Master Science Teacher Standards

FINAL

Approved on August 6, 2004

MASTER SCIENCE TEACHER STANDARDS

Standard I. Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.

Standard II. History, Nature, and Context of Science: The Master Science Teacher understands, applies knowledge of, and guides others to understand the historical perspectives of science, the nature of science, and how science interacts with and influences personal and societal decisions.

Standard III. Scientific Inquiry: The Master Science Teacher understands, applies knowledge of, and guides others to understand processes of scientific inquiry and the role of inquiry in science learning and teaching.

Standard IV. Alignment and Integration: The Master Science Teacher understands, applies knowledge of, and guides others to understand the Texas Essential Knowledge and Skills (TEKS) and the national science standards and knows the importance of vertical alignment of the TEKS and integration of the science disciplines with one another and with other disciplines.

Standard V. Safety: The Master Science Teacher understands, implements, models, and advocates: safe classroom, field, and laboratory experiences; safe use of equipment and technology; and ethical use of organisms and specimens and guides others to do the same.

Standard VI. Inclusive Instruction: The Master Science Teacher uses and guides others to use a variety of instructional strategies and resources to meet the diverse needs of all learners.

Standard VII. Learning and Teaching Environment: The Master Science Teacher demonstrates and promotes a positive attitude, high expectations, passion, and enthusiasm for science learning and teaching.

Standard VIII. Student Assessment: The Master Science Teacher collaborates to select, construct, and administer aligned assessments, analyzes the results to modify instruction to improve student achievement, and develops those skills in others.

Standard IX. Mentoring and Shared Leadership: The Master Science Teacher facilitates standards-based science instruction by: communicating and collaborating with educational stakeholders; exhibiting leadership, mentoring, coaching, and consulting with colleagues; facilitating professional development; and making decisions based on research.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Content

Unifying Concepts

The EC–12 Master Science Teacher knows and understands:

1.1k how unifying themes form a conceptual framework to organize science and technology;

1.2k how patterns in data and observations of natural phenomena allow predictions to be made;

1.3k how the concepts and processes listed below provide unifying themes across the science disciplines:

- systems, order, and organization;
- evidence, models, and explanation;
- change, constancy, and measurements;
- evolution and equilibrium;
- form and function; and
- properties and patterns;

1.4k how change and constancy occur in systems (e.g., conservation laws, symmetry, stability, cyclic variation, rates of change);

1.5k the complementary nature of form and function in a given system;

1.6k how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical);

1.7k how systems and systems thinking and analyzing can be used to understand the natural and designed world and human behavior; and

Application: What Master Science Teachers Can Do

EC–12 Content

Unifying Concepts

The EC–12 Master Science Teacher is able to:

1.1s apply the systems model (e.g., whole and parts, interacting parts, boundaries, input, output, feedback, subsystems) to identify and analyze common themes that occur in physical science, life science, and earth and space science;

1.2s recognize patterns found in the natural world;

1.3s analyze systems in terms of cycles, structure, processes, properties, and patterns;

1.4s analyze the interactions that occur among the components of a given system or subsystem;

1.5s analyze the concepts of constancy and change; and

1.6s evaluate the strengths and limitations of various physical, conceptual, and mathematical models.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Content: Unifying Concepts (continued)

1.8k the integration of physical science, life science, and earth and space science concepts.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

EC–4 Content

The EC–4 Master Science Teacher knows and understands scientific processes, scientific concepts, and vertical alignment of the Texas Essential Knowledge and Skills (TEKS) for science for grades EC–8.

Physical Science

The EC–4 Master Science Teacher knows and understands:

1.9k properties of objects and materials;

1.10k physical and chemical properties of and changes in matter;

1.11k understand the organization and use of the periodic table;

1.12k concepts of and the relationship between force and motion;

1.13k concepts of heat, light, electricity, sound, and magnetism;

1.14k conservation of matter and energy;

1.15k forms of energy and energy transformations; and

1.16k strategies, resources, and scientific equipment for teaching developmentally appropriate physical science concepts to students in grades EC–4.

Application: What Master Science Teachers Can Do

EC–4 Content

The EC–4 Master Science Teacher is able to apply knowledge of the Texas Essential Knowledge and Skills (TEKS) for grades EC–8 to teach and develop units of instruction appropriate for students in grades EC–4.

Physical Science

The EC–4 Master Science Teacher is able to:

1.7s select and demonstrate appropriate techniques, procedures, and tools to observe and record properties of materials (e.g., size, shape, temperature, magnetism, hardness, mass, conduction, density);

1.8s analyze changes in the position and motion of an object subject to an unbalanced force;

1.9s apply properties of forces and motion (e.g., push or pull, friction, gravity, electric force, magnetic force) to analyze common objects, experiences, and situations;

1.10s describe the properties of various forms of energy and analyze how energy is transferred and transformed from one form to another in a variety of everyday situations;

1.11s analyze interactions between matter and energy; physical changes, including changes in state; and chemical changes; and

1.12s apply the laws of conservation of matter and conservation of energy to analyze a variety of phenomena.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

EC–4 Content (continued)

Life Science

The EC–4 Master Science Teacher knows and understands:

1.17k the basic characteristics and needs of organisms;

1.18k the distinction between living and nonliving objects;

1.19k the structures and functions of living organisms, including humans;

1.20k the life cycles and growth patterns of a variety of organisms;

1.21k reproduction and the principles of heredity;

1.22k the mechanisms of how populations or species evolve over time;

1.23k regulatory mechanisms and behavior;

1.24k relationships among organisms and between organisms and their environment; and

1.25k strategies, resources, and scientific equipment for teaching developmentally appropriate life science concepts to students in grades EC–4.

Application: What Master Science Teachers Can Do

EC–4 Content (continued)

Life Science

The EC–4 Master Science Teacher is able to:

1.13s describe stages in the life cycles of common plants and animals;

1.14s identify characteristics of living and nonliving objects;

1.15s identify characteristics and needs of plants and animals;

1.16s explain how structure and function are related in living systems;

1.17s identify adaptive characteristics and explain how adaptations influence the survival of populations or species;

1.18s describe the processes by which plants and animals reproduce and explain how hereditary information is passed from one generation to the next;

1.19s analyze the role of internal and external stimuli in the behavior of organisms;

1.20s compare and contrast inherited traits and learned characteristics;

1.21s describe ways living organisms depend on each other and their environment for basic needs;

1.22s analyze the characteristics of habitats within ecosystems; and

1.23s identify organisms, populations, or species with similar needs and analyze how they compete with one another for resources.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

EC–4 Content (continued)

Earth and Space Science

The EC–4 Master Science Teacher knows and understands:

1.26k properties of Earth materials;

1.27k the structure and function of Earth systems;

1.28k the impact of oceans on land formation, life, and ecosystems;

1.29k changes in Earth systems resulting from natural events and human activities;

1.30k relationship between renewable and nonrenewable resources;

1.31k components and characteristics of the solar system and the universe;

1.32k the cycles in Earth and space systems;

1.33k theories of the origins of the universe; and

1.34k strategies, resources, and scientific equipment for teaching developmentally appropriate earth and space science concepts to students in grades EC–4.

