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SNAPSHOT

— BIOLOGY —

Process Standards (Scientific and Engineering Practices)

- B.1 Scientific and engineering practices.** The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.
- B.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

Tools to Know

- B.1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations
- B.1(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems
- B.1(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards
- B.1(D) use appropriate tools such as microscopes, slides, Petri dishes, laboratory glassware, metric rulers, digital balances, pipets, filter paper, micropipettes, gel electrophoresis and polymerase chain reaction (PCR) apparatuses, microcentrifuges, water baths, incubators, thermometers, hot plates, data collection probes, test tube holders, lab notebooks or journals, hand lenses, and models, diagrams, or samples of biological specimens or structures
- B.1(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence
- B.1(F) organize quantitative and qualitative data using scatter plots, line graphs, bar graphs, charts, data tables, digital tools, diagrams, scientific drawings, and student-prepared models
- B.2(D) evaluate experimental and engineering designs

Cell Structure and Biochemistry

- B.5 Biological structures, functions, and processes.** The student knows that biological structures at multiple levels of organization perform specific functions and processes that affect life.

Readiness Standards

- B.5(B) compare and contrast prokaryotic and eukaryotic cells, including their complexity, and compare and contrast scientific explanations for cellular complexity

Supporting Standards

- B.5(A) relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell
- B.5(D) compare the structures of viruses to cells and explain how viruses spread and cause disease

SEs Not Included in Assessed Curriculum

B.5(C) investigate homeostasis through the cellular transport of molecules

Organism Growth and Cell Differentiation

- B.6 Biological structures, functions, and processes.** The student knows how an organism grows and the importance of cell differentiation.

- B.6(C) relate disruptions of the cell cycle to how they lead to the development of diseases such as cancer

- B.6(A) explain the importance of the cell cycle to the growth of organisms, including an overview of the stages of the cell cycle and deoxyribonucleic acid (DNA) replication models
- B.6(B) explain the process of cell specialization through cell differentiation, including the role of environmental factors

Mechanisms of Genetics

- B.7 Mechanisms of genetics.** The student knows the role of nucleic acids in gene expression.

- B.7(C) identify and illustrate changes in DNA and evaluate the significance of these changes

- B.7(A) identify components of DNA, explain how the nucleotide sequence specifies some traits of an organism, and examine scientific explanations for the origin of DNA
- B.7(B) describe the significance of gene expression and explain the process of protein synthesis using models of DNA and ribonucleic acid (RNA)

SEs Not Included in Assessed Curriculum

B.7(D) discuss the importance of molecular technologies such as polymerase chain reaction (PCR), gel electrophoresis, and genetic engineering that are applicable in current research and engineering practices

Heredity and Diversity

B.8 Mechanisms of genetics. The student knows the role of nucleic acids and the principles of inheritance and variation of traits in Mendelian and non-Mendelian genetics.

Readiness Standards	Supporting Standards
B.8(B) predict possible outcomes of various genetic combinations using monohybrid and dihybrid crosses, including non-Mendelian traits of incomplete dominance, codominance, sex-linked traits, and multiple alleles	B.8(A) analyze the significance of chromosome reduction, independent assortment, and crossing-over during meiosis in increasing diversity in populations of organisms that reproduce sexually

Evolutionary Theory

B.9 Biological evolution. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life that has multiple lines of evidence.

B.9(B) examine scientific explanations for varying rates of change such as gradualism, abrupt appearance, and stasis in the fossil record	B.9(A) analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental
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Evolutionary Mechanisms

B.10 Biological evolution. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life that has multiple mechanisms.

B.10(B) analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success	B.10(A) analyze and evaluate how natural selection produces change in populations and not in individuals
B.10(C) analyze and evaluate how natural selection may lead to speciation	B.10(D) analyze evolutionary mechanisms other than natural selection, including genetic drift, gene flow, mutation, and genetic recombination, and their effect on the gene pool of a population

Energy Conversions in Organisms

B.11 Biological structures, functions, and processes. The student knows the significance of matter cycling, energy flow, and enzymes in living organisms.

B.11(B) investigate and explain the role of enzymes in facilitating cellular processes	B.11(A) explain how matter is conserved and energy is transferred during photosynthesis and cellular respiration using models, including the chemical equations for these processes
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Interactions Among Biological Systems

B.12 Biological structures, functions, and processes. The student knows that multicellular organisms are composed of multiple systems that interact to perform complex functions.

