the effect of making a change in one part of a system on the system as a whole.	PS1011 PS1022 PS1361 PS1532 aqps1533 PS1611 aqps1612 PS1931 aqps1932 BI1331 BI1421 ch038 ch040 aqch042 ch044 aqch045	PS1021 aqps1022 PS1531 aqps1532 PS1534 aqps1611 PS1613 aqps1931 BI1311 BI1341 ch037 aqch038 ch041 ch043 aqch044 ch046	aqps1021 PS1351 aqps1531 PS1533 aqps1534 PS1612 aqps1613 PS1932 BI1321 BI1411 aqch037 ch039 ch042 aqch043 ch045 aqch046	BI13M01 BI13M02 BI13M03 BI13M04 BI13N01

	ch047	aqch047	ch069	BI13N02
	aqch069	ch070	aqch070	CH13D01
	ph020	ph027	ph028	CH13D02
	ph030	aqph030	ph033	CH13D03
	ph034	ph036	ph037	CH13D04
	ph053	ph054	adop086	CH13D05
	ph087	agph087	ph088	CH13D06
				CH13D07
				CH13F02
				PH13C05
				PH13D03
				PH13D04
				PH13E01
				PH13E03
				PH13E04
				PH13E06
				PH13E07
				PH13J01
				PH13J02
				PH13J03
				PH13Q01
				PH13Q02
				PH13Q03
				PS13J01
				PS13J02
				PS13M05
				PS13M06
				PS13003
				PS13P01
				PS13S03

S11.A.3.1.3	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	PS1921 aqps1922 PS1924 aqps1931 ph082 ph084 aqph086 ph088	aqps1921 PS1923 aqps1924 PS1932 aqph082 ph085 ph087	PS1922 aqps1923 PS1931 aqps1932 ph083 ph086 aqph087	PH13P01 PH13P02 PH13P03 PH13Q01 PH13Q02 PH13Q03 PS13S02 PS13S03
S11.A.3.1.4	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. 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.	PS1531 aqps1532 PS1534 ph093	aqps1531 PS1533 aqps1534	PS1532 aqps1533 ph037	PH13E07 PH13S02 PS13O03
S11.A.3.2.1	Systems, Models, and Patterns Compare observations of the real world to observations of a constructed model. Compare the accuracy of predictions represented in a model to actual observations and behavior.	BI112 aqch001	aqbi112	ch001	BI13A01 CH13A01
S11.A.3.2.3	Systems, Models, and Patterns Compare observations of the real world to observations of a constructed model. 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).	PS411 aqps511 ch005 aqch007	PS421 PS512 aqch005	PS511 aqps512 ch007	CH13B01 PS13D01 PS13D02 PS13E01
S11.A.3.3.1	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.	PS711 PS722 aqbi711 BI811 BI1111 aqbi1112	PS721 aqps722 BI712 BI911 aqbi1111	aqps721 BI711 aqbi712 BI1011 BI1112	BI13G01 BI13H01 BI13I01 BI13J01 BI13K01 PS13G01 PS13G02

S11.A.3.3.2	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties.	PS411 aqps511 BI1251 ch007	PS421 PS512 ch005 aqch007	PS511 aqps512 aqch005	BI13L05 CH13B01 PS13D01 PS13D02 PS13E01
S11.A.3.3.3	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).	PS421 aqps1711 ch007	BI1341 PS1713 aqch007	PS1711 aqps1713 ph059	BI13M04 CH13B01 PH13K03 PS13D02 PS13Q01

S11.B.1.1.1	Structure and Function of Organisms Explain structure and function at multiple levels of organization. Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical).	BI221 aqbi222 BI332 aqbi333 aqbi461 BI612 BI911 aqbi1041 BI1043 BI1161 BI1231 BI1261 BI1291	aqbi221 BI331 aqbi332 BI351 BI611 aqbi612 BI1021 BI1042 aqbi1043 BI1141 BI1211 BI1211 BI1271 BI12101	BI222 aqbi331 BI333 BI461 aqbi611 BI811 BI1041 aqbi1042 BI1121 BI1221 BI1221 BI1281	BI13B02 BI13C03 BI13C05 BI13D06 BI13F01 BI13H01 BI13I01 BI13J02 BI13J04 BI13K02 BI13K03 BI13K04 BI13K05 BI13K06 BI13L01 BI13L02 BI13L03 BI13L04 BI13L05 BI13L05 BI13L06 BI13L07 BI13L08 BI13L09 DI10140
					BI13L10

S11.B.1.1.2	Structure and Function of Organisms Explain structure and function at multiple levels of organization. Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into classification groups, compare systems).	BI312 aqbi711 BI911 BI1031 BI112 BI1131 BI1161	aqbi312 BI712 BI821 BI1011 BI1111 aqbi1112 BI1141	BI711 aqbi712 BI831 BI1021 aqbi1111 BI1121 BI1151	BI13C01 BI13G01 BI13H01 BI13H02 BI13H03 BI13H03 BI13J01 BI13J02 BI13J03 BI13K01 BI13K02 BI13K03 BI13K04 BI13K05 BI13K06
S11.B.1.1.3	Structure and Function of Organisms Explain structure and function at multiple levels of organization. Compare and contrast cellular processes (e.g., photosynthesis and respiration, meiosis and mitosis, protein synthesis and DNA replication).	BI331 aqbi342 BI412 BI452 aqbi453 BI462	aqbi331 BI343 aqbi412 aqbi452 BI461 aqbi462	BI342 aqbi343 BI421 BI453 aqbi461	BI13C03 BI13C04 BI13D01 BI13D02 BI13D05 BI13D06
S11.B.2.1.1	Continuity of Life Explain the mechanisms of the theory of evolution. 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.	BI511 aqbi512 BI521 aqbi522	aqbi511 BI513 aqbi521	BI512 aqbi513 BI522	BI13E01 BI13E02
S11.B.2.1.2	Continuity of Life Explain the mechanisms of the theory of evolution. Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population.	BI463 BI513	aqbi463 aqbi513	BI471	BI13D06 BI13D07 BI13E01
S11.B.2.1.3	Continuity of Life Explain the mechanisms of the theory of evolution. Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population.	BI471			BI13D07