Application: What Master Science Teachers Can Do

EC–4 Content (continued)

Earth and Space Science

The EC–4 Master Science Teacher is able to:

1.24s describe properties and uses of minerals, fossils, rocks, soils, water, atmospheric gases, and other Earth materials, including renewable, nonrenewable, and inexhaustible resources;

1.25s use the senses and basic tools for monitoring changes in weather and making weather measurements;

1.26s relate the movements and orientations of the earth, moon, and sun to tides, phases, seasons, day and night, and time;

1.27s describe forces, processes, and human activities that change Earth's surface;

1.28s identify objects in the sky, describe their characteristics, and analyze their interactions;

1.29s identify, order, and describe components of the solar system and their relationship to the sun and to each other;

1.30s describe various Earth and space cycles (e.g., rock cycle, water cycle, carbon cycle, nitrogen cycle, seasons);

1.31s identify scientific theories of the origin of the universe; and

1.32s analyze the effect of the sun on earth systems.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

4–8 Content

The 4–8 Master Science Teacher knows and understands scientific processes, scientific concepts, and vertical alignment of the Texas Essential Knowledge and Skills (TEKS) for science for grades EC–12.

Physical Science

The 4–8 Master Science Teacher knows and understands:

1.35k all physical science content specified for EC–4 Master Science Teachers;

1.36k the structure and properties of matter, compounds, elements, and atoms;

1.37k how physical and chemical properties influence the development and application of everyday materials such as cooking surfaces, insulation, adhesives, and plastics;

1.38k energy transfers and transformations during physical and chemical changes;

1.39k the behavior of gases;

1.40k chemical bonding;

1.41k factors that affect chemical reactions;

1.42k characteristics and applications of various types of reactions (e.g., oxidation-reduction, acid-base);

1.43k properties and characteristics of solutions;

1.44k the processes, effects, and significance of nuclear fission and fusion;

Application: What Master Science Teachers Can Do

4–8 Content

The 4–8 Master Science Teacher is able to apply knowledge of the Texas Essential Knowledge and Skills (TEKS) for grades EC–12 to teach and develop units of instruction appropriate for students in grades 4–8.

Physical Science

The 4–8 Master Science Teacher is able to:

1.33s apply all physical science skills specified for EC–4 Master Science Teachers, using content and contexts appropriate for grades 4–8;

1.34s investigate physical properties of solids, liquids, and gases;

1.35s describe the structure, component parts, and properties of an atom;

1.36s analyze interactions between matter and energy, including changes in state and specific heat;

1.37s analyze physical and chemical changes in matter;

1.38s measure, graph, and describe changes in position, direction of motion, and speed;

1.39s analyze the relationship between force and motion in a variety of situations including simple machines, the flow of blood through the human body, and geologic processes;

1.40s apply properties and characteristics of waves to analyze sound, light, and other wave phenomena;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know	**Application: What Master Science Teachers Can Do**
4–8 Content: Physical Science (continued)	***4–8 Content: Physical Science (continued)***
1.45k the laws governing motion;	1.41s interpret the periodic table, including groupings within the table, and chemical formulas and equations;
1.46k that energy and momentum are conserved in physical systems;	1.42s apply the law of conservation of energy to analyze a variety of phenomena (e.g., specific heat, chemical and nuclear reactions, efficiency of simple machines);
1.47k the characteristics and behavior of waves;	1.43s apply the law of conservation of matter to analyze a variety of phenomena (e.g., water cycle, decomposition); and
1.48k the electromagnetic spectrum and the characteristics of light and sound;	1.44s analyze the transfer of energy in a variety of situations and devices (e.g., production of heat, light, sound, and magnetic effects by electrical energy; the process of photosynthesis; weather processes).
1.49k the principles of electricity and magnetism;	
1.50k the basic principles of quantum physics; and	
1.51k strategies, resources, and scientific equipment for teaching developmentally appropriate physical science concepts to students in grades 4–8.	

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

4–8 Content (continued)

Life Science

The 4–8 Master Science Teacher knows and understands:

1.52k all life science content specified for EC–4 Master Science Teachers;

1.53k the structures, functions, and levels of organization (e.g., cells, tissues, organs, organ systems) in living systems;

1.54k growth and developmental processes of a variety of organisms;

1.55k principles of heredity, including the structure and function of nucleic acids;

1.56k principles of and evidence for the theory of biological evolution;

1.57k the diversity of life and how organisms are classified;

1.58k how organisms maintain homeostasis in a changing external environment;

1.59k the flow of energy and matter within living organisms, among organisms, and between organisms and the environment;

1.60k characteristics of ecosystems and biomes;

1.61k the relationship between carrying capacity and changes in populations and ecosystems;

1.62k the role of ecological succession in ecosystems; and

1.63k strategies, resources, and scientific equipment for teaching developmentally appropriate life science concepts to students in grades 4–8.

Application: What Master Science Teachers Can Do

4–8 Content (continued)

Life Science

The 4–8 Master Science Teacher is able to:

1.45s apply all life science skills specified for EC–4 Master Science Teachers, using content and contexts appropriate for grades 4–8;

1.46s analyze how structure complements function in cells, organs, organ systems, organisms, and populations;

1.47s identify human body systems and describe their functions;

1.48s distinguish between dominant and recessive traits and predict the probable outcomes of genetic combinations;

1.49s explain that every organism requires a set of instructions for specifying its traits;

1.50s describe how an inherited trait can be determined by one or by many genes and how more than one trait can be influenced by a single gene;

1.51s compare and contrast sexual and asexual reproduction;

1.52s compare traits in a population or species that enhance its survival and reproduction;

1.53s describe how interactions with the environment can result in changes in gene frequencies;

1.54s describe how populations and species change through time;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

4–8 Content: Life Science (continued)

1.55s analyze the role of natural selection in species variation, diversity, speciation, phylogeny, adaptation, behavior, and extinction;

1.56s analyze responses in organisms that result from internal and external stimuli;

1.57s describe feedback mechanisms that allow organisms to maintain stable internal conditions;

1.58s identify the abiotic and biotic components of an ecosystem;

1.59s describe the interrelationships among producers, consumers, and decomposers in an ecosystem;

1.60s analyze and describe adaptive characteristics that result in a population's or species' unique niche in an ecosystem; and

1.61s describe interactions between and within living and nonliving systems.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

4–8 Content (continued)

Earth and Space Science

The 4–8 Master Science Teacher knows and understands:

1.64k all earth and space science content specified for EC–4 Master Science Teachers;

1.65k theories and evidence regarding the formation and history of the Earth;

1.66k the characteristics and interactions of Earth's geosphere, atmosphere, hydrosphere, and biosphere;

1.67k the evolution and characteristics of different landforms and the processes that shape them;

1.68k sources, characteristics, and uses of natural resources (e.g., minerals, renewable and nonrenewable energy resources, water);

1.69k the role of energy in governing weather and climate;

1.70k characteristics of the solar system and universe, including scale;

1.71k characteristics of stars, including the Sun, and their life cycles;

1.72k scientific theories of the evolution of the universe;

1.73k methods of exploring the solar system and the universe;

Application: What Master Science Teachers Can Do

4–8 Content (continued)

Earth and Space Science

The 4–8 Master Science Teacher is able to:

1.62s apply all earth and space science skills specified for EC–4 Master Science Teachers, using content and contexts appropriate for grades 4–8;

1.63s analyze and describe characteristics and interactions of the Earth's geosphere, hydrosphere, atmosphere, and biosphere;

1.64s describe procedures for determining the physical properties used for mineral identification (e.g., density, hardness, streak, cleavage);

1.65s identify and analyze the effects of plate movement, including faulting, folding, earthquakes, and volcanic activity;

1.66s analyze a variety of Earth cycles (e.g., rock cycle, water cycle, carbon cycle, nitrogen cycle) and predict the results of modifying any of these cycles;