B.12(B) explain how the interactions that occur among systems that perform functions of transport, reproduction, and response in plants are facilitated by their structures	B.12(A) analyze the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals
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Interdependence and Ecosystem Stability

B.13 Interdependence within environmental systems. The student knows that interactions at various levels of organization occur within an ecosystem to maintain stability.

Readiness Standards	Supporting Standards
B.13(D) explain how environmental change, including change due to human activity, affects biodiversity and analyze how changes in biodiversity impact ecosystem stability	B.13(A) investigate and evaluate how ecological relationships, including predation, parasitism, commensalism, mutualism, and competition, influence ecosystem stability B.13(B) analyze how ecosystem stability is affected by disruptions to the cycling of matter and flow of energy through trophic levels using models B.13(C) explain the significance of the carbon and nitrogen cycles to ecosystem stability and analyze the consequences of disrupting these cycles

STAAR	33-35 questions	40 points	26-30 questions (1-point multiple choice/non-multiple choice)	5-7 questions (2-point non-multiple choice)
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Process Standards (Scientific and Engineering Practices)

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- B.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.
- B.3 Scientific and engineering practices.** The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.
- B.4 Scientific and engineering practices.** The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society.

Ways to Show

- B.1(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems
- B.1(H) distinguish among scientific hypotheses, theories, and laws
- B.2(A) identify advantages and limitations of models such as their size, scale, properties, and materials
- B.2(B) analyze data by identifying significant statistical features, patterns, sources of error, or limitations
- B.2(C) use mathematical calculations to assess quantitative relationships in data
- B.3(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories
- B.3(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats
- B.3(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence
- B.4(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student
- B.4(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content
- B.4(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers

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SNAPSHOT

— CHEMISTRY —

Process Standards (Scientific and Engineering Practices)

- C.1 Scientific and engineering practices.** The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.
- C.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

Tools to Know

- C.1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations
- C.1(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems
- C.1(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards
- C.1(D) use appropriate tools such as Safety Data Sheets (SDS), scientific or graphing calculators, computers and probes, electronic balances, an adequate supply of consumable chemicals, and sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, and burettes
- C.1(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence
- C.1(F) organize quantitative and qualitative data using oral or written lab reports, labeled drawings, particle diagrams, charts, tables, graphs, journals, summaries, or technology-based reports
- C.2(D) evaluate experimental and engineering designs

The Periodic Table

- C.5 Science concepts.** The student understands the development of the Periodic Table and applies its predictive power.

Readiness Standards	Supporting Standards
C.5(B) predict the properties of elements in chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals, based on valence electrons patterns using the Periodic Table	C.5(A) explain the development of the Periodic Table over time using evidence such as chemical and physical properties
C.5(C) analyze and interpret elemental data, including atomic radius, atomic mass, electronegativity, ionization energy, and reactivity to identify periodic trends	

Atomic Theory

- C.6 Science concepts.** The student understands the development of atomic theory and applies it to real-world phenomena.

C.6(B) describe the structure of atoms and ions, including the masses, electrical charges, and locations of protons and neutrons in the nucleus and electrons in the electron cloud	C.6(A) construct models using Dalton's Postulates, Thomson's discovery of electron properties, Rutherford's nuclear atom, Bohr's nuclear atom, and Heisenberg's Uncertainty Principle to show the development of modern atomic theory over time
C.6(E) construct models to express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis dot structures	C.6(C) investigate the mathematical relationship between energy, frequency, and wavelength of light using the electromagnetic spectrum and relate it to the quantization of energy in the emission spectrum
	C.6(D) calculate average atomic mass of an element using isotopic composition

Chemical Bonds

- C.7 Science concepts.** The student knows how atoms form ionic, covalent, and metallic bonds.

C.7(A) construct an argument to support how periodic trends such as electronegativity can predict bonding between elements	C.7(C) classify and draw electron dot structures for molecules with linear, bent, trigonal planar, trigonal pyramidal, and tetrahedral molecular geometries as explained by Valence Shell Electron Pair Repulsion (VSEPR) theory
C.7(B) name and write the chemical formulas for ionic and covalent compounds using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules	C.7(D) analyze the properties of ionic, covalent, and metallic substances in terms of intramolecular and intermolecular forces

The Mole

C.8 Science concepts. The student understands how matter is accounted for in chemical substances.

