Texas Education Agency
TEXAS EDUCATOR CERTIFICATION
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TExES | Texas Examinations of Educator Standards

Preparation Manual

138 Life Science 8–12

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Chapter 1

Introduction to the Life Science 8–12 Test and Suggestions for Using This Test Preparation Manual

1

OVERVIEW

The State Board for Educator Certification (SBEC) has approved Texas educator standards that delineate what the beginning educator should know and be able to do. These standards, which are based on the state-required curriculum for students — the Texas Essential Knowledge and Skills (TEKS) — form the basis for the Texas Examinations of Educator Standards® (TExES®) program. This initiative, administered by Texas Education Agency (TEA), will affect all areas of Texas education — from the more than 170 approved Texas Educator Preparation Programs (EPPs) to the more than 7,000 Texas school campuses. This standards-based system reflects SBEC's commitment to help align Texas education from kindergarten through college. SBEC and TEA's roles in this K–16 initiative will ensure that newly certified Texas educators have the essential knowledge and skills to teach the TEKS to the state's public school students.

This manual is designed to help examinees prepare for the TExES test in this field. Its purpose is to familiarize examinees with the competencies to be tested, test question formats and pertinent study resources. EPP staff may also find this information useful as they help examinees prepare for careers as Texas educators.

KEY FEATURES OF THE MANUAL

- *List of competencies that will be tested*
- *Strategies for answering multiple-choice questions*
- *Sample test questions and answer key*

If you have any questions after reading this preparation manual or you would like additional information about the TExES tests or the educator standards, please visit the TEA website at **www.tea.state.tx.us**.

USING THE TEST FRAMEWORK

The Texas Examinations of Educator Standards (TExES) tests measure the content knowledge required of an entry-level educator in a particular field in Texas public schools. This manual is designed to guide your preparation by helping you become familiar with the material to be covered on the test you are planning to take, identify areas where you feel you may be weak and increase your knowledge in those areas by helping you design a study plan.

When preparing for this test, you should focus on the competencies and descriptive statements, which delineate the content that is eligible for testing. A portion of the content is represented in the sample questions that are included in this manual. These test questions represent only a sampling of questions. Thus, your test preparation should focus on the competencies and descriptive statements and not simply on the sample questions.

ORGANIZATION OF THE TExES TEST FRAMEWORK

The test framework is based on the educator standards for this field.

The content covered by this test is organized into broad areas of content called domains. Each domain covers one or more of the educator standards for this field. Within each domain, the content is further defined by a set of competencies. Each competency is composed of two major parts:

1. the **competency statement**, which broadly defines what an entry-level educator in this field in Texas public schools should know and be able to do, and
2. the **descriptive statements**, which describe in greater detail the knowledge and skills eligible for testing.

The educator standards being assessed within each domain are listed for reference at the beginning of the test framework, which begins on page 12. These are followed by a complete set of the framework's competencies and descriptive statements.

An example of a competency and its accompanying descriptive statements is provided below.

SAMPLE COMPETENCY

Life Science 8–12

COMPETENCY 001

THE TEACHER UNDERSTANDS HOW TO SELECT AND MANAGE LEARNING ACTIVITIES TO ENSURE THE SAFETY OF ALL STUDENTS AND THE CORRECT USE AND CARE OF ORGANISMS, NATURAL RESOURCES, MATERIALS, EQUIPMENT AND TECHNOLOGIES.

1

SAMPLE DESCRIPTIVE STATEMENTS

The beginning teacher:

A. Uses current sources of information about laboratory safety, including safety regulations and guidelines for the use of science facilities.

B. Recognizes potential safety hazards in the laboratory and in the field and knows how to apply procedures, including basic first aid, for responding to accidents.

C. Employs safe practices in planning, implementing and managing all instructional activities and designs, and implements rules and procedures to maintain a safe learning environment.

D. Understands procedures for selecting, maintaining and safely using chemicals, tools, technologies, materials, specimens and equipment, including procedures for the recycling, reuse and conservation of laboratory resources and for the safe handling and ethical treatment of organisms.

E. Knows how to use appropriate equipment and technology (e.g., Internet, spreadsheet, calculator) for gathering, organizing, displaying and communicating data in a variety of ways (e.g., charts, tables, graphs, diagrams, maps, satellite images, written reports, oral presentations).

F. Understands how to use a variety of tools, techniques and technology to gather, organize and analyze data, perform calculations and how to apply appropriate methods of statistical measures and analyses.

G. Knows how to apply techniques to calibrate measuring devices and understands concepts of precision, accuracy and error with regard to reading and recording numerical data from scientific instruments (e.g., significant figures).

H. Uses the International System of Units (i.e., metric system) and performs unit conversions within and across measurement systems.

STUDYING FOR THE TExES TEST

The following steps may be helpful in preparing for the TExES test.