S11.B.2.1.4	Continuity of Life Explain the mechanisms of the theory of evolution. Explain why natural selection can act only on inherited traits.	BI511 aqbi512 BI522	aqbi511 BI513 aqbi522	BI512 aqbi513	BI13E01 BI13E02
S11.B.2.2.1	Continuity of Life Describe how genetic information is inherited and expressed. Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication).	BI431 BI442 aqbi451 BI453 aqbi461	BI441 aqbi442 BI452 aqbi453 BI462	aqbi441 BI451 aqbi452 BI461 aqbi462	BI13D03 BI13D04 BI13D05 BI13D06
S11.B.2.2.2	Continuity of Life Describe how genetic information is inherited and expressed. Compare and contrast mitosis and meiosis in passing on genetic information.	Bl411 aqbi412	aqbi411 BI421	BI412	BI13D01 BI13D02
S11.B.2.2.3	Continuity of Life Describe how genetic information is inherited and expressed. Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex- linked traits).	BI421 aqbi441	BI431 BI442	BI441 aqbi442	BI13D02 BI13D03 BI13D04
S11.B.3.1.1	Ecological Behavior and Systems Use evidence or examples to explain the characteristics of and interactions within an ecosystem. Explain the significance of diversity in ecosystems.	BI1311 BI1411	BI1321 BI1421	BI1351 BI1441	BI13M01 BI13M02 BI13M05 BI13N01 BI13N02 BI13N04
S11.B.3.1.2	Ecological Behavior and Systems Use evidence or examples to explain the characteristics of and interactions within an ecosystem. 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.	BI1311 BI1341 BI1421	BI1321 BI1351	BI1331 BI1411	BI13M01 BI13M02 BI13M03 BI13M04 BI13M05 BI13N01 BI13N02

S11.B.3.1.3	Ecological Behavior and Systems Use evidence or examples to explain the characteristics of and interactions within an ecosystem. Describe how living organisms affect the survival of one another.	BI1311 BI1341 BI1421	BI1321 BI1351 BI1431	BI1331 BI1411 BI1441	BI13M01 BI13M02 BI13M03 BI13M04 BI13M05 BI13N01 BI13N02 BI13N03 BI13N04
S11.B.3.1.4	Ecological Behavior and Systems Use evidence or examples to explain the characteristics of and interactions within an ecosystem. 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.	BI1411	BI1421		BI13N01 BI13N02
S11.B.3.1.5	Ecological Behavior and Systems Use evidence or examples to explain the characteristics of and interactions within an ecosystem. Predict how limiting factors (e.g., physical, biological, chemical) can affect organisms.	BI1331 BI1411 BI1441	BI1341 BI1421	BI1351 BI1431	BI13M03 BI13M04 BI13M05 BI13N01 BI13N02 BI13N03 BI13N04
S11.B.3.2.1	Ecological Behavior and Systems Analyze patterns of change in natural or human-made systems over time. Use evidence to explain how cyclical patterns in population dynamics affect natural systems.	BI1321	BI1341		BI13M02 BI13M04
S11.B.3.2.2	Ecological Behavior and Systems Analyze patterns of change in natural or human-made systems over time. Explain biological diversity as an indicator of a healthy environment.	BI1351	BI1441		BI13M05 BI13N04
S11.B.3.2.3	Ecological Behavior and Systems Analyze patterns of change in natural or human-made systems over time. Explain how natural processes (e.g., seasonal change, catastrophic events, habitat alterations) impact the environment over time.	BI1321 BI1441	BI1341	BI1431	BI13M02 BI13M04 BI13N03 BI13N04
S11.B.3.3.1	Ecological Behavior and Systems Explain how human-made systems impact the management and distribution of natural resources. Describe different human-made systems and how they use renewable and nonrenewable natural resources (i.e., energy, transportation, distribution, management, and processing).	BI1411 BI1441	BI1421	BI1431	BI13N01 BI13N02 BI13N03 BI13N04

S11.B.3.3.2	Ecological Behavior and Systems Explain how human-made systems impact the management and distribution of natural resources. 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.	BI1431	BI1441		BI13N03 BI13N04
S11.B.3.3.3	Ecological Behavior and Systems Explain how human-made systems impact the management and distribution of natural resources. Explain the environmental benefits and risks associated with human-made systems (e.g., integrated pest management, genetically engineered organisms, organic food production).	BI471	BI1431	BI1441	BI13D07 BI13N03 BI13N04

Grade: High School Subject: Chemistry

Strand Key	Description	Learning	Activities		Lesson Quizzes
S11.A.1.1.1	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS411 aqps1411 PS1372 aqps1373 BI311 BI1351 ch007 aqch037 ch041 ch043 aqch044 ch046 aqch047 aqph022 ph024 ph024 ph053 ph056 ph083	PS421 PS1371 aqps1372 PS1374 aqbi311 ch005 aqch007 ch039 ch042 aqch043 ch045 ph021 ph023 ph042 ph045 ph054 ph071	PS1411 aqps1373 aqps1374 BI431 aqch005 ch037 ch040 aqch042 ch047 ph022 aqph023 ph043 ph047 ph055 ph077	BI13C01 BI13D03 BI13M05 CH13B01 CH13D01 CH13D02 CH13D03 CH13D04 CH13D05 CH13D06 CH13D07 PH13C06 PH13C07 PH13C08 PH13G02 PH13G03 PH13G03 PH13G03 PH13G04 PH13G05 PH13J01 PH13J02 PH13J01 PH13J02 PH13J02 PH13D02 PH13D02 PH13D02 PH13D02 PS13D01 PS13N01