Readiness Standards	Supporting Standards
C.8(B) calculate the number of atoms or molecules in a sample of material using Avogadro's number	C.8(A) define mole and apply the concept of molar mass to convert between moles and grams C.8(C) calculate percent composition of compounds C.8(D) differentiate between empirical and molecular formulas

Chemical Equations

C.9 Science concepts. The student understands how matter is accounted for in chemical reactions.

C.9(A) interpret, write, and balance chemical equations, including synthesis, decomposition, single replacement, double replacement, and combustion reactions using the law of conservation of mass	C.9(B) differentiate among acid-base reactions, precipitation reactions, and oxidation-reduction reactions C.9(C) perform stoichiometric calculations, including determination of mass relationships, gas volume relationships, and percent yield C.9(D) describe the concept of limiting reactants in a balanced chemical equation
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Principles of Gases

C.10 Science concepts. The student understands the principles of the kinetic molecular theory and ideal gas behavior.

C.10(A) describe the postulates of the kinetic molecular theory C.10(B) describe and calculate the relationships among volume, pressure, number of moles, and temperature for an ideal gas	C.10(C) define and apply Dalton's law of partial pressure
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Solutions

C.11 Science concepts. The student understands and can apply the factors that influence the behavior of solutions.

C.11(B) distinguish among types of solutions, including electrolytes and nonelectrolytes and unsaturated, saturated, and supersaturated solutions C.11(C) investigate how solid and gas solubilities are influenced by temperature using solubility curves and how rates of dissolution are influenced by temperature, agitation, and surface area C.11(D) investigate the general rules regarding solubility and predict the solubility of the products of a double replacement reaction	C.11(A) describe the unique role of water in solutions in terms of polarity C.11(E) calculate the concentration of solutions in units of molarity C.11(F) calculate the dilutions of solutions using molarity
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Acids and Bases

C.12 Science concepts. The student understands and applies various rules regarding acids and bases.

C.12(A) name and write the chemical formulas for acids and bases using IUPAC nomenclature rules C.12(C) differentiate between strong and weak acids and bases	C.12(B) define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions C.12(D) predict products in acid-base reactions that form water C.12(E) define pH and calculate the pH of a solution using the hydrogen ion concentration
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Thermochemistry

C.13 Science concepts. The student understands the energy changes that occur in chemical reactions.

Readiness Standards	Supporting Standards
C.13(A) explain everyday examples that illustrate the four laws of thermodynamics C.13(C) classify processes as exothermic or endothermic and represent energy changes that occur in chemical reactions using thermochemical equations or graphical analysis	C.13(B) investigate the process of heat transfer using calorimetry C.13(D) perform calculations involving heat, mass, temperature change, and specific heat

Nuclear Chemistry

C.14 Science concepts. The student understands the basic processes of nuclear chemistry.

C.14(C) give examples of applications of nuclear phenomena such as nuclear stability, radiation therapy, diagnostic imaging, solar cells, and nuclear power	C.14(A) describe the characteristics of alpha, beta, and gamma radioactive decay processes in terms of balanced nuclear equations C.14(B) compare fission and fusion reactions
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Process Standards (Scientific and Engineering Practices)

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- C.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.
- C.3 Scientific and engineering practices.** The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.
- C.4 Scientific and engineering practices.** The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society.

Ways to Show

- C.1(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems
- C.1(H) distinguish between scientific hypotheses, theories, and laws
- C.2(A) identify advantages and limitations of models such as their size, scale, properties, and materials
- C.2(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations
- C.2(C) use mathematical calculations to assess quantitative relationships in data
- C.3(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories
- C.3(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats
- C.3(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence
- C.4(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student
- C.4(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content
- C.4(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers

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SNAPSHOT

— ENVIRONMENTAL —
SYSTEMS

Process Standards (Scientific and Engineering Practices)

- E.1 Scientific and engineering practices.** The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to explain phenomena or design solutions using appropriate tools and models.
- E.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