1. Identify the information the test will cover by reading through the test competencies (see Chapter 3). Within each domain of this TExES test, each competency will receive approximately equal coverage.
2. Read each competency with its descriptive statements in order to get a more specific idea of the knowledge you will be required to demonstrate on the test. You may wish to use this review of the competencies to set priorities for your study time.
3. Review the "Preparation Resources" section of this manual (Appendix B) for possible resources to consult. Also, compile key materials from your preparation course work that are aligned with the competencies.
4. Study this manual for approaches to taking the TExES test.
5. When using resources, concentrate on the key skills and important abilities that are discussed in the competencies and descriptive statements.
6. Use the study plan sheet (Appendix A) to help you plan your study.

NOTE: This preparation manual is the only TExES test study material endorsed by Texas Education Agency (TEA) for this field. Other preparation materials may not accurately reflect the content of the test or the policies and procedures of the TExES program.

Chapter 2

Background Information on the TExES Testing Program

THE TExES TESTS FOR TEXAS TEACHERS

As required by the Texas Education Code §21.048, successful performance on educator certification examinations is required for the issuance of a Texas educator certificate. Each TExES test is a criterion-referenced examination designed to measure the knowledge and skills delineated in the corresponding TExES test framework. Each test framework is based on standards that were developed by Texas educators and other education stakeholders.

Each TExES test is designed to measure the requisite knowledge and skills that an entry-level educator in this field in Texas public schools must possess. The tests include both individual (stand-alone) test questions and questions that are arranged in clustered sets based on real-world situations faced by educators.

DEVELOPMENT OF THE NEW TExES TESTS

Committees of Texas educators and members of the community guide the development of the new TExES tests by participating in each stage of the test development process. These working committees are composed of Texas educators from public and charter schools, university and EPP faculty, education service center staff, representatives from professional educator organizations, content experts and members of the business community. The committees are balanced in terms of position, affiliation, years of experience, ethnicity, gender and geographical location. The committee membership is rotated during the development process so that numerous Texas stakeholders may be actively involved. The steps in the process to develop the TExES tests are described below.

1. **Develop Standards.** Committees are established to recommend what the beginning educator should know and be able to do. Using the Texas Essential Knowledge and Skills (TEKS) as the focal point, draft standards are prepared to define the knowledge and skills required of the beginning educator.

2. **Review Standards.** Committees review and revise the draft standards. The revised draft standards are then placed on the TEA website for public review and comment. These comments are used to prepare a final draft of the standards that will be presented to the SBEC Board for discussion, the State Board of Education (SBOE) for review and comment and the SBEC Board for approval. Standards not based specifically on the TEKS, such as those for librarians and counselors, are proposed as rule by the SBEC Board; sent to the SBOE for its 90-day review; and, if not rejected by the SBOE, adopted by the SBEC Board.

3. **Develop Test Frameworks.** Committees review and revise draft test frameworks that are based on the standards. These frameworks outline the specific competencies to be measured on the new TExES tests. Draft frameworks are not finalized until after the standards are approved and the job analysis/content validation survey (see #4) is complete.

4. **Conduct Job Analysis/Content Validation Surveys.** A representative sample of Texas educators who practice in or prepare individuals for each of the fields for which an educator certificate has been proposed are surveyed to determine the relative job importance of each competency outlined in the test framework for that content area. Frameworks are revised as needed following an analysis of the survey responses.

5. **Develop and Review New Test Questions.** The test contractor develops draft questions that are designed to measure the competencies described in the test framework. Committees review the newly developed test questions that have been written to reflect the competencies in the new test framework. Committee members scrutinize the draft questions for appropriateness of content and difficulty; clarity; match to the competencies; and potential ethnic, gender and regional bias.

6. **Conduct Pilot Test of New Test Questions.** All of the newly developed test questions that have been deemed acceptable by the question review committees are then administered to an appropriate sample of candidates for certification.

7. **Review Pilot Test Data.** Pilot test results are reviewed to ensure that the test questions are valid, reliable and free from bias.

8. **Administer TExES Tests.** New TExES tests are constructed to reflect the competencies, and the tests are administered to candidates for certification.

9. **Set Passing Standard.** A Standard Setting Committee convenes to review performance data from the initial administration of each new TExES test and to recommend a final passing standard for that test. The SBEC Board considers this recommendation as it establishes a passing score on the test.

TAKING THE TExES TEST AND RECEIVING SCORES

Please refer to the current TExES *Registration Bulletin* or the ETS TExES website at **www.texes.ets.org** for information on test dates, test centers, fees, registration procedures and program policies.