S11.A.1.1.4	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS411 aqps911 aqps1411 BI511 aqbi512 BI521 aqbi522 ch007 aqch031 ch044 aqch045	PS421 PS1351 BI311 aqbi511 BI513 aqbi521 ch005 aqch007 ch032 aqch044 ph047	PS911 PS1411 aqbi311 BI512 aqbi513 BI522 aqch005 ch031 aqch032 ch045	BI13C01 BI13E01 BI13E02 CH13B01 CH13C03 CH13D06 PH13H02 PS13D01 PS13D02 PS13I01 PS13M05 PS13N01
S11.A.1.1.5	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS511 aqps512 BI312 aqbi321 BI331 aqbi332 BI341 aqbi342 BI351	aqps511 BI311 aqbi312 BI322 aqbi331 BI333 aqbi341 BI343	PS512 aqbi311 BI321 aqbi322 BI332 aqbi333 BI342 aqbi343	BI13C01 BI13C02 BI13C03 BI13C04 BI13C05 PS13E01
S11.A.1.2.1	Reasoning and Analysis Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications. Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy).	PS1612 aqbi611 BI1431 aqph030	aqps1612 BI612 BI1441 ph035	BI611 aqbi612 ph030	BI13F01 BI13N03 BI13N04 PH13E01 PH13E05 PS13P01

S11.A.1.3.1	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Use appropriate quantitative data to describe or interpret change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	PS1921 aqps1922 PS1924 aqps1931 ph081 aqph082 ph085 ph087	aqps1921 PS1923 aqps1924 PS1932 aqph081 ph083 ph086 aqph087	PS1922 aqps1923 PS1931 aqps1932 ph082 ph084 aqph086 ph088	PH13P01 PH13P02 PH13P03 PH13Q01 PH13Q02 PH13Q03 PS13S02 PS13S03
S11.A.1.3.2	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Describe or interpret dynamic changes to stable systems (e.g., chemical reactions, human body, food webs, tectonics, homeostasis).	PS1011 BI1321 ch029 aqch030	BI1221 ch028 aqch029	BI1311 aqch028 ch030	BI13L02 BI13M01 BI13M02 CH13C02 PS13J01
S11.A.1.3.3	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Describe how changes in physical and biological indicators (e.g., soil, plants, animals) of water systems reflect changes in these systems (e.g. changes in bloodworm populations reflect changes in pollution levels in streams).	BI1341 BI1441	BI1421	BI1431	BI13M04 BI13N02 BI13N03 BI13N04
S11.A.1.3.4	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Compare the rate of use of natural resources and their impact on sustainability.	BI1431	BI1441		BI13N03 BI13N04
S11.A.2.1.1	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. 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.	PS111 PS122 aqps123 BI111 aqbi112	PS121 aqps122 PS124 aqbi111	aqps121 PS123 aqps124 BI112	BI13A01 PS13A01 PS13A02
S11.A.2.1.3	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.	PS123 aqps124	aqps123 BI112	PS124 aqbi112	BI13A01 PS13A02

S11.A.2.1.4	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Critique the results and conclusions of scientific inquiry for consistency and logic.	PS123 aqps124	aqps123 BI112	PS124 aqbi112	BI13A01 PS13A02
S11.A.2.1.5	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Communicate results of investigations using multiple representations.	PS122 aqps123	aqps122 BI112	PS123 aqbi112	BI13A01 PS13A02
S11.A.2.2.1	Processes, Procedures, and Tools of Scientific Investigations Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide. Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).	PS111 PS311 aqps312 ch001	PS122 aqps311 BI112 aqch001	aqps122 PS312 aqbi112	BI13A01 CH13A01 PS13A01 PS13A02 PS13C01
S11.A.2.2.2	Processes, Procedures, and Tools of Scientific Investigations Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide. 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.	PS1211 aqbi311	PS1221	BI311	BI13C01 PS13L01 PS13L02
S11.A.3.1.1	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts.	BI1311	BI1321		BI13M01 BI13M02
S11.A.3.1.2	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Analyze and predict the effect of making a change in one part of a system on the system as a whole.	PS1011 PS1022 PS1361 PS1532 aqps1533 PS1611 aqps1612 PS1931 aqps1932 BI1331 BI1421 ch038 ch040 aqch042 ch044 aqch045	PS1021 aqps1022 PS1531 aqps1532 PS1534 aqps1611 PS1613 aqps1931 BI1311 BI1341 ch037 aqch038 ch041 ch043 aqch044 ch046	aqps1021 PS1351 aqps1531 PS1533 aqps1534 PS1612 aqps1613 PS1932 BI1321 BI1411 aqch037 ch039 ch042 aqch043 ch045 aqch046	BI13M01 BI13M02 BI13M03 BI13M04 BI13N01

	ch047	aqch047	ch069	BI13N02
	aqch069	ch070	aqch070	CH13D01
	ph020	ph027	ph028	CH13D02
	ph030	aqph030	ph033	CH13D03
	ph034	ph036	ph037	CH13D04
	ph053	ph054	adop086	CH13D05
	ph087	agph087	ph088	CH13D06
				CH13D07
				CH13F02
				PH13C05
				PH13D03
				PH13D04
				PH13E01
				PH13E03
				PH13E04
				PH13E06
				PH13E07
				PH13J01
				PH13J02
				PH13J03
				PH13Q01
				PH13Q02
				PH13Q03
				PS13J01
				PS13J02
				PS13M05
				PS13M06
				PS13003
				PS13P01
				PS13S03