Tools to Know

- E.1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations
- E.1(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems
- E.1(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards
- E.1(D) use appropriate tools such as meter sticks, metric rulers, pipettes, graduated cylinders, standard laboratory glassware, balances, timing devices, pH meters or probes, various data collecting probes, thermometers, calculators, computers, internet access, turbidity testing devices, hand magnifiers, work and disposable gloves, compasses, first aid kits, binoculars, field guides, water quality test kits or probes, soil test kits or probes, 30 meter tape measures, tarps, shovels, trowels, screens, buckets, rock and mineral samples equipment, air quality testing devices, cameras, flow meters, Global Positioning System (GPS) units, Geographic Information System (GIS) software, computer models, densimeters, spectrophotometers, stereomicroscopes, compound microscopes, clinometers, field journals, various prepared slides, hand lenses, hot plates, Petri dishes, sampling nets, waders, leveling grade rods (Jason sticks), protractors, inclination and height distance calculators, samples of biological specimens or structures, core sampling equipment, and kick nets
- E.1(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence
- E.1(F) organize quantitative and qualitative data using probeware, spreadsheets, lab notebooks or journals, models, diagrams, graphs paper, computers, or cellphone applications
- E.2(D) evaluate experimental and engineering designs

Relationships within Habitats, Ecosystems, and Biomes

- E.5 Science concepts.** The student knows the relationships of biotic and abiotic factors within habitats, ecosystems, and biomes.

Readiness Standards

- E.5(B) explain the cycling of water, phosphorus, carbon, silicon, and nitrogen through ecosystems, including sinks, and the human interactions that alter these cycles using tools such as models
- E.5(G) predict changes that may occur in an ecosystem if genetic diversity is increased or decreased

Supporting Standards

- E.5(A) identify native plants and animals within a local ecosystem and compare their roles to those of plants and animals in other biomes, including aquatic, grassland, forest, desert, and tundra
- E.5(C) evaluate the effects of fluctuations in abiotic factors on local ecosystems and local biomes
- E.5(D) measure the concentration of dissolved substances such as dissolved oxygen, chlorides, and nitrates and describe their impacts on an ecosystem
- E.5(E) use models to predict how the introduction of an invasive species may alter the food chain and affect existing populations in an ecosystem
- E.5(F) use models to predict how species extinction may alter the food chain and affect existing populations in an ecosystem

Resources within Local Environmental Systems

- E.6 Science concepts.** The student knows the interrelationships among the resources within the local environmental system.

- E.6(B) relate how water sources, management, and conservation affect water uses and quality
- E.6(C) document the use and conservation of both renewable and non-renewable resources as they pertain to sustainability
- E.6(E) analyze and evaluate the economic significance and interdependence of resources within the local environmental system

- E.6(A) compare and contrast land use and management methods and how they affect land attributes such as fertility, productivity, economic value, and ecological stability
- E.6(D) identify how changes in limiting resources such as water, food, and energy affect local ecosystems
- E.6(F) evaluate the impact of waste management methods such as reduction, reuse, recycling, upcycling, and composting on resource availability in the local environment

Energy Flow and Environmental Resources

E.7 Science concepts. The student knows the sources and flow of energy through an environmental system.

Readiness Standards		Supporting Standards	
E.7(A)	describe the interactions between the components of the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere	E.7(B)	relate biogeochemical cycles to the flow of energy in ecosystems, including energy sinks such as oil, natural gas, and coal deposits
E.7(C)	explain the flow of heat energy in an ecosystem, including conduction, convection, and radiation	E.7(D)	identify and describe how energy is used, transformed, and conserved as it flows through ecosystems

Carrying Capacity and Ecosystem Populations

E.8 Science concepts. The student knows the relationship between carrying capacity and changes in populations and ecosystems.

E.8(B)	identify factors that may alter carrying capacity such as disease; natural disaster; available food, water, and livable space; habitat fragmentation; and periodic changes in weather	E.8(A)	compare exponential and logistical population growth using graphical representations
		E.8(C)	calculate changes in population size in ecosystems
		E.8(D)	analyze and make predictions about the impact on populations of geographic locales due to diseases, birth and death rates, urbanization, and natural events such as migration and seasonal changes

Natural Patterns in Environments

E.9 Science concepts. The student knows that environments change naturally.

E.9(A)	analyze and describe how natural events such as tectonic movement, volcanic events, fires, tornadoes, hurricanes, flooding, and tsunamis affect natural populations	E.9(B)	explain how regional changes in the environment may have global effects
E.9(C)	examine how natural processes such as succession and feedback loops can restore habitats and ecosystems	E.9(D)	describe how temperature inversions have short-term and long-term effects, including El Niño and La Niña oscillations, ice cap and glacial melting, and changes in ocean surface temperatures
		E.9(E)	analyze the impact of natural global climate change on ice caps, glaciers, ocean currents, and surface temperatures

Human Impact on Environments

E.10 Science concepts. The student knows how humans impact environmental systems through emissions and pollutants.

