Life Science 7-12 Standards

FINAL

Approved on October 6, 2000

LIFE SCIENCE STANDARDS

Standard I. The science teacher manages classroom, field, and laboratory activities to ensure the safety of all students and the ethical care and treatment of organisms and specimens.

Standard II. The science teacher understands the correct use of tools, materials, equipment, and technologies.

Standard III. The science teacher understands the process of scientific inquiry and its role in science instruction.

Standard IV. The science teacher has theoretical and practical knowledge about teaching science and about how students learn science.

Standard V. The science teacher knows the varied and appropriate assessments and assessment practices to monitor science learning.

Standard VI. The science teacher understands the history and nature of science.

Standard VII. The science teacher understands how science affects the daily lives of students and how science interacts with and influences personal and societal decisions.

Standard VIII. *Teachers of life science are not responsible for this standard.*

Standard IX. The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in life science.

Standard X. *Teachers of life science are not responsible for this standard.*

Standard XI. The science teacher knows unifying concepts and processes that are common to all sciences.

Standard I. **The science teacher manages classroom, field, and laboratory activities to ensure the safety of all students and the ethical care and treatment of organisms and specimens.**

Teacher Knowledge: What Teachers Know	**Application: What Teachers Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher knows and understands:	The beginning teacher is able to:
1.1k safety regulations and guidelines for science facilities;	1.1s employ safe practices in designing, planning, and implementing all instructional activities (e.g., laboratory, field, demonstrations);
1.2k safety regulations and guidelines for science instruction;	1.2s determine sufficient space and classroom arrangement for carrying out laboratory activities;
1.3k procedures for the appropriate storage, handling, use, disposal, care, and maintenance of chemicals, materials, specimens, and equipment;	1.3s provide students with continuous instruction and training in safe techniques and procedures for all laboratory and field activities, student demonstrations, and independent projects;
1.4k sources of information about laboratory safety;	1.4s read and interpret safety information about chemicals on a Materials Safety Data Sheet (MSDS) and on other chemical labels, including household products;
1.5k procedures for the safe handling and ethical care and treatment of organisms and specimens;	1.5s check equipment for safety (e.g., cracks in glassware, proper grounding of electrical equipment) prior to use;
1.6k procedures for responding to an accident in the laboratory, including first aid;	1.6s create, implement, and enforce rules and safety procedures to promote and maintain a safe learning environment during laboratory and field activities;
1.7k legal issues associated with accidents and injuries that occur in the classroom, field, or laboratory;	1.7s implement regular procedures to inventory and maintain appropriate safety equipment; and
1.8k potential safety hazards in the field (e.g., insect bites, poisonous plants); and	1.8s optimize quick and safe access to all safety equipment (e.g., eyewash station, sink, safety shower, fire blanket, and extinguisher).
1.9k the importance of providing laboratory space and equipment for all students, including those with special needs.	

Standard II. **The science teacher understands the correct use of tools, materials, equipment, and technologies.**

Teacher Knowledge: What Teachers Know	**Application: What Teachers Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher knows and understands:	The beginning teacher is able to:
2.1k procedures for the storing, securing, and routine maintenance of scientific equipment used in instructional activities;	2.1s select and use appropriate tools, technology, materials, and equipment needed for instructional activities;
2.2k correct and safe operating procedures for scientific equipment used in instructional activities;	2.2s instruct and monitor students' use of materials, tools, and instruments;
2.3k concepts of precision, accuracy, and error with regard to reading and recording numerical data from a scientific instrument;	2.3s make science resources accessible to all students;
2.4k the international system of measurement (i.e., metric system);	2.4s recycle, reuse, and conserve laboratory resources as appropriate;
2.5k the use of grade-appropriate equipment and technology for gathering, analyzing, and reporting data; and	2.5s use the appropriate number of significant figures to record and report numerical data;
2.6k the use of technology to acquire, assess, analyze, interpret, and communicate information.	2.6s perform unit conversions within the international system of measurement (i.e., metric system);
	2.7s perform conversions within and across measurement systems;
	2.8s use techniques to calibrate measuring devices as appropriate;
	2.9s organize, display, and communicate data in a variety of ways (e.g., charts, tables, graphs, diagrams, written reports, oral presentations);
	2.10s gather, organize, display, and communicate data using appropriate technology (e.g., Internet, graphing calculators, spreadsheets); and
	2.11s evaluate the validity of data and data sources.