S11.A.3.1.3	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	PS1921 aqps1922 PS1924 aqps1931 ph082 ph084 aqph086 ph088	aqps1921 PS1923 aqps1924 PS1932 aqph082 ph085 ph087	PS1922 aqps1923 PS1931 aqps1932 ph083 ph086 aqph087	PH13P01 PH13P02 PH13P03 PH13Q01 PH13Q02 PH13Q03 PS13S02 PS13S03
S11.A.3.1.4	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. 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.	PS1531 aqps1532 PS1534 ph093	aqps1531 PS1533 aqps1534	PS1532 aqps1533 ph037	PH13E07 PH13S02 PS13O03
S11.A.3.2.1	Systems, Models, and Patterns Compare observations of the real world to observations of a constructed model. Compare the accuracy of predictions represented in a model to actual observations and behavior.	BI112 aqch001	aqbi112	ch001	BI13A01 CH13A01
S11.A.3.2.3	Systems, Models, and Patterns Compare observations of the real world to observations of a constructed model. 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).	PS411 aqps511 ch005 aqch007	PS421 PS512 aqch005	PS511 aqps512 ch007	CH13B01 PS13D01 PS13D02 PS13E01
S11.A.3.3.1	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.	PS711 PS722 aqbi711 BI811 BI1111 aqbi1112	PS721 aqps722 BI712 BI911 aqbi1111	aqps721 BI711 aqbi712 BI1011 BI1112	BI13G01 BI13H01 BI13I01 BI13J01 BI13K01 PS13G01 PS13G02

S11.A.3.3.2	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties.	PS411 aqps511 BI1251 ch007	PS421 PS512 ch005 aqch007	PS511 aqps512 aqch005	BI13L05 CH13B01 PS13D01 PS13D02 PS13E01
S11.A.3.3.3	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).	PS421 aqps1711 ch007	BI1341 PS1713 aqch007	PS1711 aqps1713 ph059	BI13M04 CH13B01 PH13K03 PS13D02 PS13Q01
S11.C.1.1.1	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., protons, neutrons, electrons).	PS511 aqps512	aqps511 ch008	PS512 aqch008	CH13B01 PS13E01
S11.C.1.1.2	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Explain the relationship between the physical properties of a substance and its molecular or atomic structure.	ch014 aqch015 ch062 aqch063	aqch014 ch061 aqch062 ch064	ch015 aqch061 ch063 aqch064	CH13B03 CH13E05 CH13E06
S11.C.1.1.3	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.	ch018 aqch019 ch021 ch025	aqch018 ch020 aqch021	ch019 aqch020 ch024	CH13B05 CH13B06 CH13B07 CH13B08
S11.C.1.1.4	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.	ch013 aqch014	aqch013 ch015	ch014 aqch015	CH13B03
S11.C.1.1.5	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Predict the behavior of gases though the application of laws (e.g., Boyle's law, Charles' law, or ideal gas law).	ch039 ch042 aqch043 ch045	ch040 aqch042 ch044 aqch045	ch041 ch043 aqch044	CH13D02 CH13D03 CH13D04 CH13D05 CH13D06

S11.C.1.1.6	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Describe factors that influence the frequency of collisions during chemical reactions that might affect the reaction rates (e.g., surface area, concentration, temperature).	ch069 aqch070	aqch069	ch070	CH13F02
S11.C.2.1.1	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Compare or analyze waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels, and motion.	ph063	ph064		PH13L02 PH13L03
S11.C.2.1.2	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Describe energy changes in chemical reactions.	ch021 aqch006 ch068	aqch021 ch009 aqch068	ch006 aqch009	CH13B06 CH13F01
S11.C.2.1.3	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Apply the knowledge of conservation of energy to explain common systems (e.g., refrigeration, rocket propulsion, heat pump).	ph035 ph053	ph036 ph055	ph049	PH13E05 PH13E06 PH13I02 PH13J01 PH13J03
S11.C.2.1.4	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Use Ohm's Law to explain relative resistances, currents, and voltage.	ph081 aqph082	aqph081 ph083	ph082	PH13P01 PH13P02
S11.C.2.2.1	Forms, Sources, Conversion, and Transfer of Energy Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences. Explain the environmental impacts of energy use by various economic sectors (e.g., mining, logging, transportation) on environmental systems.	BI1431 aqch087	BI1441 ch088	ch087 aqch088	BI13N03 BI13N04 CH13H03
S11.C.2.2.2	Forms, Sources, Conversion, and Transfer of Energy Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences. 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).	BI1431 aqch087 ph030	BI1441 ch088 aqph030	ch087 aqch088	BI13N03 BI13N04 CH13H03 PH13E01
S11.C.2.2.3	Forms, Sources, Conversion, and Transfer of Energy Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences. 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.	BI1431 aqch087 ph030	BI1441 ch088 aqph030	ch087 aqch088	BI13N03 BI13N04 CH13H03 PH13E01

Grade: High School Subject: Physical Science

Strand Key	Description	Learning	Activities		Lesson Quizzes
S11.A.1.1.1	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS411 aqps1411 PS1372 aqps1373 BI311 BI1351 ch007 aqch037 ch041 ch043 aqch044 ch046 aqch047 aqph022 ph024 ph024 ph053 ph056 ph083	PS421 PS1371 aqps1372 PS1374 aqbi311 ch005 aqch007 ch039 ch042 aqch043 ch045 ph021 ph023 ph042 ph045 ph054 ph071	PS1411 aqps1373 aqps1374 BI431 aqch005 ch037 ch040 aqch042 ch047 ph022 aqph023 ph043 ph047 ph055 ph077	BI13C01 BI13D03 BI13M05 CH13B01 CH13D01 CH13D02 CH13D03 CH13D04 CH13D05 CH13D06 CH13D07 PH13C06 PH13C07 PH13C08 PH13G02 PH13G03 PH13G03 PH13G03 PH13G04 PH13G05 PH13J01 PH13J02 PH13J01 PH13J02 PH13J02 PH13D02 PH13D02 PH13D02 PH13D02 PS13D01 PS13N01