E.10(A)	identify sources of emissions in air, soil, and water, including point and nonpoint sources	E.10(C)	investigate the effects of pollutants such as chlorofluorocarbons, greenhouse gases, pesticide runoff, nuclear waste, aerosols, metallic ions, and heavy metals, as well as thermal, light, and noise pollution
E.10(B)	distinguish how an emission becomes a pollutant based on its concentration, toxicity, reactivity, and location within the environment	E.10(D)	evaluate indicators of air, soil, and water quality against regulatory standards to determine the health of an ecosystem
E.10(E)	distinguish between the causes and effects of global warming and ozone depletion, including the causes, the chemicals involved, the atmospheric layer, the environmental effects, the human health effects, and the relevant wavelengths on the electromagnetic spectrum (IR and UV)		

Individual and Collective Actions

E.11 Science concepts. The student understands how individual and collective actions impact environmental systems.

E.11(A)	evaluate the negative effects of human activities on the environment, including overhunting, overfishing, ecotourism, all-terrain vehicles, and personal watercraft	E.11(C)	research the advantages and disadvantages of "going green" such as organic gardening and farming, natural methods of pest control, hydroponics, xeriscaping, energy-efficient homes and appliances, and hybrid cars
E.11(B)	evaluate the positive effects of human activities on the environment, including habitat restoration projects, species preservation efforts, nature conservancy groups, game and wildlife management, and ecotourism		

Ethics and Economic Priorities

E.12 Science concepts. The student understands how ethics and economic priorities influence environmental decisions.

Readiness Standards	Supporting Standards
E.12(A) evaluate cost-benefit trade-offs of commercial activities such as municipal development, food production, deforestation, over-harvesting, mining, and use of renewable and non-renewable energy sources	E.12(B) evaluate the economic impacts of individual actions on the environment such as overbuilding, habitat destruction, poaching, and improper waste disposal
E.12(C) analyze how ethical beliefs influence environmental scientific and engineering practices such as methods for food production, water distribution, energy production, and the extraction of minerals	E.12(D) discuss the impact of research and technology on social ethics and legal practices in situations such as the design of new buildings, recycling, or emission standards
	E.12(E) argue from evidence whether or not a healthy economy and a healthy environment are mutually exclusive

Environmental Legislation

E.13 Science concepts. The student knows how legislation mediates human impacts on the environment.

E.13(A) describe past and present state and national legislation, including Texas automobile emissions regulations, the National Park Service Act, the Clean Air Act, the Clean Water Act, the Soil and Water Resources Conservation Act, and the Endangered Species Act	E.13(B) evaluate the goals and effectiveness of past and present international agreements such as the environmental Antarctic Treaty System, the Montreal Protocol, the Kyoto Protocol, and the Paris Climate Accord
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Process Standards (Scientific and Engineering Practices)

- E.1 Scientific and engineering practices.** The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to explain phenomena or design solutions using appropriate tools and models.
- E.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.
- E.3 Scientific and engineering practices.** The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.
- E.4 Scientific and engineering practices.** The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society.

Ways to Show

- E.1(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems
- E.1(H) distinguish between scientific hypotheses, theories, and laws
- E.2(A) identify advantages and limitations of models such as their size, scale, properties, and materials
- E.2(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations
- E.2(C) use mathematical calculations to assess quantitative relationships in data
- E.3(A) develop explanations and propose solutions supported by data and models consistent with scientific ideas, principles, and theories
- E.3(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats
- E.3(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence
- E.4(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student
- E.4(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content
- E.4(C) research and explore resources such as museums, planetariums, observatories, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers

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SNAPSHOT

— INTEGRATED —
PHYSICS AND
CHEMISTRY

Process Standards (Scientific and Engineering Practices)

- I.1 Scientific and engineering practices.** The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.
- I.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

Tools to Know

- I.1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations
- I.1(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems
- I.1(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards
- I.1(D) use appropriate tools such as data-collecting probes, software applications, the internet, standard laboratory glassware, metric rulers, meter sticks, spring scales, multimeters, Gauss meters, wires, batteries, light bulbs, switches, magnets, electronic balances, mass sets, Celsius thermometers, hot plates, an adequate supply of consumable chemicals, lab notebooks or journals, timing devices, models, and diagrams
- I.1(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence
- I.1(F) organize quantitative and qualitative data using labeled drawings and diagrams, graphic organizers, charts, tables, and graphs
- I.2(D) evaluate experimental and engineering designs