1.67s describe and analyze effects of the transfer of energy between the atmosphere, land, and ocean (e.g., currents, erosion, hurricanes);

1.68s describe characteristics of ocean water (e.g., salinity, turbidity, heat capacity, colligative properties, density);

1.69s identify the relationships between groundwater and surface water in a watershed;

1.70s explain weather measurements and analyze weather processes;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know	**Application: What Master Science Teachers Can Do**
4–8 Content: Earth and Space Science (continued)	***4–8 Content: Earth and Space Science (continued)***
1.74k that equilibrium of a system may change; and	1.71s analyze and describe how human activity and natural processes, both gradual and catastrophic, can alter Earth systems, including the extinction of species;
1.75k strategies, resources, and scientific equipment for teaching developmentally appropriate earth and space science concepts to students in grades 4–8.	1.72s identify properties of and analyze interactions among the components of the solar system;
	1.73s analyze how the Earth's position, orientation, and surface features affect seasons, weather, and climate; and
	1.74s examine characteristics of the universe, such as distances, stars, and galaxies, and describe scientific theories of the origin of the universe.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know	**Application: What Master Science Teachers Can Do**
8–12 Content	***8–12 Content***
The 8–12 Master Science Teacher will have a broad knowledge of all science disciplines (i.e., physical science, life science, earth and space science) and will demonstrate proficiency in one science discipline at the level of a bachelor's degree in that discipline.	
The 8–12 Master Science Teacher knows and understands scientific processes, scientific concepts, and vertical alignment of the Texas Essential Knowledge and Skills (TEKS) for science for grades EC–12.	*The 8–12 Master Science Teacher is able to apply knowledge of the Texas Essential Knowledge and Skills (TEKS) for grades EC–12 to teach and develop units of instruction appropriate for students in grades 8–12.*
Physical Science	**Physical Science**
The 8–12 Master Science Teacher knows and understands:	The 8–12 Master Science Teacher is able to:
1.76k all physical science content specified for EC–4 and 4–8 Master Science Teachers;	1.75s apply all physical science skills specified for EC–4 and 4–8 Master Science Teachers, using content and contexts appropriate for grades 8–12;
1.77k motion and forces: motion occurs when a net force is applied, and gravitation, electricity, and magnetism are universal forces;	1.76s create, analyze, and interpret graphs describing the motion of a particle;
1.78k conservation of energy and increase in disorder: energy is kinetic or potential, and everything becomes less orderly over time;	1.77s analyze examples of uniform and accelerated motion, including linear, projectile, and circular motion;
1.79k interactions of energy and matter: waves and particles can transfer energy, and energy occurs in discrete quantities;	1.78s create and analyze free-body diagrams;
1.80k structure and properties of matter: atoms and molecules interact with one another through electric forces;	1.79s apply Newton's laws to solve a variety of practical problems (e.g., properties of frictional forces, the inclined plane, motion of a pendulum);
1.81k structure of atoms: matter is made up of atoms, which are themselves made up of smaller components;	1.80s apply the law of universal gravitation to solve a variety of problems (e.g., gravitational fields of the planets, properties of circular orbits);
	1.81s apply the inverse square law to calculate electrostatic forces, fields, and potentials;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know	**Application: What Master Science Teachers Can Do**
8–12 Content: Physical Science (continued)	***8–12 Content: Physical Science (continued)***
1.82k conservation of matter and energy: matter and energy are conserved in chemical and physical changes;	1.82s describe the source of the magnetic force and analyze the magnetic field for various current distributions;
1.83k chemical reactions: chemical reactions release or consume energy; and	1.83s describe the relationship between electricity and magnetism;
1.84k strategies, resources, and scientific equipment for teaching developmentally appropriate physical science concepts to students in grades 8–12.	1.84s design and analyze series and parallel DC circuits in terms of current, resistance, voltage, and power, and describe the components and characteristics of AC circuits (e.g., impedance, resonance, r.m.s. voltage and current);
	1.85s analyze the operation of electromagnets, motors, and generators;
	1.86s apply the work-energy theorem to analyze and solve a variety of practical problems (e.g., finding the speed of an object given its potential energy function, determining the work done by frictional forces);
	1.87s solve problems using the conservation of energy in a physical system (e.g., determining potential energy for conservative forces, investigating the mechanical equivalence of thermal energy);
	1.88s apply the first law of thermodynamics to investigate energy transformations in a variety of everyday situations;
	1.89s describe the concept of entropy and its relationship to the second law of thermodynamics;
	1.90s compare and contrast transverse and longitudinal waves;
	1.91s relate concepts of amplitude, frequency, velocity, and wavelength to the properties of sound and light waves (e.g., pitch, color);

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Physical Science (continued)

1.92s apply the properties of wave reflection, refraction, and interference to analyze and explain acoustical and optical phenomena;

1.93s describe the electromagnetic spectrum and explain how electromagnetic waves are produced;

1.94s interpret wave particle duality;

1.95s describe examples and consequences of the uncertainty principle;

1.96s describe and analyze the photoelectric effect;

1.97s use the quantum model of the atom to describe the line spectra from gas-discharge tubes;

1.98s differentiate between physical and chemical properties of matter;

1.99s describe and create models to explain the molecular structure of solids, liquids, and gases;

1.100s use the periodic table to predict and explain the physical (e.g., metallic, nonmetallic) and chemical (e.g., electron valence) properties of an element;

1.101s apply the gas laws (e.g., Charles's law, Boyle's law, ideal gas law) to predict gas behavior in a variety of situations;

1.102s describe the properties of the bonds and the arrangement of atoms in molecules, ionic crystals, polymers, and metallic substances;

1.103s compare and contrast the chemical properties of ionic and covalent compounds;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Physical Science (continued)

1.104s describe the physical and chemical properties of covalent compounds in terms of intermolecular forces in the bonds;

1.105s use the physical properties of a substance (e.g., boiling point, crystal structure) to predict the kind of interaction between molecules of a given substance;

1.106s solve problems involving moles and stoichiometry;

1.107s analyze factors that affect solubility;

1.108s determine the molarity, molality, and percent composition of aqueous solutions;

1.109s analyze and describe models to explain the structural properties of water;

1.110s describe the importance of water as a solvent in living organisms and the environment;

1.111s describe the atom in terms of protons, neutrons, and electron clouds;

1.112s analyze relationships among electron energy levels, photons, and atomic spectra;

1.113s relate electronic configuration to physical and chemical properties and reactivity;

1.114s describe the relationship between the kinetic theory and the universal gas law;

1.115s analyze and describe the effects of energy transformations that occur in phase changes;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Physical Science (continued)

1.116s identify and analyze the effects of energy transformations that occur in chemical reactions to enable students to make predictions about other reactions;

1.117s analyze and describe models to explain the process(es) of radioactivity and radioactive decay;

1.118s compare fission and fusion reactions in terms of the mass of the reactants and products and the amount of energy released in the reactions;

1.119s use the half-life of radioactive elements to solve real-world problems (e.g., carbon dating, radioactive traces);

1.120s evaluate the risks and benefits of the commercial uses of nuclear energy and the medical uses of radioisotopes;

1.121s evaluate environmental issues associated with the storage, containment, and disposal of nuclear wastes;

1.122s interpret and balance chemical and nuclear equations using number of atoms, mass, and charge;

1.123s analyze processes occurring during redox reactions using applications from everyday life;

1.124s determine oxidation numbers and balance redox equations in order to determine if the reaction will occur;

1.125s describe the operating principles of an electrochemical cell and the process of electroplating metals;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Physical Science (continued)