Your score report will be available to you in your testing account on the ETS TExES online registration system by 5 p.m. Central time on the score reporting date indicated in the *Registration Bulletin*. The report will indicate whether you have passed the test and will include:

- A total test scaled score. Scaled scores are reported to allow for the comparison of scores on the same content-area test taken on different test administration dates. The total scaled score is not the percentage of questions answered correctly and is not determined by averaging the number of questions answered correctly in each domain.
  - For all TExES tests, the score scale is 100–300 with a scaled score of 240 as the minimum passing score. This score represents the minimum level of competency required to be an entry-level educator in this field in Texas public schools.
- Your performance in the major content domains of the test and in the specific content competencies of the test.
  - This information may be useful in identifying strengths and weaknesses in your content preparation and can be used for further study or for preparing to retake the test. However, it is important to use caution when interpreting scores reported by domain and competency as these scores are typically based on a smaller number of items than the total score and therefore may not be as reliable as the total score.
- A link to information to help you understand the score scale and interpret your results.

A score report will not be available to you if you are absent or choose to cancel your score.

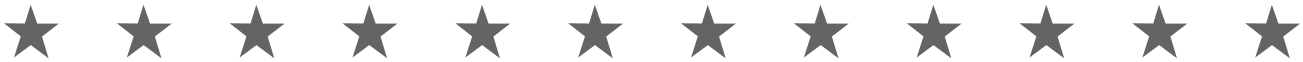
For more information about scores or to access scores online, go to **www.texes.ets.org**.

EDUCATOR STANDARDS

Complete, approved educator standards are posted on the TEA website at **www.tea.state.tx.us**.

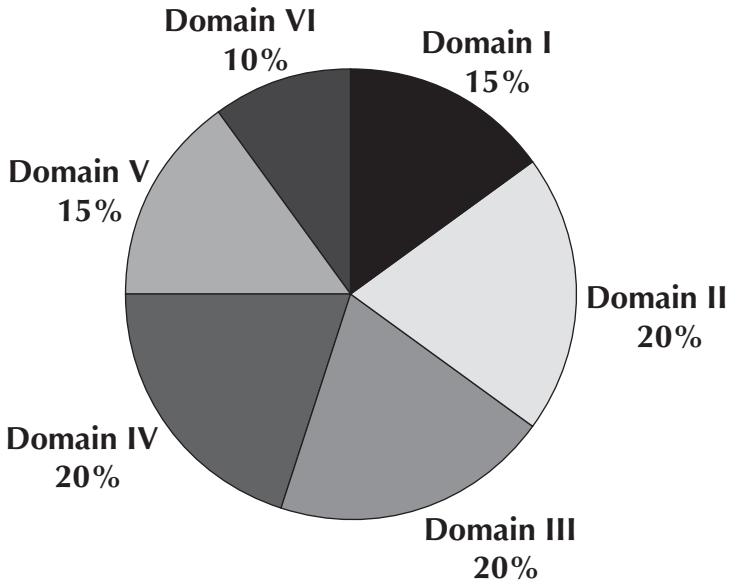
Chapter 3

Study Topics



TEST FRAMEWORK FOR FIELD 138: LIFE SCIENCE 8–12

THE DOMAINS



- **Domain I: Scientific Inquiry and Processes**
  Standards Assessed: Life Science I–III, VI–VII, XI
- **Domain II: Cell Structure and Processes**
  Standard Assessed: Life Science IX
- **Domain III: Heredity and Evolution of Life**
  Standard Assessed: Life Science IX
- **Domain IV: Diversity of Life**
  Standard Assessed: Life Science IX
- **Domain V: Interdependence of Life and Environmental Systems**
  Standard Assessed: Life Science IX
- **Domain VI: Science Learning, Instruction and Assessment**
  Standards Assessed: Life Science IV–V

TOTAL TEST BREAKDOWN

- Exam is offered as a paper-based or computer-administered test
- 90 Multiple-Choice Questions (80 Scored Questions*)

*The number of scored questions will not vary; however, the number of questions that are not scored may vary in the actual test. Your final scaled score will be based only on scored questions.

THE STANDARDS

DOMAIN I — SCIENTIFIC INQUIRY AND PROCESSES (approximately 15% of the test)

LIFE SCIENCE 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.

LIFE SCIENCE STANDARD II:
The science teacher understands the correct use of tools, materials, equipment and technologies.

LIFE SCIENCE STANDARD III:
The science teacher understands the process of scientific inquiry and its role in science instruction.

LIFE SCIENCE STANDARD VI:
The science teacher understands the history and nature of science.

LIFE 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.

LIFE SCIENCE STANDARD XI:
The science teacher knows unifying concepts and processes that are common to all sciences.

DOMAIN II — CELL STRUCTURE AND PROCESSES (approximately 20% of the test)

LIFE SCIENCE 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.

DOMAIN III — HEREDITY AND EVOLUTION OF LIFE (approximately 20% of the test)

LIFE SCIENCE 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.

DOMAIN IV — DIVERSITY OF LIFE (approximately 20% of the test)

LIFE SCIENCE 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.

DOMAIN V — INTERDEPENDENCE OF LIFE AND ENVIRONMENTAL SYSTEMS (approximately 15% of the test)

LIFE SCIENCE 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.