Standard III. **The science teacher understands the process of scientific inquiry and its role in science instruction.**

Teacher Knowledge: What Teachers Know

Teachers of Students in Grades 7–12

The beginning teacher knows and understands:

3.1k how scientists use different types of investigation, depending on the questions they are trying to answer;

3.2k principles and procedures for designing and conducting an inquiry-based scientific investigation (such as making observations; asking questions; researching and reviewing current knowledge in light of experimental evidence; using tools to gather and analyze evidence; proposing answers, explanations, and predictions; and communicating results);

3.3k the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis);

3.4k how current knowledge and theories guide scientific investigations;

3.5k the use of technology in scientific research; and

3.6k appropriate methods of statistical analysis and measures (e.g., mean, median, mode, correlation).

Application: What Teachers Can Do

Teachers of Students in Grades 7–12

The beginning teacher is able to:

3.1s design and conduct inquiry-based scientific investigations, including nonexperimental and experimental designs;

3.2s plan and implement instruction that provides opportunities for all students to engage in scientific inquiry by using various appropriate combinations of the following processes:

- ask a scientific question;
- formulate a testable hypothesis;
- select appropriate equipment and technology for gathering information related to the hypothesis;
- make observations and collect data taking accurate and precise measurements;
- organize, analyze, and evaluate data to find data trends and patterns and make inferences; and
- communicate and defend a valid conclusion about the hypothesis under investigation;

3.3s link inquiry investigations to students' prior knowledge and experience;

3.4s focus inquiry-based instruction on questions and issues that are relevant to students;

3.5s use strategies to assist students in identifying, refining, and focusing scientific ideas and questions guiding an inquiry activity (i.e., an inquiry-based scientific investigation);

3.6s guide students in making systematic observations and measurements;

3.7s use a variety of tools and techniques to access, gather, store, retrieve, organize, and analyze data;

Application: What Teachers Can Do

Teachers of Students in Grades 7–12 (continued)

Standard III. **The science teacher understands the process of scientific inquiry and its role in science instruction.**

***Standard IV*. The science teacher has theoretical and practical knowledge about teaching science and about how students learn science.**

Teacher Knowledge: What Teachers Know

Teachers of Students in Grades 7–12

The beginning teacher knows and understands:

4.1k theories about how students develop scientific understanding;

4.2k how the developmental characteristics of students influence science learning;

4.3k the statewide curriculum as defined in the Texas Essential Knowledge and Skills (TEKS);

4.4k methods of planning and implementing an inquiry-based science program;

4.5k how students' prior knowledge and attitudes about science may affect their learning;

4.6k common student misconceptions in science and effective ways to address these misconceptions;

4.7k how to establish a collaborative scientific community among students that supports actively engaged learning;

4.8k the importance of planning activities that are inclusive and accommodate the needs of all students;

4.9k strategies that students with diverse strengths and needs can use to determine word meaning in content-related texts;

4.10k strategies that students with diverse strengths and needs can use to develop content-area vocabulary;

4.11k strategies that students with diverse strengths and needs can use to facilitate comprehension before, during, and after reading content-related texts;

4.12k the design and management of learning environments that provide the time, space, and resources needed for learning science;

Application: What Teachers Can Do

Teachers of Students in Grades 7–12

The beginning teacher is able to:

4.1s use lab and field investigations to enable students to develop an understanding of science;

4.2s sequence learning activities in a way that allows students to build upon their prior knowledge and challenges them to expand their understanding of science;

4.3s model active learning and inquiry processes for students;

4.4s encourage students' self-motivation in their own learning;

4.5s display and model scientific attributes, such as curiosity, openness to new ideas, and skepticism;

4.6s design and adapt curricula and select content to meet the interests, knowledge, understanding, abilities, experiences, and needs of students;

4.7s use a variety of instructional strategies to ensure all students' reading comprehension of content-related texts, including helping students link the content of texts to their lives and connect related ideas across different texts;

4.8s teach students how to locate, retrieve, and retain content-related information from a range of texts and technologies;

4.9s teach students how to locate the meanings and pronunciations of unfamiliar content-related words using appropriate sources, such as dictionaries, thesauruses, and glossaries;

4.10s use questioning strategies to move students from concrete to more abstract understanding;