1.126s describe the effect of solution concentration on the properties and chemical reactivity of a variety of aqueous solutions;

1.127s analyze and interpret relationships among ionic and covalent compounds, electrical conductivity, and colligative properties of water;

1.128s illustrate the relationship between the hydronium ion concentration and the pH for various acids and bases;

1.129s apply the principles of solution concentration and stoichiometry to analyze characteristics of a neutralization reaction;

1.130s analyze and apply the principles of acid-base titration;

1.131s analyze examples from the real world that illustrate the effects of acids and bases on an ecological system;

1.132s apply the law of conservation of energy to evaluate the energy exchange that occurs during a chemical reaction;

1.133s analyze factors (e.g., temperature, concentration) that affect the rate of a chemical reaction; and

1.134s analyze and describe the chemical properties of a variety of household chemicals in order to predict potential for chemical reactivity.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

8–12 Content (continued)

Life Science

The 8–12 Master Science Teacher knows and understands:

1.85k all life science content specified for EC–4 and 4–8 Master Science Teachers;

1.86k cells: the structural and functional units of life;

1.87k heredity: the continuity and variations of traits from one generation to the next;

1.88k evolution of life: the historical changes in life forms;

1.89k diversity of life: similarities and differences among organisms;

1.90k flow of matter and energy: organisms are linked to one another and to their physical setting by the transfer and transformation of matter and energy;

1.91k interdependence of life: species depend on one another and the environment for survival; and

1.92k strategies, resources, and scientific equipment for teaching developmentally appropriate life science concepts to students in grades 8–12.

Application: What Master Science Teachers Can Do

8–12 Content (continued)

Life Science

The 8–12 Master Science Teacher is able to:

1.135s apply all life science skills specified for EC–4 and 4–8 Master Science Teachers, using content and contexts appropriate for grades 8–12;

1.136s compare and contrast prokaryotic cells, eukaryotic cells, and viruses;

1.137s explain how cells carry out the life processes, including homeostasis, energy production, transportation of molecules, disposal of wastes, synthesis of new molecules and cell parts, and cellular reproduction;

1.138s analyze cell differentiation in the development of organisms;

1.139s describe how an organism grows and the function of specialized cells, tissues, and organs;

1.140s compare and contrast cells in different parts of plants and animals;

1.141s describe the role of microorganisms and viruses in maintaining health (e.g., digestion) and in causing disease;

1.142s describe the structure and replication of DNA;

1.143s explain the process of protein synthesis;

1.144s compare growth, sexual and asexual reproduction, and the underlying processes of mitosis and meiosis;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Life Science (continued)

1.145s describe the biological significance and causes (e.g., mutation, genetic engineering) of genetic variation in populations;

1.146s analyze human karyotypes in order to identify gender and genetic disorders;

1.147s analyze how fossils, DNA sequences, anatomical similarities, physiological similarities, and embryology provide evidence of change in populations and species;

1.148s analyze the results of natural selection in species variation, diversity, speciation, phylogeny, adaptation, behavior, and extinction;

1.149s predict how an environmental change will prompt adaptations of an organism over many generations;

1.150s explain the uses and limitations of classification schemes;

1.151s analyze relationships among organisms to develop a model of a hierarchical classification system;

1.152s classify organisms at several taxonomic levels using dichotomous keys;

1.153s describe the characteristics of kingdoms, including monerans, protists, fungi, plants, and animals;

1.154s describe how adaptations allow an organism to exist within an environment;

1.155s analyze how systems and subsystems maintain homeostasis;

1.156s compare the structures and functions of different types of biomolecules, such as carbohydrates, lipids, proteins, and nucleic acids;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Life Science (continued)

1.157s identify and analyze the effects of enzymes in synthesis and degradation of biomolecules (e.g., DNA, food);

1.158s compare and contrast the processes of photosynthesis and cellular respiration;

1.159s analyze the functions of systems in plants (e.g., transport, reproduction);

1.160s analyze the functions of systems in animals (e.g., digestion, circulation);

1.161s describe the relationships between internal feedback mechanisms in the maintenance of homeostasis;

1.162s explain how organisms, including humans, respond to external stimuli (e.g., environmental changes, interactions among members of a species);

1.163s analyze the importance of nutrition, environmental conditions, and physical exercise on health;

1.164s analyze the flow of energy and cycling of matter through the carbon, oxygen, nitrogen, and water cycles;

1.165s analyze the flow of energy and cycling of matter through different trophic levels and between organisms, including humans, and the physical environment;

1.166s explain the relationship between the abiotic characteristics of the different biomes and the variations, tolerances, and adaptations of populations or species of plants and animals in those biomes;

1.167s identify the indigenous plants and animals in an ecosystem and assess their function;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Life Science (continued)

1.168s compare and contrast the characteristics of freshwater, brackish, and saltwater ecosystems;

1.169s analyze interactions in an ecosystem (e.g., food chains, food webs, food pyramids), including human interactions;

1.170s interpret interactions among organisms and viruses exhibiting predation, parasitism, commensalism, and mutualism;

1.171s predict how the introduction, removal, or reintroduction of an organism may alter the food chain, affect existing populations in an ecosystem, and influence natural selection;

1.172s analyze the interdependence among organisms in an aquatic environment and the biosphere;

1.173s relate carrying capacity to population dynamics;

1.174s calculate the exponential growth of populations given various assumptions;

1.175s analyze how geographic locales, natural events, diseases, and birth and death rates affect population predictions; and

1.176s analyze and evaluate the economic significance and interdependence of components of an environmental system.

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Teacher Knowledge: What Master Science Teachers Know

8–12 Content (continued)

Earth and Space Science

The 8–12 Master Science Teacher knows and understands:

1.93k all earth and space science content specified for EC–4 and 4–8 Master Science Teachers;

1.94k structure and function of Earth systems: the Earth is comprised of a set of closely coupled subsystems—the geosphere, hydrosphere, atmosphere, and biosphere;

1.95k Earth's history: the Earth system exists in a state of dynamic equilibrium that evolves over geologic time;

1.96k components and properties of the solar system: the major components of the solar system are in a state of regular, predictable motion;

1.97k composition, history, and properties of the universe and its scale in space and time: current theories of the origin and evolution of the universe are based on the assumption that the fundamental laws of nature do not change over space and time; and

1.98k strategies, resources, and scientific equipment for teaching developmentally appropriate earth and space science concepts to students in grades 8–12.