DOMAIN VI — SCIENCE LEARNING, INSTRUCTION AND ASSESSMENT (approximately 10% of the test)

LIFE SCIENCE STANDARD IV:
The science teacher has theoretical and practical knowledge about teaching science and about how students learn science.

LIFE SCIENCE STANDARD V:
The science teacher knows the varied and appropriate assessments and assessment practices to monitor science learning.

COMPETENCIES

DOMAIN I — SCIENTIFIC INQUIRY AND PROCESSES

COMPETENCY 001
THE TEACHER UNDERSTANDS HOW TO SELECT AND MANAGE LEARNING ACTIVITIES TO ENSURE THE SAFETY OF ALL STUDENTS AND THE CORRECT USE AND CARE OF ORGANISMS, NATURAL RESOURCES, MATERIALS, EQUIPMENT AND TECHNOLOGIES.

The beginning teacher:

A. Uses current sources of information about laboratory safety, including safety regulations and guidelines for the use of science facilities.

B. Recognizes potential safety hazards in the laboratory and in the field and knows how to apply procedures, including basic first aid, for responding to accidents.

C. Employs safe practices in planning, implementing and managing all instructional activities and designs, and implements rules and procedures to maintain a safe learning environment.

D. Understands procedures for selecting, maintaining and safely using chemicals, tools, technologies, materials, specimens and equipment, including procedures for the recycling, reuse and conservation of laboratory resources and for the safe handling and ethical treatment of organisms.

E. Knows how to use appropriate equipment and technology (e.g., Internet, spreadsheet, calculator) for gathering, organizing, displaying and communicating data in a variety of ways (e.g., charts, tables, graphs, diagrams, maps, satellite images, written reports, oral presentations).

F. Understands how to use a variety of tools, techniques and technology to gather, organize and analyze data, perform calculations and how to apply appropriate methods of statistical measures and analyses.

G. Knows how to apply techniques to calibrate measuring devices and understands concepts of precision, accuracy and error with regard to reading and recording numerical data from scientific instruments (e.g., significant figures).

H. Uses the International System of Units (i.e., metric system) and performs unit conversions within and across measurement systems.

COMPETENCY 002

THE TEACHER UNDERSTANDS THE NATURE OF SCIENCE, THE PROCESS OF SCIENTIFIC INQUIRY AND THE UNIFYING CONCEPTS THAT ARE COMMON TO ALL SCIENCES.

The beginning teacher:

A. Understands the nature of science, the relationship between science and technology, the predictive power of science and limitations to the scope of science (i.e., the types of questions that science can and cannot answer).

B. Knows the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis) and how and why scientists use different types of scientific investigations.

C. Understands principles and procedures for designing and conducting a variety of scientific investigations, with emphasis on inquiry-based investigations, and how to communicate and defend scientific results.

D. Understands how logical reasoning, verifiable observational and experimental evidence and peer review are used in the process of generating and evaluating scientific knowledge.

E. Understands how to identify potential sources of error in an investigation, evaluate the validity of scientific data and develop and analyze different explanations for a given scientific result.

F. Knows the characteristics and general features of systems; how properties and patterns of systems can be described in terms of space, time, energy and matter; and how system components and different systems interact.

G. Knows how to apply and analyze the systems model (e.g., interacting parts, boundaries, input, output, feedback, subsystems) across the science disciplines.

H. Understands how shared themes and concepts (e.g., systems, order and organization; evidence, models and explanation; change, constancy and measurements; evolution and equilibrium; and form and function) provide a unifying framework in science.

I. Understands the difference between a theory and a hypothesis, 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).

COMPETENCY 003

THE TEACHER UNDERSTANDS THE HISTORY OF SCIENCE, HOW SCIENCE IMPACTS THE DAILY LIVES OF STUDENTS AND HOW SCIENCE INTERACTS WITH AND INFLUENCES PERSONAL AND SOCIETAL DECISIONS.

The beginning teacher:

A. Understands the historical development of science, key events in the history of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge.

B. Knows how to 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).

C. Knows that science is a human endeavor influenced by societal, cultural and personal views of the world, and that decisions about the use and direction of science are based on factors such as ethical standards, economics and personal and societal biases and needs.

D. Understands the application of scientific ethics to the conducting, analyzing and publishing of scientific investigations.

E. Applies scientific principles to analyze factors (e.g., diet, exercise, personal behavior) that influence personal and societal choices concerning fitness and health (e.g., physiological and psychological effects and risks associated with the use of substances and substance abuse).

F. Applies scientific principles, the theory of probability and risk/benefit analysis to analyze the advantages of, disadvantages of or alternatives to a given decision or course of action.

G. Understands the role science can play in helping resolve personal, societal and global issues (e.g., recycling, population growth, disease prevention, resource use, evaluating product claims).