Force and Motion

- I.5 Science concepts.** The student knows the relationship between force and motion in everyday life. The student is expected to:

Readiness Standards

- I.5(A) investigate, analyze, and model motion in terms of position, velocity, acceleration, and time using tables, graphs, and mathematical relationships
- I.5(B) analyze data to explain the relationship between mass and acceleration in terms of the net force on an object in one dimension using force diagrams, tables, and graphs
- I.5(D) describe the nature of the four fundamental forces: gravitation; electromagnetic; the strong and weak nuclear forces, including fission and fusion; and mass-energy equivalency

Supporting Standards

- I.5(C) apply the concepts of momentum and impulse to design, evaluate, and refine a device to minimize the net force on objects during collisions such as those that occur during vehicular accidents, sports activities, or the dropping of personal electronic devices
- I.5(E) construct and communicate an explanation based on evidence for how changes in mass, charge, and distance affect the strength of gravitational and electrical forces between two objects

Energy Transfer and Conservation

- I.6 Science concepts.** The student knows the impact of energy transfer and energy conservation in everyday life.

- I.6(C) plan and conduct an investigation to provide evidence that energy is conserved within a closed system
- I.6(D) investigate and demonstrate the movement of thermal energy through solids, liquids, and gases by convection, conduction, and radiation such as weather, living, and mechanical systems
- I.6(E) plan and conduct an investigation to evaluate the transfer of energy or information through different materials by different types of waves such as wireless signals, ultraviolet radiation, and microwaves
- I.6(F) construct and communicate an evidence-based explanation for how wave interference, reflection, and refraction are used in technology such as medicine, communication, and scientific research

- I.6(A) design and construct series and parallel circuits that model real-world circuits such as in-home wiring, automobile wiring, and simple electrical devices to evaluate the transfer of electrical energy
- I.6(B) design, evaluate, and refine a device that generates electrical energy through the interaction of electric charges and magnetic fields
- I.6(G) evaluate evidence from multiple sources to critique the advantages and disadvantages of various renewable and nonrenewable energy sources and their impact on society and the environment

Structure and Properties of Matter

I.7 Science concepts. The student knows that relationships exist between the structure and properties of matter.

Readiness Standards		Supporting Standards	
I.7(C)	explain how physical and chemical properties of substances are related to their usage in everyday life such as in sunscreen, cookware, industrial applications, and fuels	I.7(A)	model basic atomic structure and relate an element's atomic structure to its bonding, reactivity, and placement on the Periodic Table
I.7(D)	explain how electrons can transition from a high energy level to a low energy state, emitting photons at different frequencies for different energy transitions	I.7(B)	use patterns within the Periodic Table to predict the relative physical and chemical properties of elements
I.7(E)	explain how atomic energy levels and emission spectra present evidence for the wave particle duality	I.7(F)	plan and conduct an investigation to provide evidence that the rate of reaction or dissolving is affected by multiple factors such as particle size, stirring, temperature, and concentration

Matter in Everyday Life

I.8 Science concepts. The student knows that changes in matter affect everyday life.

I.8(A)	investigate how changes in properties are indicative of chemical reactions such as hydrochloric acid with a metal, oxidation of metal, combustion, and neutralizing an acid with a base	I.8(C)	research and communicate the uses, advantages, and disadvantages of nuclear reactions in current technologies
I.8(B)	develop and use models to balance chemical equations and support the claim that atoms, and therefore mass, are conserved during a chemical reaction	I.8(D)	construct and communicate an evidence-based explanation of the environmental impact of the end-products of chemical reactions such as those that may result in degradation of water, soil, air quality, and global climate change