Teacher Knowledge: What Teachers Know

Teachers of Students in Grades 7–12 (continued)

Application: What Teachers Can Do

Teachers of Students in Grades 7–12 (continued)

***Standard IV*. The science teacher has theoretical and practical knowledge about teaching science and about how students learn science.**

Standard V. **The science teacher knows the varied and appropriate assessments and assessment practices to monitor science learning.**

Teacher Knowledge: What Teachers Know

Teachers of Students in Grades 7–12

The beginning teacher knows and understands:

5.1k the relationships among curriculum, assessment, and instruction;

5.2k characteristics of various assessments, such as reliability, validity, and the absence of bias;

5.3k the purposes, characteristics, and uses of various types of assessments in science, including formative and summative assessments;

5.4k the importance of carefully selecting or designing formative and summative assessments for the specific decisions they are intended to inform;

5.5k the importance of monitoring and assessing students' science understanding and skills on a regular, ongoing basis;

5.6k ways in which assessment results inform instructional practice;

5.7k strategies for assessing students' prior knowledge and misconceptions about science;

5.8k questioning strategies designed to elicit higher-level thinking;

5.9k the importance of sharing evaluation criteria with students;

5.10k the role of assessments as learning experiences; and

5.11k strategies for engaging students in meaningful self-assessment.

Application: What Teachers Can Do

Teachers of Students in Grades 7–12

The beginning teacher is able to:

5.1s use formal and informal assessments of science performance and products (e.g., rubrics, portfolios, student profiles, checklists) to evaluate student participation in and understanding of the inquiry process (i.e., of inquiry-based scientific investigations);

5.2s select or design a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) to monitor student understanding and progress;

5.3s design assessments that match each learning objective;

5.4s base decisions regarding instructional content, methods, and practice on information about students' strengths and needs gathered through assessment;

5.5s select assessment instruments and methods that provide students with adequate opportunities to demonstrate their achievements;

5.6s evaluate assessment materials and procedures for reliability, validity, absence of bias, and clarity of language;

5.7s encourage use of self-assessment strategies in science;

5.8s use a variety of strategies (e.g., pre-testing, reviewing student journals, monitoring discussions, asking questions) to gain insight about students' prior knowledge and misconceptions about science;

5.9s state evaluation criteria clearly so that students can understand and derive meaning from them; and

5.10s evaluate the quality of data obtained from an assessment and determine what decisions can appropriately be made based on the data.

Standard VI. **The science teacher understands the history and nature of science.**

Teacher Knowledge: What Teachers Know	**Application: What Teachers Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher knows and understands:	The beginning teacher is able to:
6.1k the limitations of the scope of science and the use and limitations of physical, mathematical, and conceptual models to describe and analyze scientific ideas about the natural world;	6.1s provide students with opportunities to examine the types of questions that science can and cannot answer;
6.2k that science is a human endeavor influenced by societal, cultural, and personal views of the world;	6.2s design and conduct scientific investigations to answer questions;
6.3k that scientific ideas and explanations must be consistent with observational and experimental evidence;	6.3s analyze, review, and critique the strengths and weaknesses of scientific explanations, hypotheses, and theories using scientific evidence and information;
6.4k how logical reasoning is used in the process of developing, evaluating, and validating scientific hypotheses and theories;	6.4s analyze ways in which personal or societal bias can affect the direction, support, and use of scientific research;
6.5k the roles that publishing and peer review play in developing and validating scientific knowledge;	6.5s use key events and knowledge of individuals from throughout the history of science to illustrate scientific concepts;
6.6k principles of scientific ethics in reporting data and in experimenting with living organisms, including human subjects;	6.6s design instruction that accounts for the contributions to science of individuals from a variety of cultures; and
6.7k that scientific theories have predictive power;	6.7s use examples from the history of science to demonstrate the changing nature of scientific theories and knowledge (i.e., that scientific theories and knowledge are always subject to revision in light of new evidence).
6.8k that scientific theories are constantly being modified to conform more closely to new observational and experimental evidence about the natural world;	
6.9k the historical development of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge; and	
6.10k the relationship between science and technology.	