DOMAIN II — CELL STRUCTURE AND PROCESSES

COMPETENCY 004

THE TEACHER UNDERSTANDS THE STRUCTURE AND FUNCTION OF BIOMOLECULES.

The beginning teacher:

A. Identifies the chemical elements necessary for life and understands how these elements combine to form biologically important compounds.

B. Relates the physical and chemical properties of water and carbon to the significance of these properties in basic life processes.

C. Analyzes how a molecule's biological function is related to its shape (e.g., enzymes, tRNA, DNA, receptors, neurotransmitters, lipids).

D. Understands the importance of chemical reactions in the synthesis and degradation of biomolecules.

E. Identifies and compares the structures and functions of different types of biomolecules, including carbohydrates, lipids, proteins and nucleic acids.

F. Explains how enzymes function in synthesis and degradation of biomolecules (e.g., DNA, food).

COMPETENCY 005

THE TEACHER UNDERSTANDS THAT CELLS ARE THE BASIC STRUCTURES OF LIVING THINGS AND HAVE SPECIALIZED PARTS THAT PERFORM SPECIFIC FUNCTIONS.

The beginning teacher:

A. Differentiates among viruses, prokaryotic cells and eukaryotic cells (e.g., structure and function).

B. Describes the basic components of prokaryotic and eukaryotic cells (e.g., cell membrane, cell wall, ribosomes, nucleus, mitochondrion, chloroplast), the functions and the interrelationships of these components.

C. Identifies differences in cell structure and function in different types of organisms (e.g., differences in plant and animal cells).

D. Analyzes specialization of structure and function in different types of cells in living organisms (e.g., skin, nerve and muscle cells in animals; root, stem and leaf cells in plants).

COMPETENCY 006

THE TEACHER UNDERSTANDS HOW CELLS CARRY OUT LIFE PROCESSES.

The beginning teacher:

A. Analyzes how cells maintain homeostasis (e.g., the effects of concentration gradients, rate of movement and surface area/volume ratio).

B. Understands processes by which cells transport water, nutrients and wastes across cell membranes (e.g., osmosis, diffusion, transport systems).

C. Analyzes energy flow in the processes of photosynthesis and cellular respiration.

D. Compares and contrasts anaerobic and aerobic respiration and their products.

COMPETENCY 007

THE TEACHER UNDERSTANDS HOW SPECIALIZED CELLS, TISSUES, ORGANS, ORGAN SYSTEMS AND ORGANISMS GROW AND DEVELOP.

The beginning teacher:

A. Understands factors (e.g., hormones, cell size) that regulate the cell cycle and the effects of unregulated cell growth (e.g., cancer).

B. Analyzes the role of cell differentiation in the development of tissues, organs, organ systems and living organisms.

C. Analyzes factors (e.g., genetics, disease, nutrition, exposure to toxic chemicals) affecting cell differentiation and the growth and development of organisms.

D. Identifies the different levels of organization in multicellular organisms and relates the parts to each other and to the whole.

DOMAIN III — HEREDITY AND EVOLUTION OF LIFE

COMPETENCY 008

THE TEACHER UNDERSTANDS THE STRUCTURES AND FUNCTIONS OF NUCLEIC ACIDS IN THE MECHANISMS OF GENETICS.

The beginning teacher:

A. Relates the structure of DNA (e.g., bases, sugars, phosphates) to the nature, function and relationships of genes, chromatin and chromosomes.

B. Relates the structures of DNA and RNA to the processes of replication, transcription, translation and genetic regulation.

C. Compares and contrasts the organization and control of the genome in viruses, prokaryotic cells and eukaryotic cells.

D. Understands the types, biological significance and causes of mutations.

E. Identifies methods and applications of genetic identification and manipulation (e.g., production of recombinant DNA, cloning, PCR).

F. Analyzes human karyotypes in order to identify chromosomal disorders and sex.

COMPETENCY 009

THE TEACHER UNDERSTANDS THE CONTINUITY AND VARIATIONS OF TRAITS FROM ONE GENERATION TO THE NEXT.

The beginning teacher:

A. Applies the laws of probability to determine genotypic and phenotypic frequencies in Mendelian inheritance (e.g., using Punnett squares, pedigree charts).

B. Compares the processes of meiosis and mitosis (in plants and animals) and describes their roles in sexual and asexual reproduction.

C. Recognizes factors influencing the transmission of genes from one generation to the next (e.g., linkage, position of genes on a chromosome, crossing over, independent assortment).

D. Understands how the genotype of an organism influences the expression of traits in its phenotype (e.g., dominant and recessive traits; monogenic, polygenic and polytypic inheritance; genetic disorders).

E. Analyzes the effects of environmental factors (e.g., light, nutrition, moisture, temperature) on the expression of traits in the phenotype of an organism.

COMPETENCY 010

THE TEACHER UNDERSTANDS THE THEORY OF BIOLOGICAL EVOLUTION.