Application: What Master Science Teachers Can Do

8–12 Content (continued)

Earth and Space Science

The 8–12 Master Science Teacher is able to:

1.177s apply all earth and space science skills specified for EC–4 and 4–8 Master Science Teachers, using content and contexts appropriate for grades 8–12;

1.178s analyze the processes that power the movement of Earth's continental and oceanic plates;

1.179s identify and analyze the effects of plate movement, including faulting, folding, earthquakes, and volcanic activity;

1.180s compare and contrast chemical and mechanical weathering;

1.181s analyze a given landform to understand its history (e.g., weathering, tectonism);

1.182s analyze the role of weathering in the formation of soils;

1.183s describe procedures for determining the physical properties used for mineral identification (e.g., density, hardness, streak, cleavage);

1.184s use physical properties and a key to identify common minerals and describe their properties and economic significance;

1.185s classify rocks according to how they are formed during the rock cycle;

1.186s analyze factors (e.g., temperature, pressure, rate of cooling) that influence the formation of rock types;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Earth and Space Science (continued)

1.187s identify the composition and analyze the structure of the atmosphere;

1.188s explain the range of atmospheric conditions in which organisms can live;

1.189s explain the effect of natural events and human activities on the atmosphere;

1.190s explain the role of the Sun as the major source of energy for phenomena on the Earth's surface (e.g., weather, water cycle);

1.191s describe and analyze effects of the transfer of energy at the boundaries between the atmosphere and land and ocean masses;

1.192s identify, describe, and compare global climatic zones;

1.193s describe the effects of phenomena such as El Niño and the jet stream on local weather;

1.194s analyze the causes and effects of severe weather systems;

1.195s identify and evaluate water sources, uses, quality, and conservation methods within a local environmental system;

1.196s describe the tools and procedures needed to collect and analyze baseline quantitative data, such as pH, salinity, temperature, mineral content, nitrogen compounds, and turbidity, from an aquatic environment;

1.197s analyze carbon, nitrogen, water, and nutrient cycles within an aquatic ecosystem;

1.198s evaluate and predict effects of chemical, physical, and thermal changes on the biotic and abiotic components of an aquatic ecosystem;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Earth and Space Science (continued)

1.199s describe and analyze both local and global issues affecting an aquatic system;

1.200s identify and analyze the characteristics of a local watershed;

1.201s describe and explain procedures for estimating water quantity and analyzing water quality in a local watershed;

1.202s explain the effect of floods, droughts, irrigation, and industrialization on a watershed;

1.203s apply the principles of fluid statics and dynamics (e.g., Archimedes' and Bernoulli's principles, hydrostatic pressure) to analyze aquatic systems;

1.204s describe and analyze the dynamics of fluids in an upwelling;

1.205s identify and determine characteristics of ocean water (e.g., salinity, turbidity, heat capacity, colligative properties, and density);

1.206s explain the interrelationships among plate tectonic activity, ocean currents, climates, and biomes;

1.207s compare and contrast the topography of the ocean floor with the topography of the continents;

1.208s evaluate the causes and effects of tides, tidal bores, and tsunamis;

1.209s analyze and evaluate issues, including economic issues, regarding the use of fossil fuels and other renewable, nonrenewable, and alternative energy sources;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Earth and Space Science (continued)

1.210s describe and analyze the effects that events such as hurricanes, fires, deforestation, mining, population growth, and municipal development may have on environments;

1.211s explain how regional changes in the environment may have a global effect;

1.212s evaluate the effect of human activity and technology on land fertility and aquatic viability;

1.213s identify and evaluate methods of land use and management;

1.214s describe and analyze examples of a community restoring an ecosystem;

1.215s describe and examine a habitat restoration or protection program;

1.216s analyze the relationship between current geologic theories for the origin of Earth and the geologic time scale;

1.217s describe and analyze the historical development of the theory of plate tectonics, including continental drift and sea-floor spreading;

1.218s describe the origin of fossil fuels;

1.219s describe the historical development of scientific theories of Earth and solar system formation;

1.220s describe how data collected by the space program has contributed to scientific knowledge about Earth, the solar system, and the universe;

1.221s describe the approximate mass, size, motion, temperature, structure, and composition of the Sun;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

Application: What Master Science Teachers Can Do

8–12 Content: Earth and Space Science (continued)

1.222s compare and contrast the planets in terms of size, orbit, composition, rotation, atmosphere, moons, and geologic activity;

1.223s apply the law of universal gravitation to analyze planetary motion;

1.224s describe procedures for observing the nighttime sky to determine movement of the planets relative to the stars;

1.225s describe the properties of objects other than planets that orbit the Sun;

1.226s describe and analyze the Sun's effects (e.g., gravitational, electromagnetic, solar wind) on Earth;

1.227s analyze information about lunar phases and use that information to model the Earth, moon, and Sun system;

1.228s compare and contrast factors essential to life on Earth (e.g., temperature, water, mass, gases) to conditions on other planets;

1.229s analyze the relationship between Earth's placement in the solar system and the conditions on Earth that enable organisms to survive;

1.230s analyze the effects of the moon on tides;

1.231s analyze the effects of Earth's rotation, revolution, and tilt of axis on its environment;

1.232s describe the historical origins of the constellations and their role in ancient and modern navigation;

1.233s apply astronomical units of measurement;

Standard I. **Content: The Master Science Teacher knows and understands and is able to mentor the teaching of the Texas Essential Knowledge and Skills (TEKS) in science.**

	Application: What Master Science Teachers Can Do ***8–12 Content: Earth and Space Science (continued)*** 1.234s describe the historical development of the big bang theory; 1.235s research and analyze empirical data on the estimated age of the universe; 1.236s describe and analyze characteristics of galaxies; 1.237s analyze and interpret data to make inferences about the formation of our solar system; 1.238s analyze and interpret data to make inferences about the formation of galaxies; 1.239s describe and analyze the nuclear reactions that occur in stars; 1.240s describe how characteristics of stars, such as temperature, age, relative size, composition, and radial velocity, can be determined using spectral analysis; 1.241s identify the stages in the life cycle of stars using the Hertzsprung-Russell diagram; and 1.242s explain the postulates and implications of the special theory of relativity.

Standard II. **History, Nature, and Context of Science: The Master Science Teacher understands, applies knowledge of, and guides others to understand the historical perspectives of science, the nature of science, and how science interacts with and influences personal and societal decisions.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 History, Nature, and Context of Science

The EC–12 Master Science Teacher knows and understands:

2.1k the historical development of science and the contributions that diverse cultures and individuals have made to scientific knowledge;

2.2k the organizational, explanatory, and predictive power of scientific theories and models;

2.3k limitations to the kinds of questions that can be answered through scientific means;

2.4k that all scientific ideas are subject to refinement as new information challenges prevailing theories and as new theories lead to looking at old observations in new ways;

2.5k that scientific ideas and explanations must be consistent with observational and experimental evidence;

2.6k the role of logical reasoning in developing, evaluating, and validating scientific hypotheses and theories;

2.7k the roles that the sharing of research results and peer review play in developing and validating scientific knowledge;

2.8k principles of scientific ethics in conducting research and reporting results;

2.9k that science is a human endeavor influenced by societal, cultural, and personal views of the world;

2.10k how learning science enables students to function in an increasingly complex society; and

Application: What Master Science Teachers Can Do

EC–12 History, Nature, and Context of Science

The EC–12 Master Science Teacher is able to:

2.1s explain the significance of key scientific and technological advances throughout history (e.g., Copernican revolution, relativity, atomic theory, germ theory, industrial revolution);

2.2s use examples from the history of science to demonstrate how scientific knowledge is developed and changes over time;

2.3s design science instruction that is inclusive and accounts for the contributions to science of diverse cultures and individuals;

2.4s use physical, conceptual, and mathematical models to describe and make predictions about natural phenomena;

2.5s provide students with opportunities to explore the kinds of questions that science can and cannot answer;

2.6s evaluate the design of scientific investigations for strengths and weaknesses;

2.7s analyze, review, and critique scientific explanations, hypotheses, and theories using scientific evidence and information;

2.8s analyze ways in which personal or societal needs and priorities can affect the direction, support, and applications of scientific research;

2.9s apply scientific principles, the theory of probability, and the principles of risk-benefit analysis to analyze the advantages, disadvantages, or alternatives to a given decision or course of action;

Standard II. **History, Nature, and Context of Science: The Master Science Teacher understands, applies knowledge of, and guides others to understand the historical perspectives of science, the nature of science, and how science interacts with and influences personal and societal decisions.**

Teacher Knowledge: What Master Science Teachers Know	**Application: What Master Science Teachers Can Do**
EC–12 History, Nature, and Context of Science (continued)	***EC–12 History, Nature, and Context of Science (continued)***
2.11k the role science can play in helping cause and/or resolve personal, societal, and global challenges.	2.10s use situations from students' daily lives to develop activities and instructional materials that investigate how science can be used to make informed decisions; and 2.11s demonstrate how science can be used to help make informed decisions about societal and global issues.