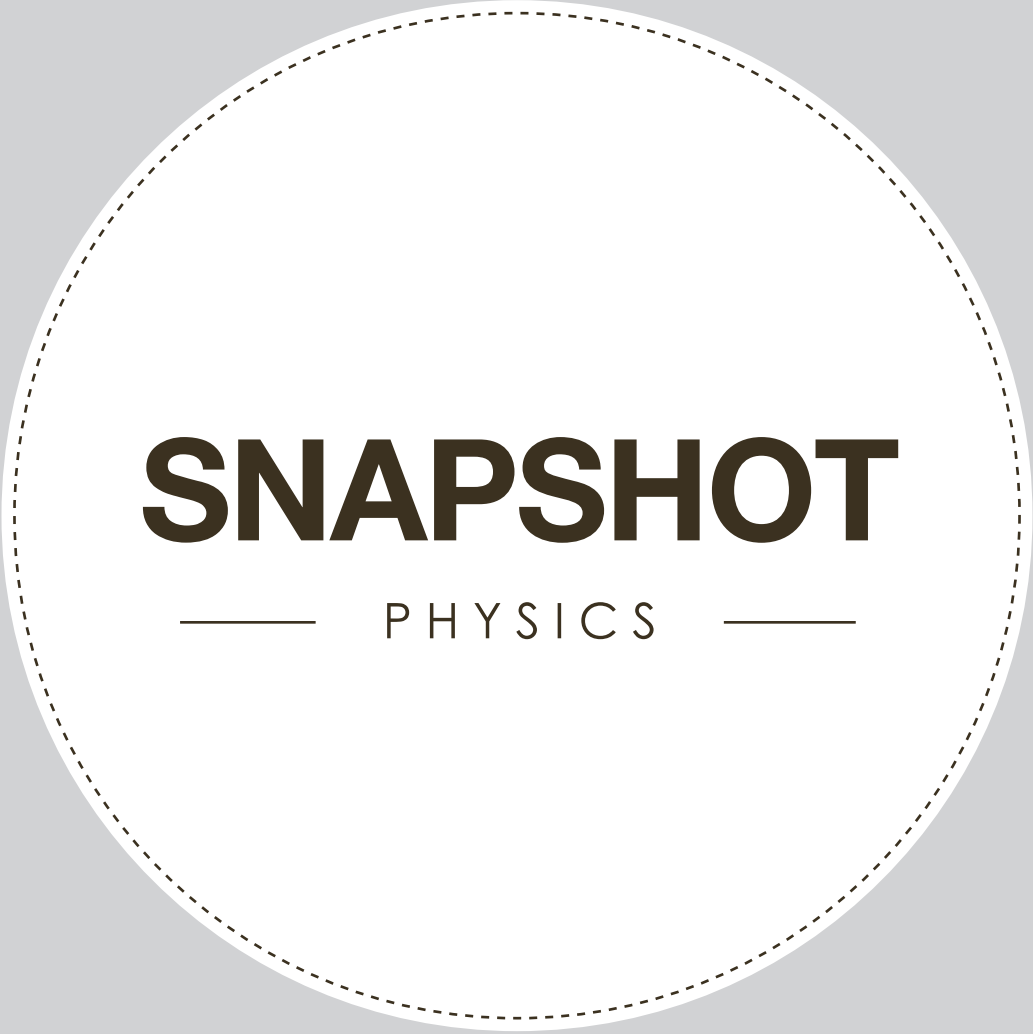
Process Standards (Scientific and Engineering Practices)

- I.1 Scientific and engineering practices.** The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.
- I.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.
- I.3 Scientific and engineering practices.** The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.
- I.4 Scientific and engineering practices.** The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society.

Ways to Show

- I.1(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems
- I.1(H) distinguish between scientific hypotheses, theories, and laws
- I.2(A) identify advantages and limitations of models such as their size, scale, properties, and materials
- I.2(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations
- I.2(C) use mathematical calculations to assess quantitative relationships in data
- I.3(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories
- I.3(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats
- I.3(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence
- I.4(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student
- I.4(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content
- I.4(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers

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SNAPSHOT

— PHYSICS —

Process Standards (Scientific and Engineering Practices)

- P.1 Scientific and engineering practices.** The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.
- P.2 Scientific and engineering practices.** The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

Tools to Know

- P.1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations
- P.1(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems
- P.1(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards
- P.1(D) use appropriate tools such as balances, ballistic carts or equivalent, batteries, computers, constant velocity cars, convex lenses, copper wire, discharge tubes with power supply (H, He, Ne, Ar), data acquisition probes and software, dynamics and force demonstration equipment, electrostatic generators, electrostatic kits, friction blocks, graph paper, graphing technology, hand-held visual spectrometers, inclined planes, iron filings, lab masses, laser pointers, magnets, magnetic compasses, metric rulers, motion detectors, multimeters (current, voltage, resistance), optics bench, optics kit, photogates, plane mirrors, prisms, protractors, pulleys, resistors, rope or string, scientific calculators, stopwatches, springs, spring scales, switches, tuning forks, wave generators, or other equipment and materials that will produce the same results
- P.1(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence
- P.1(F) organize quantitative and qualitative data using bar charts, line graphs, scatter plots, data tables, labeled diagrams, and conceptual mathematical relationships
- P.2(D) evaluate experimental and engineering designs

Mechanics

- P.5 Science concepts.** The student knows and applies the laws governing motion in a variety of situations.