The beginning teacher:

A. Understands stability and change in populations (e.g., Hardy-Weinberg equilibrium) and analyzes factors leading to genetic variation and evolution in populations (e.g., mutation, gene flow, genetic drift, recombination, nonrandom mating, natural selection).

B. Analyzes the effects of natural selection on adaptations and diversity in populations and species.

C. Understands the role of intraspecific and interspecific competition in evolutionary change.

D. Compares and contrasts the different effects of selection (e.g., directional, stabilizing, diversifying) on a variable characteristic.

E. Analyzes processes that contribute to speciation (e.g., natural selection, founder effect, reproductive isolation).

F. Analyzes the development of isolating mechanisms that discourage hybridization between species (e.g., species' recognition marks, behavioral displays, ecological separation, seasonal breeding).

COMPETENCY 011

THE TEACHER UNDERSTANDS EVIDENCE FOR EVOLUTIONARY CHANGE DURING EARTH'S HISTORY.

The beginning teacher:

A. Analyzes how fossils, DNA sequences, anatomical similarities, physiological similarities and embryology provide evidence of both common origin and change in populations and species.

B. Understands the relationship between environmental change, mutations and adaptations of an organism over many generations.

C. Identifies major developments in the evolutionary history of life (e.g., formation of organic molecules, self-replication, backbones, vascular tissue, colonization of the land).

D. Understands theories regarding the causes of extinction of species and the pace and mode of evolutionary change (e.g., punctuated equilibrium, mass extinctions, adaptive radiation).

DOMAIN IV — DIVERSITY OF LIFE

COMPETENCY 012

THE TEACHER UNDERSTANDS SIMILARITIES AND DIFFERENCES BETWEEN LIVING ORGANISMS AND HOW TAXONOMIC SYSTEMS ARE USED TO ORGANIZE AND INTERPRET THE DIVERSITY OF LIFE.

The beginning teacher:

A. Compares and contrasts structural and physiological adaptations of plants and animals living in various aquatic and terrestrial environments (e.g., freshwater and marine; forest and plain; desert and tundra).

B. Understands the relationship between environmental changes in aquatic and terrestrial ecosystems and adaptive changes in organisms inhabiting these ecosystems.

C. Explains the uses and limitations of classification schemes.

D. Relates taxonomic classification to evolutionary history and knows how to distinguish between traits that are taxonomically useful (e.g., homologous traits) and those that are not (e.g., convergent traits).

E. Analyzes relationships among organisms to develop a model of a hierarchical classification system and knows how to classify aquatic and terrestrial organisms at several taxonomic levels (e.g., species, phylum/division, kingdom) using dichotomous keys.

F. Identifies distinguishing characteristics of domains and kingdoms, including eubacteria, archaebacteria, protists, fungi, plants and animals.

COMPETENCY 013

THE TEACHER UNDERSTANDS THAT, AT ALL LEVELS OF NATURE, LIVING SYSTEMS ARE FOUND WITHIN OTHER LIVING SYSTEMS, EACH WITH ITS OWN BOUNDARIES AND LIMITS.

The beginning teacher:

A. Identifies the basic requirements (e.g., nutrients, oxygen, water, carbon dioxide) necessary for various organisms to carry out life functions.

B. Compares how various organisms obtain, transform, transport, release, eliminate and store energy and matter.

C. Analyzes characteristics, functions and relationships of systems in animals including humans (e.g., digestive, circulatory, nervous, endocrine, reproductive, integumentary, skeletal, respiratory, muscular, excretory, immune systems).

D. Analyzes characteristics, functions and relationships of systems in plants (e.g., transport, control, reproductive, nutritional, structural systems).

E. Identifies methods of reproduction, growth and development of various plants and animals.

COMPETENCY 014

THE TEACHER UNDERSTANDS THE PROCESSES BY WHICH ORGANISMS MAINTAIN HOMEOSTASIS.

The beginning teacher:

A. Explains the importance of maintaining a stable internal environment.

B. Describes the relationships among internal feedback mechanisms in maintaining homeostasis.

C. Identifies anatomical structures and physiological processes in a variety of organisms that function to maintain homeostasis in the face of changing environmental conditions.

D. Analyzes the importance of nutrition, environmental conditions and physical exercise on health in humans and other organisms.

E. Analyzes the role of viruses and microorganisms in maintaining or disrupting homeostasis in different organisms (e.g., the role of bacteria in digestion, diseases of plants and animals).

COMPETENCY 015

THE TEACHER UNDERSTANDS THE RELATIONSHIP BETWEEN BIOLOGY AND BEHAVIOR.

The beginning teacher:

A. Understands how the behavior of organisms, including humans, responds to internal and external stimuli.

B. Recognizes that behavior in many animals is determined by a combination of genetic and learned factors.

C. Identifies adaptive advantages of innate and learned patterns of behavior.

D. Explains mediating factors in innate (e.g., imprinting, hormonal system) and learned (e.g., classical conditioning, play) behavior.