Standard III. **Scientific Inquiry: The Master Science Teacher understands, applies knowledge of, and guides others to understand processes of scientific inquiry and the role of inquiry in science learning and teaching.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Scientific Inquiry

The EC–12 Master Science Teacher knows and understands:

3.1k the processes, tenets, and assumptions of multiple methods of inquiry leading to scientific knowledge;

3.2k how to conduct laboratory and field research and the importance of research in science investigations;

3.3k that scientific inquiry is characterized by a curiosity and openness to new scientific ideas;

3.4k how scientists use different types of investigation, depending on the questions they are trying to answer;

3.5k principles and procedures for designing and conducting an inquiry-based scientific investigation;

3.6k the characteristics and appropriate use of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis);

3.7k how current knowledge and theories guide scientific investigations;

3.8k the use of technology in scientific research; and

3.9k appropriate methods of statistical analysis and measures (e.g., mean, median, mode, correlation).

Application: What Master Science Teachers Can Do

EC–12 Scientific Inquiry

The EC–12 Master Science Teacher is able to:

3.1s provide documentation of having designed and conducted an original scientific investigation that meets accepted standards of scientific research;

3.2s identify, evaluate, and use information for research from a variety of sources, including professional journals, Web sites, and textbooks;

3.3s design and conduct scientific investigations using appropriate methods for experimental and nonexperimental research (e.g., descriptive studies, controlled experiments, comparative data analysis);

3.4s plan and implement instruction that provides opportunities for all students to engage in scientific inquiry;

3.5s link inquiry investigations to students' prior knowledge and experience;

3.6s use strategies to assist students in identifying, refining, and focusing scientific ideas and questions guiding an inquiry activity;

3.7s guide students in making systematic observations and measurements, analyzing data, and recording and reporting results;

3.8s use and demonstrate the use of a variety of tools and techniques to access, gather, store, retrieve, organize, and analyze data;

3.9s consistently provide opportunities for students to use higher-order thinking skills, logical reasoning, and problem solving to reach conclusions based on evidence;

Standard III. **Scientific Inquiry: The Master Science Teacher understands, applies knowledge of, and guides others to understand processes of scientific inquiry and the role of inquiry in science learning and teaching.**

	Application: What Master Science Teachers Can Do ***EC–12 Scientific Inquiry (continued)*** 3.10s recognize patterns in collected data and observations of natural phenomena and develop, analyze, and evaluate different explanations for the results of scientific investigations; 3.11s identify potential sources of error in a given inquiry-based investigation; 3.12s effectively manage groups of students in laboratory and field settings to optimize scientific inquiry; and 3.13s develop criteria for assessing student participation in and understanding of the inquiry process.

***Standard IV*. Alignment and Integration: The Master Science Teacher understands, applies knowledge of, and guides others to understand the Texas Essential Knowledge and Skills (TEKS) and the national science standards and knows the importance of vertical alignment of the TEKS and integration of the science disciplines with one another and with other disciplines.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Alignment and Integration

The EC–12 Master Science Teacher knows and understands:

4.1k the purpose, content, and organization of the Texas Essential Knowledge and Skills (TEKS) for Science;

4.2k the national science standards and other science education initiatives (e.g., Project 2061);

4.3k how students build scientific knowledge and skills and the relationship between students' cognitive development and vertical alignment of the Texas Essential Knowledge and Skills (TEKS);

4.4k how learning in one science discipline can support and enhance learning in other science disciplines;

4.5k connections between science and other disciplines in the school curriculum;

4.6k connections between science and daily life;

4.7k how science fits into the overall curriculum; and

4.8k how to evaluate and select instructional materials based on alignment with the Texas Essential Knowledge and Skills (TEKS), sound scientific principles, and learner-centered pedagogy.

Application: What Master Science Teachers Can Do

EC–12 Alignment and Integration

The EC–12 Master Science Teacher is able to:

4.1s use the Texas Essential Knowledge and Skills (TEKS) to plan and implement grade-appropriate instruction that is vertically aligned with the overall science curriculum;

4.2s apply information from publications related to science education (e.g., *National Science Education Standards*, *Science for All Americans*, *Benchmarks for Science Literacy*) to curriculum, instruction, and assessment;

4.3s apply knowledge of students' developmental levels, how people learn science, and the Texas Essential Knowledge and Skills (TEKS) to sequence learning activities;

4.4s work with other teachers and administrators to ensure coordination of the science curriculum across grade levels and among the science disciplines;

4.5s make connections among science disciplines by using unifying concepts and processes;

4.6s integrate content, materials, skills, and processes from other disciplines to further science learning;

4.7s integrate science into other content areas and ensure that students have developed sufficient knowledge of the underlying concepts to make the integration meaningful;

4.8s use common examples from students' daily lives to help explain or illustrate scientific processes, concepts, and principles; and

***Standard IV*. Alignment and Integration: The Master Science Teacher understands, applies knowledge of, and guides others to understand the Texas Essential Knowledge and Skills (TEKS) and the national science standards and knows the importance of vertical alignment of the TEKS and integration of the science disciplines with one another and with other disciplines.**

	Application: What Master Science Teachers Can Do ***EC–12 Alignment and Integration (continued)*** 4.9s provide guidance to other teachers regarding proper alignment and effective integration of science content.

Standard V. **Safety: The Master Science Teacher understands, implements, models, and advocates: safe classroom, field, and laboratory experiences; safe use of equipment and technology; and ethical use of organisms and specimens and guides others to do the same.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Safety and Resources

The EC–12 Master Science Teacher knows and understands:

5.1k safety regulations and guidelines as stated in current documentation, such as *Texas Safety Standards for K–12* and the *Texas Facilities Standards*;

5.2k procedures for the appropriate storage, ordering, inventorying, handling, use, disposal, care, and maintenance of chemicals, materials, specimens, and equipment;

5.3k sources of information about laboratory safety;

5.4k procedures for the safe handling and ethical care and treatment of organisms and specimens;

5.5k procedures for responding to an accident or emergency in the classroom, field, or laboratory;

5.6k legal issues associated with accidents and injuries that occur in the classroom, field, or laboratory;

5.7k the importance of providing safe and adequate laboratory space and equipment for all students, including those with special needs; and

5.8k the safe use of grade-appropriate equipment and technology for gathering, analyzing, and reporting data.