S11.A.1.1.4	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS411 aqps911 aqps1411 BI511 aqbi512 BI521 aqbi522 ch007 aqch031 ch044 aqch045	PS421 PS1351 BI311 aqbi511 BI513 aqbi521 ch005 aqch007 ch032 aqch044 ph047	PS911 PS1411 aqbi311 BI512 aqbi513 BI522 aqch005 ch031 aqch032 ch045	BI13C01 BI13E01 BI13E02 CH13B01 CH13C03 CH13D06 PH13H02 PS13D01 PS13D02 PS13I01 PS13M05 PS13N01
S11.A.1.1.5	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS511 aqps512 BI312 aqbi321 BI331 aqbi332 BI341 aqbi342 BI351	aqps511 BI311 aqbi312 BI322 aqbi331 BI333 aqbi341 BI343	PS512 aqbi311 BI321 aqbi322 BI332 aqbi333 BI342 aqbi343	BI13C01 BI13C02 BI13C03 BI13C04 BI13C05 PS13E01
S11.A.1.2.1	Reasoning and Analysis Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications. Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy).	PS1612 aqbi611 BI1431 aqph030	aqps1612 BI612 BI1441 ph035	BI611 aqbi612 ph030	BI13F01 BI13N03 BI13N04 PH13E01 PH13E05 PS13P01

S11.A.1.3.1	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Use appropriate quantitative data to describe or interpret change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	PS1921 aqps1922 PS1924 aqps1931 ph081 aqph082 ph085 ph087	aqps1921 PS1923 aqps1924 PS1932 aqph081 ph083 ph086 aqph087	PS1922 aqps1923 PS1931 aqps1932 ph082 ph084 aqph086 ph088	PH13P01 PH13P02 PH13P03 PH13Q01 PH13Q02 PH13Q03 PS13S02 PS13S03
S11.A.1.3.2	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Describe or interpret dynamic changes to stable systems (e.g., chemical reactions, human body, food webs, tectonics, homeostasis).	PS1011 BI1321 ch029 aqch030	BI1221 ch028 aqch029	BI1311 aqch028 ch030	BI13L02 BI13M01 BI13M02 CH13C02 PS13J01
S11.A.1.3.3	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Describe how changes in physical and biological indicators (e.g., soil, plants, animals) of water systems reflect changes in these systems (e.g. changes in bloodworm populations reflect changes in pollution levels in streams).	BI1341 BI1441	BI1421	BI1431	BI13M04 BI13N02 BI13N03 BI13N04
S11.A.1.3.4	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Compare the rate of use of natural resources and their impact on sustainability.	BI1431	BI1441		BI13N03 BI13N04
S11.A.2.1.1	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. 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.	PS111 PS122 aqps123 BI111 aqbi112	PS121 aqps122 PS124 aqbi111	aqps121 PS123 aqps124 BI112	BI13A01 PS13A01 PS13A02
S11.A.2.1.3	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.	PS123 aqps124	aqps123 BI112	PS124 aqbi112	BI13A01 PS13A02

S11.A.2.1.4	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Critique the results and conclusions of scientific inquiry for consistency and logic.	PS123 aqps124	aqps123 BI112	PS124 aqbi112	BI13A01 PS13A02
S11.A.2.1.5	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Communicate results of investigations using multiple representations.	PS122 aqps123	aqps122 BI112	PS123 aqbi112	BI13A01 PS13A02
S11.A.2.2.1	Processes, Procedures, and Tools of Scientific Investigations Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide. Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).	PS111 PS311 aqps312 ch001	PS122 aqps311 BI112 aqch001	aqps122 PS312 aqbi112	BI13A01 CH13A01 PS13A01 PS13A02 PS13C01
S11.A.2.2.2	Processes, Procedures, and Tools of Scientific Investigations Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide. 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.	PS1211 aqbi311	PS1221	BI311	BI13C01 PS13L01 PS13L02
S11.A.3.1.1	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts.	BI1311	BI1321		BI13M01 BI13M02
S11.A.3.1.2	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Analyze and predict the effect of making a change in one part of a system on the system as a whole.	PS1011 PS1022 PS1361 PS1532 aqps1533 PS1611 aqps1612 PS1931 aqps1932 BI1331 BI1421 ch038 ch040 aqch042 ch044 aqch045	PS1021 aqps1022 PS1531 aqps1532 PS1534 aqps1611 PS1613 aqps1931 BI1311 BI1341 ch037 aqch038 ch041 ch043 aqch044 ch046	aqps1021 PS1351 aqps1531 PS1533 aqps1534 PS1612 aqps1613 PS1932 BI1321 BI1411 aqch037 ch039 ch042 aqch043 ch045 aqch046	BI13M01 BI13M02 BI13M03 BI13M04 BI13N01

	ch047	aqch047	ch069	BI13N02
	aqch069	ch070	aqch070	CH13D01
	ph020	ph027	ph028	CH13D02
	ph030	aqph030	ph033	CH13D03
	ph034	ph036	ph037	CH13D04
	ph053	ph054	adop086	CH13D05
	ph087	agph087	ph088	CH13D06
				CH13D07
				CH13F02
				PH13C05
				PH13D03
				PH13D04
				PH13E01
				PH13E03
				PH13E04
				PH13E06
				PH13E07
				PH13J01
				PH13J02
				PH13J03
				PH13Q01
				PH13Q02
				PH13Q03
				PS13J01
				PS13J02
				PS13M05
				PS13M06
				PS13003
				PS13P01
				PS13S03

S11.A.3.1.3	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	PS1921 aqps1922 PS1924 aqps1931 ph082 ph084 aqph086 ph088	aqps1921 PS1923 aqps1924 PS1932 aqph082 ph085 ph087	PS1922 aqps1923 PS1931 aqps1932 ph083 ph086 aqph087	PH13P01 PH13P02 PH13P03 PH13Q01 PH13Q02 PH13Q03 PS13S02 PS13S03
S11.A.3.1.4	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. 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.	PS1531 aqps1532 PS1534 ph093	aqps1531 PS1533 aqps1534	PS1532 aqps1533 ph037	PH13E07 PH13S02 PS13O03
S11.A.3.2.1	Systems, Models, and Patterns Compare observations of the real world to observations of a constructed model. Compare the accuracy of predictions represented in a model to actual observations and behavior.	BI112 aqch001	aqbi112	ch001	BI13A01 CH13A01
S11.A.3.2.3	Systems, Models, and Patterns Compare observations of the real world to observations of a constructed model. 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).	PS411 aqps511 ch005 aqch007	PS421 PS512 aqch005	PS511 aqps512 ch007	CH13B01 PS13D01 PS13D02 PS13E01
S11.A.3.3.1	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.	PS711 PS722 aqbi711 BI811 BI1111 aqbi1112	PS721 aqps722 BI712 BI911 aqbi1111	aqps721 BI711 aqbi712 BI1011 BI1112	BI13G01 BI13H01 BI13I01 BI13J01 BI13K01 PS13G01 PS13G02