E. Understands concepts linking behavior and natural selection (e.g., kin selection, courtship behavior, altruism).

DOMAIN V — INTERDEPENDENCE OF LIFE AND ENVIRONMENTAL SYSTEMS

COMPETENCY 016

THE TEACHER UNDERSTANDS THE RELATIONSHIPS BETWEEN ABIOTIC AND BIOTIC FACTORS OF TERRESTRIAL AND AQUATIC ECOSYSTEMS, HABITATS AND BIOMES, INCLUDING THE FLOW OF MATTER AND ENERGY.

The beginning teacher:

A. Analyzes types, sources and flow of energy through different trophic levels (e.g., producers, consumers, decomposers) and between organisms and the physical environment in aquatic and terrestrial ecosystems.

B. Analyzes the flow of energy and the cycling of matter through biogeochemical cycles (e.g., carbon, water, oxygen, nitrogen, phosphorus) in aquatic and terrestrial ecosystems.

C. Understands the concept of limiting factors (e.g., light intensity, temperature, mineral availability) and the effects that they have on the productivity and complexity of different ecosystems (e.g., tropical forest vs. taiga, continental shelf vs. deep ocean).

D. Explains the relationship among abiotic characteristics of different biomes and the adaptations, variations, tolerances and roles of indigenous plants and animals in these biomes.

COMPETENCY 017

THE TEACHER UNDERSTANDS THE INTERDEPENDENCE AND INTERACTIONS OF LIVING THINGS IN TERRESTRIAL AND AQUATIC ECOSYSTEMS.

The beginning teacher:

A. Understands the concepts of ecosystem, biome, community, habitat and niche.

B. Analyzes interactions of organisms, including humans, in the production and consumption of energy (e.g., food chains, food webs, food pyramids) in aquatic and terrestrial ecosystems.

C. Understands interspecific interactions in aquatic and terrestrial ecosystems (e.g., predator-prey relationships, competition, parasitism, commensalism, mutualism) and how they affect ecosystem structure.

D. Identifies indigenous plants and animals, assesses their roles in an ecosystem and describes their relationships in different types of environments (e.g., fresh water, continental shelf, deep ocean, forest, desert, plains, tundra).

E. Analyzes how the introduction, removal or reintroduction of an organism may alter the food chain, affect existing populations and influence natural selection in terrestrial and aquatic ecosystems.

F. Evaluates the importance of biodiversity in an ecosystem and identifies changes that may occur if biodiversity is increased or reduced in an ecosystem.

G. Understands types and processes of ecosystem change over time in terrestrial and aquatic ecosystems (e.g., equilibrium, cyclical change, succession) and the effects of human activity on ecosystem change.

H. Explains the significance of plants in different types of terrestrial and aquatic ecosystems.

COMPETENCY 018

THE TEACHER UNDERSTANDS THE RELATIONSHIP BETWEEN CARRYING CAPACITY AND CHANGES IN POPULATIONS AND ECOSYSTEMS.

The beginning teacher:

A. Identifies basic characteristics of populations in an ecosystem (e.g., age pyramid, density, patterns of distribution).

B. Compares concepts of population dynamics, including exponential growth, logistic (i.e., limited) growth and cycling (e.g., boom-and-bust cycles).

C. Relates carrying capacity to population dynamics, including human population growth.

D. Analyzes the impact of density-dependent and density-independent factors (e.g., geographic locales, natural events, diseases, birth and death rates) on populations.

E. Compares *r*- and *K*-selected reproductive strategies (e.g., survivorship curves).

DOMAIN VI — SCIENCE LEARNING, INSTRUCTION AND ASSESSMENT

COMPETENCY 019

THE TEACHER UNDERSTANDS RESEARCH-BASED THEORETICAL AND PRACTICAL KNOWLEDGE ABOUT TEACHING SCIENCE, HOW STUDENTS LEARN SCIENCE AND THE ROLE OF SCIENTIFIC INQUIRY IN SCIENCE INSTRUCTION.

The beginning teacher:

A. Knows research-based theories about how students develop scientific understanding and how developmental characteristics, prior knowledge, experience and attitudes of students influence science learning.

B. Understands the importance of respecting student diversity by planning activities that are inclusive and selecting and adapting science curricula, content, instructional materials and activities to meet the interests, knowledge, understanding, abilities, possible career paths and experiences of all students, including English-language learners.

C. Knows how to plan and implement strategies to encourage student self-motivation and engagement in their own learning (e.g., linking inquiry-based investigations to students' prior knowledge, focusing inquiry-based instruction on issues relevant to students, developing instructional materials using situations from students' daily lives, fostering collaboration among students).

D. Knows how to use a variety of instructional strategies to ensure all students comprehend content-related texts, including how to locate, retrieve and retain information from a range of texts and technologies.