Readiness Standards

- P.5(A) analyze different types of motion by generating and interpreting position versus time, velocity versus time, and acceleration versus time using hand graphing and real time technology such as motion detectors, photogates, or digital applications
- P.5(C) describe and analyze motion in one dimension using equations with the concepts of distance, displacement, speed velocity, frames of reference, and acceleration
- P.5(E) explain and apply the concepts of equilibrium and inertia as represented by Newton's first law of motion using relevant real-world examples such as rockets, satellites, and automobile safety devices
- P.5(F) calculate the effect of forces on objects, including tension, friction, normal, gravity, centripetal, and applied forces, using free body diagrams and the relationship between force and acceleration as represented by Newton's second law of motion
- P.5(G) illustrate and analyze the simultaneous forces between two objects as represented in Newton's third law of motion using free body diagrams and in an experimental design scenario
- P.5(H) describe and calculate, using scientific notation, how the magnitude of force between two objects depends on their masses and the distance between their centers, and predict the effects on objects in linear and orbiting systems using Newton's law of universal gravitation

Supporting Standards

- P.5(B) define scalar and vector quantities related to one- and two-dimensional motion and combine vectors using both graphical vector addition and the Pythagorean theorem
- P.5(D) describe and analyze acceleration in uniform circular and horizontal projectile motion in two dimensions using equations

The Nature of Forces

P.6 Science concepts. The student knows the nature of forces in the physical world.

Readiness Standards	Supporting Standards
P.6(A) use scientific notation and predict how the magnitude of the electric force between two objects depends on their charges and the distance between their centers using Coulomb's law	P.6(B) identify and describe examples of electric and magnetic forces and fields in everyday life such as generators, motors, and transformers
P.6(D) analyze, design, and construct series and parallel circuits using schematics and materials such as switches, wires, resistors, lightbulbs, batteries, voltmeters, and ammeters	P.6(C) investigate and describe conservation of charge during the processes of induction, conduction, and polarization using different materials such as electroscopes, balloons, rods, fur, silk, and Van de Graaf generators
P.6(E) calculate current through, potential difference across, resistance of, and power used by electric circuit elements connected in both series and parallel circuits using Ohm's law	

Law of Conservation of Energy and Momentum

P.7 Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum.

P.7(A) calculate and explain work and power in one dimension and identify when work is and is not being done by or on a system	
P.7(B) investigate and calculate mechanical, kinetic, and potential energy of a system	
P.7(C) apply the concept of conservation of energy using the work-energy theorem, energy diagrams, and energy transformation equations, including transformations between kinetic, potential, and thermal energy	
P.7(D) calculate and describe the impulse and momentum of objects in physical systems such as automobile safety features, athletics, and rockets	
P.7(E) analyze the conservation of momentum qualitatively in inelastic and elastic collisions in one dimension using models, diagrams, and simulations	

Characteristics and Behavior of Waves

P.8 Science concepts. The student knows the characteristics and behavior of waves.

P.8(C) investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate using the relationships between wave speed, frequency, and wavelength	P.8(A) examine and describe simple harmonic motion such as masses on springs and pendulums and wave energy propagation in various types of media such as surface waves on a body of water and pulses in ropes
P.8(D) investigate behaviors of waves, including reflection, refraction, diffraction, interference, standing wave, the Doppler effect and polarization and superposition	P.8(B) compare the characteristics of transverse and longitudinal waves, including electromagnetic and sound waves
	P.8(E) compare the different applications of the electromagnetic spectrum, including radio telescopes, microwaves, and x-rays
	P.8(F) investigate the emission spectra produced by various atoms and explain the relationship to the electromagnetic spectrum
	P.8(G) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens

Quantum Phenomena

P.9 Science concepts. The student knows examples of quantum phenomena and their applications.

P.9(A) describe the photoelectric effect and emission spectra produced by various atoms and how both are explained by the photon model for light	P.9(C) compare and explain how superposition of quantum states is related to the wave-particle duality nature of light
P.9(B) investigate Malus's Law and describe examples of applications of wave polarization, including 3-D movie glasses and LCD computer screens	P.9(D) give examples of applications of quantum phenomena, including the Heisenberg uncertainty principle, quantum computing, and cybersecurity

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