S11.A.3.3.2 S11.A.3.3.3	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).	PS411 aqps511 BI1251 ch007 PS421 aqps1711 ch007	PS421 PS512 ch005 aqch007 BI1341 PS1713 aqch007	PS511 aqps512 aqch005 PS1711 aqps1713 ph059	BI13L05 CH13B01 PS13D01 PS13D02 PS13E01 BI13M04 CH13B01 PH13K03 PS13D02
					PS13Q01
S11.C.1.1.1	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., protons, neutrons, electrons).	PS411 aqps511	PS421 PS512	PS511 aqps512	PS13D01 PS13D02 PS13E01
S11.C.1.1.2	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Explain the relationship between the physical properties of a substance and its molecular or atomic structure.	PS211 PS312 PS421 PS512 aqps611	PS311 aqps312 PS511 aqps512	aqps311 PS411 aqps511 PS611	PS13B01 PS13C01 PS13D01 PS13D02 PS13E01 PS13F01
S11.C.1.1.3	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.	PS821 aqps822 PS1111	aqps821 PS831 aqps1111	PS822 PS841	PS13H02 PS13H03 PS13H04 PS13K01
S11.C.1.1.4	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.	PS321 aqps322 PS711 PS722	aqps321 PS611 PS721 aqps722	PS322 aqps611 aqps721	PS13C02 PS13F01 PS13G01 PS13G02
S11.C.1.1.5	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Predict the behavior of gases though the application of laws (e.g., Boyle's law, Charles' law, or ideal gas law).	ch039 aqch044	ch040 ch045	ch044 aqch045	CH13D02 CH13D03 CH13D06

S11.C.1.1.6	Structure, Properties, and Interaction of Matter and Energy Explain the relationship between the structure and properties of matter. Describe factors that influence the frequency of collisions during chemical reactions that might affect the reaction rates (e.g., surface area, concentration, temperature).	PS1011 PS1022	PS1021 aqps1022	aqps1021	PS13J01 PS13J02
S11.C.2.1.1	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Compare or analyze waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels, and motion.	PS1811 aqps1812	aqps1811	PS1812	PS13R01
S11.C.2.1.2	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Describe energy changes in chemical reactions.	PS312 PS1021 aqps1022 PS1612 aqps1613 PS2121	aqps312 aqps1021 PS1611 aqps1612 PS2111 aqps2121	PS1011 PS1022 aqps1611 PS1613 aqps2111	PS13C01 PS13J01 PS13J02 PS13P01 PS13U01 PS13U02
S11.C.2.1.3	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Apply the knowledge of conservation of energy to explain common systems (e.g., refrigeration, rocket propulsion, heat pump).	PS1611 aqps1612	aqps1611 PS1613	PS1612 aqps1613	PS13P01
S11.C.2.1.4	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Use Ohm's Law to explain relative resistances, currents, and voltage.	PS1911 PS1922 aqps1923	PS1921 aqps1922 PS1924	aqps1921 PS1923 aqps1924	PS13S01 PS13S02
S11.C.2.2.2	Forms, Sources, Conversion, and Transfer of Energy Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences. 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).	BI1431			BI13N03
S11.C.2.2.3	Forms, Sources, Conversion, and Transfer of Energy Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences. 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.	BI1431			BI13N03
S11.C.3.1.1	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. 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.	PS1311 aqps1371 PS1374 aqps1411	PS1351 PS1372 aqps1374	PS1371 aqps1372 PS1411	PS13M01 PS13M05 PS13M07 PS13N01

S11.C.3.1.2	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Design or evaluate simple technological or natural systems that incorporate the principles of force and motion (e.g., simple machines, compound machines).	PS1371 aqps1372 PS1531 aqps1532 PS1534	aqps1371 PS1374 aqps1531 PS1533 aqps1534	PS1372 aqps1374 PS1532 aqps1533	PS13M07 PS13O03
S11.C.3.1.3	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).	PS1311 PS1341 PS1371 aqps1372 PS1411 aqps1412 PS1422	PS1321 PS1351 aqps1371 PS1374 aqps1411 PS1421 aqps1422	PS1331 PS1361 PS1372 aqps1374 PS1412 aqps1421	PS13M01 PS13M02 PS13M03 PS13M04 PS13M05 PS13M06 PS13M07 PS13N01 PS13N02
S11.C.3.1.4	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Explain how electricity induces magnetism and how magnetism induces electricity as two aspects of a single electromagnetic force.	PS1911 PS2012 aqps2013	PS2011 aqps2012	aqps2011 PS2013	PS13S01 PS13T01
S11.C.3.1.5	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Calculate the mechanical advantage for moving an object by using a simple machine.	PS1511 aqps1512 PS1522 aqps1531 PS1533	aqps1511 PS1521 aqps1522 PS1532 aqps1533	PS1512 aqps1521 PS1531 aqps1532	PS13001 PS13002 PS13003
S11.C.3.1.6	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Identify elements of simple machines in compound machines.	PS1531 aqps1532 PS1534	aqps1531 PS1533 aqps1534	PS1532 aqps1533	PS13O03