Application: What Master Science Teachers Can Do

EC–12 Safety and Resources

The EC–12 Master Science Teacher is able to:

5.1s employ safe practices in designing, planning, and implementing instructional activities (e.g., laboratory, field, demonstrations);

5.2s create a safe, learner-centered environment that is flexible and supportive of science inquiry;

5.3s select and guide students' safe use of appropriate science tools, materials, media, and technological resources;

5.4s safely adapt everyday materials for instructional activities (e.g., low-cost hardware, household materials);

5.5s maintain current safety training and promote safety training for others;

5.6s read and interpret safety information from various sources and check equipment for safety prior to use;

5.7s explain proper use of measuring devices to ensure safe data collection;

5.8s work with the district and school to create, implement, and enforce policies, rules, and safety procedures to promote and maintain a safe learning environment during laboratory and field activities;

5.9s establish and apply procedures to inventory and maintain appropriate safety equipment;

5.10s optimize quick and safe access to all safety equipment (e.g., eyewash station, sink, safety shower, fire blanket, extinguisher);

Standard V. **Safety: The Master Science Teacher understands, implements, models, and advocates: safe classroom, field, and laboratory experiences; safe use of equipment and technology; and ethical use of organisms and specimens and guides others to do the same.**

	Application: What Master Science Teachers Can Do ***EC–12 Safety and Resources (continued)*** 5.12s apply safe procedures for storing, ordering, inventorying, handling, using, disposing of, caring for, and maintaining chemicals, materials, specimens, and equipment; 5.13s evaluate safety and management issues that arise during the setup and use of equipment in the classroom, laboratory, and field; 5.14s safely and effectively manage groups of students in laboratory and field settings; and 5.15s advocate the application of safety research and best practices for use in science facilities and field experiences.

Standard VI. **Inclusive Instruction: The Master Science Teacher uses and guides others to use a variety of instructional strategies and resources to meet the diverse needs of all learners.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Inclusive Instruction

The EC–12 Master Science Teacher knows and understands:

6.1k established theories and research on how all students learn science and develop scientific understanding;

6.2k how the developmental characteristics of students influence science learning;

6.3k instructional models that effectively support the learning of science concepts and skills;

6.4k how common preconceptions and misconceptions students have about scientific phenomena influence learning and strategies that address misconceptions;

6.5k the use and scoring of various types of assessments and the analysis of assessment data to guide instruction;

6.6k methods for providing guidance and feedback to other teachers to help them develop their knowledge and skills in science instruction for all students;

6.7k the importance of taking into account the full diversity of the student population and cultural and gender biases in designing effective science instruction;

6.8k effective, research-based instructional methodologies for use with students who are at risk;

6.9k effective strategies for teaching and assessing English language learners;

6.10k strategies for encouraging active involvement by students from groups who have been traditionally underrepresented in the sciences;

Application: What Master Science Teachers Can Do

EC–12 Inclusive Instruction

The EC–12 Master Science Teacher is able to:

6.1s determine, design, and use instructional approaches and activities, appropriate to the strengths and needs of students, that are supported by research evidence as being effective for developing important science content knowledge, concepts, process skills, problem-solving strategies, and critical and analytical thinking capacities;

6.2s respect student diversity and encourage all students to participate fully in science learning;

6.3s engage students actively in the learning process by using a variety of instructional formats that are based on research that supports their effectiveness with a range of students, including students who are at risk and those from traditionally underrepresented groups in the sciences;

6.4s apply strategies that use instructional time and resources effectively;

6.5s select and guide students' use of appropriate science tools, materials, media, and technological resources;

6.6s adapt everyday materials for instructional activities (e.g., low-cost hardware, household materials);

6.7s use and translate among multiple representations (e.g., verbal, concrete, tabular, graphic, pictorial, mathematical, symbolic) of science content;

6.8s recognize students' misconceptions and preconceptions about scientific phenomena;

Standard VI. **Inclusive Instruction: The Master Science Teacher uses and guides others to use a variety of instructional strategies and resources to meet the diverse needs of all learners.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Inclusive Instruction (continued)

6.11k assistive technologies and methodologies that enable students with disabilities and special needs to participate fully in science activities;

6.12k effective motivational strategies for learning science;

6.13k techniques for identifying students' strengths and needs in science and for modifying, differentiating, and integrating instruction based on those strengths and needs; and

6.14k the use of grade-appropriate equipment and technology for gathering, analyzing, and reporting data.

Application: What Master Science Teachers Can Do

EC–12 Inclusive Instruction (continued)

6.9s apply effective instructional strategies that help challenge and address students' misconceptions;

6.10s make connections among science and other content areas to enhance student learning and motivation;

6.11s elicit prior knowledge from students and sequence learning activities in a way that allows students to build on their prior knowledge and challenges them to expand their understanding of science;

6.12s evaluate the appropriateness of materials, instructional strategies, terminology, and technology with respect to the instructional needs of all students;

6.13s modify instruction to meet the needs of individual students;

6.14s work collaboratively to ensure access for all students to facilities, equipment, and laboratory- and field-based investigations;

6.15s plan, implement, and evaluate lessons that assist students in developing concepts and making generalizations;

6.16s use questioning strategies that encourage students to move from concrete to more abstract understanding;

6.17s present new content using language and examples comprehensible to students;

6.18s analyze and use the results from various forms of assessment to inform and adjust science instruction;

Standard VI. **Inclusive Instruction: The Master Science Teacher uses and guides others to use a variety of instructional strategies and resources to meet the diverse needs of all learners.**

	Application: What Master Science Teachers Can Do ***EC–12 Inclusive Instruction (continued)*** 6.19s use individual, small-group, and whole-class strategies to support student learning; 6.20s communicate effectively with stakeholders, including other teachers, about using programs and instructional techniques that are based on research that supports their effectiveness with a range of students; and 6.21s provide guidance to other teachers regarding lesson plans, instructional materials, and teaching strategies.

Standard VII. **Learning and Teaching Environment: The Master Science Teacher demonstrates and promotes a positive attitude, high expectations, passion, and enthusiasm for science learning and teaching.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Creating and Nurturing a Positive Learning and Teaching Environment

The EC–12 Master Science Teacher knows and understands:

7.1k how teacher attitudes and expectations affect the learning of science;

7.2k how student attitudes and expectations affect the learning of science;

7.3k the reciprocal influence of teacher and student attitudes and expectations;

7.4k how the environment inside and outside the school affects the learning of science;

7.5k that every student can learn and be successfully involved in science;

7.6k how to establish a collaborative scientific community among students and teachers that supports actively engaged learning;

7.7k how to serve as an advocate for students and for science education; and

7.8k the importance of keeping up-to-date on current and emerging science topics and technology.

Application: What Master Science Teachers Can Do

EC–12 Creating and Nurturing a Positive Learning and Teaching Environment

The EC–12 Master Science Teacher is able to:

7.1s apply the results from research to promote and create a positive learning environment with respect to linguistic, cultural, socioeconomic, and developmental diversity;

7.2s reflect on one's own behaviors and attitudes to ensure high expectations and equity in science instruction for all students;

7.3s use a variety of instructional methods, resources, and activities to promote students' confidence, interest, and inventiveness while learning science;

7.4s listen to and respect students' ideas;

7.5s model effective learning processes for students;

7.6s convey a sense of passion and enthusiasm about science;

7.7s foster collaboration among educational stakeholders;

7.8s advocate for students and science education in the school and community;

7.9s promote careers in science and science education;

7.10s use effective strategies and appropriate resources to stay current on emerging science topics and technology;

7.11s design and manage the time, space, and resources needed to create a positive teaching and learning environment;

Standard VII. **Learning and Teaching Environment: The Master Science Teacher demonstrates and promotes a positive attitude, high expectations, passion, and enthusiasm for science learning and teaching.**

	Application: What Master Science Teachers Can Do ***EC–12 Creating and Nurturing a Positive Learning and Teaching Environment (continued)*** 7.12s identify and use community resources to supplement the school science program in order to create a positive learning and teaching environment; 7.13s empower teachers and students with the courage to promote and embrace change; and 7.14s promote academic integrity in the learning environment.