Standard VII. **The science teacher understands how science affects the daily lives of students and how science interacts with and influences personal and societal decisions.**

Teacher Knowledge: What Teachers Know	**Application: What Teachers Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher knows and understands:	The beginning teacher is able to:
7.1k that human decisions about the use of science and technology are based on factors such as ethical standards, economics, and societal and personal needs;	7.1s use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions;
7.2k scientific concepts and principles relating to personal and societal health, including the physiological and psychological effects and risks associated with the use of substances and substance abuse;	7.2s apply scientific principles and processes to analyze factors (e.g., diet, exercise, personal behavior) that influence personal choices concerning fitness and health;
7.3k concepts related to changes in populations and to characteristics of human population growth;	7.3s analyze factors that affect the severity of disease and methods for preventing, controlling, or curing diseases and ailments;
7.4k types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources;	7.4s analyze how factors such as population growth, resource use, population distribution, overconsumption, technological capacity, poverty, and societal views can influence changes in environments;
7.5k the properties of natural ecosystems and how natural and human processes can influence changes in environments;	7.5s apply scientific principles and the theory of probability to analyze the advantages, disadvantages, or alternatives to a given decision or course of action; and
7.6k the principles of risk and benefit analysis and how it is used in the process of personal and societal decision making; and	7.6s demonstrate how science can be used to help make informed decisions about societal and global issues.
7.7k the role science can play in helping resolve personal, societal, and global challenges.	

Standard VIII. *Teachers of life science are not responsible for this standard.*

***Standard IX*. The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in life science.**

Teacher Knowledge: What Teachers Know

Teachers of Students in Grades EC–4*

Life Science

The beginning teacher knows and understands:

9.1k that living systems have different structures to perform different functions;

9.2k that organisms have basic needs;

9.3k that organisms respond to internal or external stimuli;

9.4k the relationship between organisms and the environment;

9.5k the life cycles of organisms; and

9.6k how populations or species evolve through time.

*See 9.7k below.

Application: What Teachers Can Do

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Teachers of Students in Grades EC–4

Life Science

The beginning teacher is able to:

9.1s describe stages in the life cycle of common plants and animals;

9.2s identify characteristics (e.g., physical traits) of plants and animals;

9.3s identify adaptive characteristics and explain how adaptations influence the survival of populations or species;

9.4s describe the processes by which plants and animals reproduce and explain how hereditary information is passed from one generation to the next;

9.5s analyze the role of internal and external stimuli in the behavior of organisms;

9.6s compare and contrast inherited traits and learned characteristics;

9.7s describe ways living organisms depend on each other and their environment for basic needs;

9.8s analyze the characteristics of habitats within an ecosystem; and

9.9s identify organisms, populations, or species with similar needs and analyze how they compete with one another for resources.

*See 9.10s below.

Teacher Knowledge: What Teachers Know

Teachers of Students in Grades 4–8**

Application: What Teachers Can Do

Teachers of Students in Grades 4–8**

Standard X. *Teachers of life science are not responsible for this standard.*

Standard XI. **The science teacher knows unifying concepts and processes that are common to all sciences.**

Teacher Knowledge: What Teachers Know	**Application: What Teachers Can Do**
Teachers of Students in Grades 7–12	***Teachers of Students in Grades 7–12***
The beginning teacher knows and understands:	The beginning teacher is able to:
11.1k how systems and subsystems can be used as a conceptual framework to organize and unify the common themes of science and technology;	11.1s apply the systems model (e.g., 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;
11.2k how patterns in observations and data which explain natural phenomena allow predictions to be made;	11.2s analyze a system (e.g., a cell, the ocean, an ideal gas) in terms of cycles, structure, and processes;
11.3k how the concepts and processes listed below provide a unifying framework across the science disciplines: • systems, order, and organization; • evidence, models, and explanation; • change, constancy, and measurements; • evolution and equilibrium; and • form and function;	11.3s analyze the general features of systems (e.g., input, process, output, feedback);
11.4k properties and patterns of systems can be described in terms of space, time, energy, and matter;	11.4s analyze the interactions that occur between the components of a given system or subsystem;
11.5k how change and constancy occur in systems (e.g., conservation laws, symmetry, stability, cyclic variation, rates of change);	11.5s analyze the interactions and interrelationships between various systems and subsystems; and
11.6k the complementary nature of form and function in a given system; and	11.6s use the systems model to analyze the concepts of constancy (e.g., conservation of mass, energy, and momentum) and change (e.g., evolution).
11.7k 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).	