Grade: High School Subject: Physics

Strand Key	Description	Learning	Activities		Lesson Quizzes
S11.A.1.1.1	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS411 aqps1411 PS1372 aqps1373 BI311 BI1351 ch007 aqch037 ch041 ch043 aqch044 ch046 aqch047 aqph022 ph024 ph024 ph053 ph056 ph083	PS421 PS1371 aqps1372 PS1374 aqbi311 ch005 aqch007 ch039 ch042 aqch043 ch045 ph021 ph023 ph042 ph045 ph054 ph071	PS1411 aqps1373 aqps1374 BI431 aqch005 ch037 ch040 aqch042 ch047 ph022 aqph023 ph043 ph047 ph055 ph077	BI13C01 BI13D03 BI13M05 CH13B01 CH13D01 CH13D02 CH13D03 CH13D04 CH13D05 CH13D06 CH13D07 PH13C06 PH13C07 PH13C08 PH13G02 PH13G03 PH13G03 PH13G03 PH13G04 PH13G05 PH13J01 PH13J02 PH13J01 PH13J02 PH13J02 PH13D02 PH13D02 PH13D02 PH13D02 PS13D01 PS13N01

S11.A.1.1.4	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS411 aqps911 aqps1411 BI511 aqbi512 BI521 aqbi522 ch007 aqch031 ch044 aqch045	PS421 PS1351 BI311 aqbi511 BI513 aqbi521 ch005 aqch007 ch032 aqch044 ph047	PS911 PS1411 aqbi311 BI512 aqbi513 BI522 aqch005 ch031 aqch032 ch045	BI13C01 BI13E01 BI13E02 CH13B01 CH13C03 CH13D06 PH13H02 PS13D01 PS13D02 PS13I01 PS13M05 PS13N01
S11.A.1.1.5	Reasoning and Analysis Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems. 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).	PS511 aqps512 BI312 aqbi321 BI331 aqbi332 BI341 aqbi342 BI351	aqps511 BI311 aqbi312 BI322 aqbi331 BI333 aqbi341 BI343	PS512 aqbi311 BI321 aqbi322 BI332 aqbi333 BI342 aqbi343	BI13C01 BI13C02 BI13C03 BI13C04 BI13C05 PS13E01
S11.A.1.2.1	Reasoning and Analysis Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications. Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy).	PS1612 aqbi611 BI1431 aqph030	aqps1612 BI612 BI1441 ph035	BI611 aqbi612 ph030	BI13F01 BI13N03 BI13N04 PH13E01 PH13E05 PS13P01

S11.A.1.3.1	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Use appropriate quantitative data to describe or interpret change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	PS1921 aqps1922 PS1924 aqps1931 ph081 aqph082 ph085 ph087	aqps1921 PS1923 aqps1924 PS1932 aqph081 ph083 ph086 aqph087	PS1922 aqps1923 PS1931 aqps1932 ph082 ph084 aqph086 ph088	PH13P01 PH13P02 PH13P03 PH13Q01 PH13Q02 PH13Q03 PS13S02 PS13S03
S11.A.1.3.2	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Describe or interpret dynamic changes to stable systems (e.g., chemical reactions, human body, food webs, tectonics, homeostasis).	PS1011 BI1321 ch029 aqch030	BI1221 ch028 aqch029	BI1311 aqch028 ch030	BI13L02 BI13M01 BI13M02 CH13C02 PS13J01
S11.A.1.3.3	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Describe how changes in physical and biological indicators (e.g., soil, plants, animals) of water systems reflect changes in these systems (e.g. changes in bloodworm populations reflect changes in pollution levels in streams).	BI1341 BI1441	BI1421	BI1431	BI13M04 BI13N02 BI13N03 BI13N04
S11.A.1.3.4	Reasoning and Analysis Describe and interpret patterns of change in natural and human-made systems. Compare the rate of use of natural resources and their impact on sustainability.	BI1431	BI1441		BI13N03 BI13N04
S11.A.2.1.1	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. 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.	PS111 PS122 aqps123 BI111 aqbi112	PS121 aqps122 PS124 aqbi111	aqps121 PS123 aqps124 BI112	BI13A01 PS13A01 PS13A02
S11.A.2.1.3	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.	PS123 aqps124	aqps123 BI112	PS124 aqbi112	BI13A01 PS13A02

S11.A.2.1.4	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Critique the results and conclusions of scientific inquiry for consistency and logic.	PS123 aqps124	aqps123 BI112	PS124 aqbi112	BI13A01 PS13A02
S11.A.2.1.5	Processes, Procedures, and Tools of Scientific Investigations Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process. Communicate results of investigations using multiple representations.	PS122 aqps123	aqps122 BI112	PS123 aqbi112	BI13A01 PS13A02
S11.A.2.2.1	Processes, Procedures, and Tools of Scientific Investigations Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide. Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).	PS111 PS311 aqps312 ch001	PS122 aqps311 BI112 aqch001	aqps122 PS312 aqbi112	BI13A01 CH13A01 PS13A01 PS13A02 PS13C01
S11.A.2.2.2	Processes, Procedures, and Tools of Scientific Investigations Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide. 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.	PS1211 aqbi311	PS1221	BI311	BI13C01 PS13L01 PS13L02
S11.A.3.1.1	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain a system and its parts.	BI1311	BI1321		BI13M01 BI13M02
S11.A.3.1.2	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Analyze and predict the effect of making a change in one part of a system on the system as a whole.	PS1011 PS1022 PS1361 PS1532 aqps1533 PS1611 aqps1612 PS1931 aqps1932 BI1331 BI1421 ch038 ch040 aqch042 ch044 aqch045	PS1021 aqps1022 PS1531 aqps1532 PS1534 aqps1611 PS1613 aqps1931 BI1311 BI1341 ch037 aqch038 ch041 ch043 aqch044 ch046	aqps1021 PS1351 aqps1531 PS1533 aqps1534 PS1612 aqps1613 PS1932 BI1321 BI1411 aqch037 ch039 ch042 aqch043 ch045 aqch046	BI13M01 BI13M02 BI13M03 BI13M04 BI13N01

	ch047	aqch047	ch069	BI13N02
	aqch069	ch070	aqch070	CH13D01
	ph020	ph027	ph028	CH13D02
	ph030	aqph030	ph033	CH13D03
	ph034	ph036	ph037	CH13D04
	ph053	ph054	adop086	CH13D05
	ph087	agph087	ph088	CH13D06
				CH13D07
				CH13F02
				PH13C05
				PH13D03
				PH13D04
				PH13E01
				PH13E03
				PH13E04
				PH13E06
				PH13E07
				PH13J01
				PH13J02
				PH13J03
				PH13Q01
				PH13Q02
				PH13Q03
				PS13J01
				PS13J02
				PS13M05
				PS13M06
				PS13003
				PS13P01
				PS13S03