Standard VIII. **Student Assessment: The Master Science Teacher collaborates to select, construct, and administer aligned assessments, analyzes the results to modify instruction to improve student achievement, and develops those skills in others.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Student Assessment

The EC–12 Master Science Teacher knows and understands:

8.1k the relationships among curriculum, student assessment, and instruction;

8.2k technical issues associated with testing (e.g., reliability, validity, absence of bias, clarity of language, appropriateness of level);

8.3k the purposes, characteristics, and uses of various student assessment methods in science, including formative and summative assessments;

8.4k the importance of carefully selecting or designing formative and summative student assessments for the specific decisions they are intended to inform;

8.5k how formal and informal assessment of students' science understanding and skills on a regular basis can improve instructional practice;

8.6k strategies for assessing students' prior knowledge and misconceptions about science;

8.7k the importance of sharing assessment criteria with students;

8.8k the role of student assessments as learning experiences;

8.9k strategies for engaging students in meaningful self-assessments; and

8.10k how to communicate effectively with others about the development and use of student assessment techniques and the interpretation of results to guide instruction.

Application: What Master Science Teachers Can Do

EC–12 Student Assessment

The EC–12 Master Science Teacher is able to:

8.1s select, design, and administer a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) to monitor student understanding and progress in science;

8.2s interpret student assessment results to determine specific strategies to guide instruction;

8.3s monitor ongoing assessment of student progress by working with other teachers;

8.4s use a variety of strategies to gain insight about students' prior knowledge and misconceptions about science;

8.5s evaluate student assessment materials and procedures for reliability, validity, absence of bias, clarity of language, and alignment to the Texas Essential Knowledge and Skills (TEKS);

8.6s state evaluation criteria clearly so that students can understand and derive meaning from them;

8.7s communicate assessment results to parents/guardians;

8.8s lead teacher groups in the development of student assessment instruments and/or methods;

8.9s generate student assessment methods that align with state and national standards; and

Standard VIII. **Student Assessment: The Master Science Teacher collaborates to select, construct, and administer aligned assessments, analyzes the results to modify instruction to improve student achievement, and develops those skills in others.**

	Application: What Master Science Teachers Can Do ***EC–12 Student Assessment (continued)*** 8.10s establish criteria consistent with current ethical and legal principles regarding sharing of assessment results with students, parents/guardians, and appropriate school personnel.

***Standard IX*. Mentoring and Shared Leadership: The Master Science Teacher facilitates standards-based science instruction by: communicating and collaborating with educational stakeholders; exhibiting leadership, mentoring, coaching, and consulting with colleagues; facilitating professional development; and making decisions based on research.**

Teacher Knowledge: What Master Science Teachers Know

EC–12 Communication and Collaboration with Educational Stakeholders

The EC–12 Master Science Teacher knows and understands:

9.1k the dual role of the Master Science Teacher as a teacher and mentor in the school community;

9.2k leadership, communication, and facilitation skills and strategies;

9.3k principles, guidelines, and professional ethical standards regarding collegial and professional collaborations, including confidentiality in the mentoring relationship;

9.4k learning processes and procedures that facilitate peer learning and self-learning;

9.5k how to facilitate positive change in instructional practices through participation in ongoing professional development opportunities; and

9.6k how local, state, and national curriculum and assessment standards are related.

Application: What Master Science Teachers Can Do

EC–12 Communication and Collaboration with Educational Stakeholders

The EC–12 Master Science Teacher is able to:

9.1s collaborate with administrators to address the specific needs and concerns of novice teachers of science that contribute to attrition;

9.2s reflect on and assist other teachers in reflecting on teaching behaviors and attitudes that ensure high expectations and equity in science instruction for all students;

9.3s use positive, constructive techniques for providing feedback to other teachers;

9.4s collaborate with administrators, colleagues, families/guardians, and other members of the school community to establish and implement the roles of the Master Science Teacher and ensure effective ongoing communication;

9.5s build trust and a spirit of collaboration with other members of the school community to effect positive change in the school science program and science instruction;

9.6s use leadership skills to ensure the effectiveness and ongoing improvement of the school science program, encourage support for the program, and engage others in improving the program;

9.7s cultivate shared leadership among teachers and students in the school system and community at large;

9.8s improve scientific literacy in the community by discussing science-related issues with students, colleagues, administrators, families/guardians, and the community; and

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Application: What Master Science Teachers Can Do

EC–12 Communication and Collaboration with Educational Stakeholders (continued)

9.9s apply professional principles, guidelines, and ethical standards in collegial and professional collaborations.

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Teacher Knowledge: What Master Science Teachers Know

EC–12 Mentoring, Coaching, and Consulting

The EC–12 Master Science Teacher knows and understands:

9.7k that mentoring of colleagues is consultation and support rather than supervision and evaluation;

9.8k research-based skills and strategies for mentoring, coaching, and consulting in the development, implementation, and evaluation of an effective standards-based science program; and

9.9k research-based strategies for facilitating positive change in instructional practices through mentoring, coaching, and consultation.

Application: What Master Science Teachers Can Do

EC–12 Mentoring, Coaching, and Consulting

The EC–12 Master Science Teacher is able to:

9.10s apply effective mentoring, coaching, and consultation skills and strategies (e.g., observing, consensus building, providing feedback, decision making) to improve science instruction for all students;

9.11s use observations of teachers during instruction to identify their areas of strength and areas needing improvement;

9.12s use mentoring, coaching, and consultation to facilitate team building for identifying needs related to science instruction, developing strategies for addressing those needs, and promoting science learning;

9.13s use consultation to work effectively with colleagues with varying levels of skill and experience and/or different philosophical approaches to instruction to develop, implement, and monitor Texas Essential Knowledge and Skills (TEKS)-based science programs;

9.14s select and use strategies to maximize effectiveness as a Master Science Teacher, such as applying principles of time management and engaging in continuous self-assessment; and

9.15s use consultation to improve the teacher's ability to engage all students in the learning process.

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Teacher Knowledge: What Master Science Teachers Know

EC–12 Professional Development for Faculty

The EC–12 Master Science Teacher knows and understands:

9.10k learning processes and procedures for facilitating adult learning;

9.11k strategies for facilitating positive change in instructional practices through professional development;

9.12k models and features of effective professional development programs that promote sustained application in classroom practice (e.g., demonstration, modeling, guided practice, feedback, coaching, follow-up); and

9.13k the importance of being an active participant in professional science education organizations.

Application: What Master Science Teachers Can Do

EC–12 Professional Development for Faculty

The EC–12 Master Science Teacher is able to:

9.16s collaborate with teachers, administrators, and others to identify professional development needs, generate support for professional development programs, and ensure provision of effective professional development opportunities;

9.17s design ongoing professional development opportunities that address identified student needs in science, are appropriate for the intended audience, and are based on data and convergent research evidence;

9.18s use a variety of models and methods to create professional development opportunities that improve teachers' abilities to implement effective science instruction for all students; and

9.19s apply principles and procedures for delivering effective professional development and follow-up to promote and sustain positive change in the science program.

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Teacher Knowledge: What Master Science Teachers Know	**Application: What Master Science Teachers Can Do**
EC–12 Decision Making Based on Research	***EC–12 Decision Making Based on Research***
The EC–12 Master Science Teacher knows and understands:	The EC–12 Master Science Teacher is able to:
9.14k sources for locating information about emerging research on science and science learning; and	9.20s critically examine research on science learning and analyze the usefulness of research results for addressing instructional needs; and
9.15k methods and criteria for reviewing research on science learning and selecting research for educational applications.	9.21s apply appropriate procedures for translating research on science learning into practice.