S11.A.3.1.3	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).	PS1921 aqps1922 PS1924 aqps1931 ph082 ph084 aqph086 ph088	aqps1921 PS1923 aqps1924 PS1932 aqph082 ph085 ph087	PS1922 aqps1923 PS1931 aqps1932 ph083 ph086 aqph087	PH13P01 PH13P02 PH13P03 PH13Q01 PH13Q02 PH13Q03 PS13S02 PS13S03
S11.A.3.1.4	Systems, Models, and Patterns Analyze the parts of a simple system, their roles, and their relationships to the system as a whole. 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.	PS1531 aqps1532 PS1534 ph093	aqps1531 PS1533 aqps1534	PS1532 aqps1533 ph037	PH13E07 PH13S02 PS13O03
S11.A.3.2.1	Systems, Models, and Patterns Compare observations of the real world to observations of a constructed model. Compare the accuracy of predictions represented in a model to actual observations and behavior.	BI112 aqch001	aqbi112	ch001	BI13A01 CH13A01
S11.A.3.2.3	Systems, Models, and Patterns Compare observations of the real world to observations of a constructed model. 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).	PS411 aqps511 ch005 aqch007	PS421 PS512 aqch005	PS511 aqps512 ch007	CH13B01 PS13D01 PS13D02 PS13E01
S11.A.3.3.1	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.	PS711 PS722 aqbi711 BI811 BI1111 aqbi1112	PS721 aqps722 BI712 BI911 aqbi1111	aqps721 BI711 aqbi712 BI1011 BI1112	BI13G01 BI13H01 BI13I01 BI13J01 BI13K01 PS13G01 PS13G02

S11.A.3.3.2	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties.	PS411 aqps511 BI1251 ch007	PS421 PS512 ch005 aqch007	PS511 aqps512 aqch005	BI13L05 CH13B01 PS13D01 PS13D02 PS13E01
S11.A.3.3.3	Systems, Models, and Patterns Compare and analyze repeated processes or recurring elements in patterns. Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).	PS421 aqps1711 ch007	BI1341 PS1713 aqch007	PS1711 aqps1713 ph059	BI13M04 CH13B01 PH13K03 PS13D02 PS13Q01
S11.C.2.1.1	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. 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.	ph063	ph064		PH13L02 PH13L03
S11.C.2.1.2	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Describe energy changes in chemical reactions.	ch021 aqch006 ch068	aqch021 ch009 aqch068	ch006 aqch009	CH13B06 CH13F01
S11.C.2.1.3	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Apply the knowledge of conservation of energy to explain common systems (e.g., refrigeration, rocket propulsion, heat pump).	ph035 ph053	ph036 ph055	ph049	PH13E05 PH13E06 PH13I02 PH13J01 PH13J03
S11.C.2.1.4	Forms, Sources, Conversion, and Transfer of Energy Analyze energy sources and transfer of energy, or conversion of energy. Use Ohm's Law to explain relative resistances, currents, and voltage.	ph081 aqph082	aqph081 ph083	ph082	PH13P01 PH13P02
S11.C.2.2.1	Forms, Sources, Conversion, and Transfer of Energy Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences. Explain the environmental impacts of energy use by various economic sectors (e.g., mining, logging, transportation) on environmental systems.	BI1431 aqch087	BI1441 ch088	ch087 aqch088	BI13N03 BI13N04 CH13H03
S11.C.2.2.2	Forms, Sources, Conversion, and Transfer of Energy Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences. 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).	BI1431 aqch087 ph030	BI1441 ch088 aqph030	ch087 aqch088	BI13N03 BI13N04 CH13H03 PH13E01

S11.C.2.2.3 S11.C.3.1.1	Forms, Sources, Conversion, and Transfer of Energy Demonstrate that different ways of obtaining, transforming, and distributing energy have different environmental consequences. 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. Principles of Motion and Force	BI1431 aqch087 ph030 ph025	BI1441 ch088 aqph030 ph026	ch087 aqch088 ph027	BI13N03 BI13N04 CH13H03 PH13E01
	Use the principles of motion and force to solve real-world challenges. 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.	ph028	ph029		PH13D01 PH13D02 PH13D03 PH13D04 PH13D05
S11.C.3.1.2	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Design or evaluate simple technological or natural systems that incorporate the principles of force and motion (e.g., simple machines, compound machines).	PS1531 aqps1532 PS1534 ph038	aqps1531 PS1533 aqps1534 ph045	PS1532 aqps1533 ph037	PH13E07 PH13E08 PH13G05 PS13O03
S11.C.3.1.3	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).	ph002 aqph003 ph005 aqph006 ph008 aqph009	aqph002 ph004 aqph005 ph007 aqph008	ph003 aqph004 ph006 aqph007 ph009	PH13A02 PH13A03 PH13A04 PH13A05
S11.C.3.1.4	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Explain how electricity induces magnetism and how magnetism induces electricity as two aspects of a single electromagnetic force.	ph089 ph092	ph090	ph091	PH13R01 PH13R02 PH13R03 PH13S01
S11.C.3.1.5	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Calculate the mechanical advantage for moving an object by using a simple machine.	PS1531	aqps1531		PS13003
S11.C.3.1.6	Principles of Motion and Force Use the principles of motion and force to solve real-world challenges. Identify elements of simple machines in compound machines.	PS1532 aqps1533 ph037	aqps1532 PS1534	PS1533 aqps1534	PH13E07 PS13O03