E. Understands the science teacher's role in developing the total school program by planning and implementing science instruction that incorporates schoolwide objectives and the statewide curriculum as defined in the Texas Essential Knowledge and Skills (TEKS).

F. Knows how to design and manage the learning environment (e.g., individual, small-group, whole-class settings) to focus and support student inquiries and to provide the time, space and resources for all students to participate in field, laboratory, experimental and nonexperimental scientific investigation.

G. Understands the rationale for using active learning and inquiry methods in science instruction and how to model scientific attitudes such as curiosity, openness to new ideas and skepticism.

H. Knows principles and procedures for designing and conducting an inquiry-based scientific investigation (e.g., making observations; generating questions; researching and reviewing current knowledge in light of existing evidence; choosing tools to gather and analyze evidence; proposing answers, explanations and predictions; and communicating and defending results).

I. Knows how to assist students with generating, refining, focusing and testing scientific questions and hypotheses.

J. Knows strategies for assisting students in learning to identify, refine and focus scientific ideas and questions guiding an inquiry-based scientific investigation; to develop, analyze and evaluate different explanations for a given scientific result; and to identify potential sources of error in an inquiry-based scientific investigation.

K. Understands how to implement inquiry strategies designed to promote the use of higher-level thinking skills, logical reasoning and scientific problem solving in order to move students from concrete to more abstract understanding.

L. Knows how to guide students in making systematic observations and measurements.

M. Knows how to sequence learning activities in a way that uncovers common misconceptions, allows students to build upon their prior knowledge and challenges them to expand their understanding of science.

COMPETENCY 020

THE TEACHER KNOWS HOW TO MONITOR AND ASSESS SCIENCE LEARNING IN LABORATORY, FIELD AND CLASSROOM SETTINGS.

The beginning teacher:

A. Knows how to use formal and informal assessments of student performance and products (e.g., projects, laboratory and field journals, rubrics, portfolios, student profiles, checklists) to evaluate student participation in and understanding of inquiry-based scientific investigations.

B. Understands the relationship between assessment and instruction in the science curriculum (e.g., designing assessments to match learning objectives, using assessment results to inform instructional practice).

C. Knows the importance of monitoring and assessing students' understanding of science concepts and skills on an ongoing basis by using a variety of appropriate assessment methods (e.g., performance assessment, self-assessment, peer assessment, formal/informal assessment).

D. Understands the purposes, characteristics and uses of various types of assessment in science, including formative and summative assessments, and the importance of limiting the use of an assessment to its intended purpose.

E. Understands strategies for assessing students' prior knowledge and misconceptions about science and how to use these assessments to develop effective ways to address these misconceptions.

F. Understands characteristics of assessments, such as reliability, validity and the absence of bias in order to evaluate assessment instruments and their results.

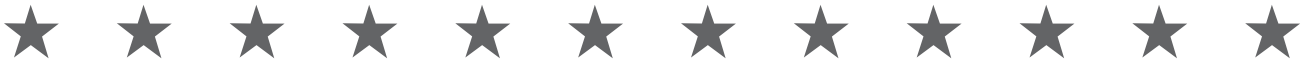
G. Understands the role of assessment as a learning experience for students and strategies for engaging students in meaningful self-assessment.

H. Recognizes the importance of selecting assessment instruments and methods that provide all students with adequate opportunities to demonstrate their achievements.

I. Recognizes the importance of clarifying teacher expectations by sharing evaluation criteria and assessment results with students.

Chapter 4

Succeeding on Multiple-Choice Questions



APPROACHES TO ANSWERING MULTIPLE-CHOICE QUESTIONS

The purpose of this section is to describe multiple-choice question formats that you will see on the Life Science 8–12 test and to suggest possible ways to approach thinking about and answering the multiple-choice questions. However, these approaches are not intended to replace familiar test-taking strategies with which you are already comfortable and that work for you.

The Life Science 8–12 test is designed to include a total of 90 multiple-choice questions, out of which 80 are scored. The number of scored questions will not vary; however, the number of questions that are not scored may vary in the actual test. Your final scaled score will be based only on scored questions. The questions that are not scored are being pilot tested in order to collect information about how these questions will perform under actual testing conditions. These questions are not identified on the test.

All multiple-choice questions on this test are designed to assess your knowledge of the content described in the test framework. In most cases, you are expected to demonstrate more than just your ability to recall factual information. You may be asked to think critically about the information, to analyze it, consider it carefully, compare it to other knowledge you have or make a judgment about it.

When you are ready to respond to a multiple-choice question, you must choose one of four answer options labeled A, B, C and D. Leave no questions unanswered. Nothing is subtracted from your score if you answer a question incorrectly. Questions for which you mark no answer or more than one answer are counted as incorrect. Your score will be determined by the number of questions for which you select the best answer.

QUESTION FORMATS

You may see the following types of multiple-choice questions on the test.

— Single Questions
— Questions with Stimulus Materials
— Clustered Questions

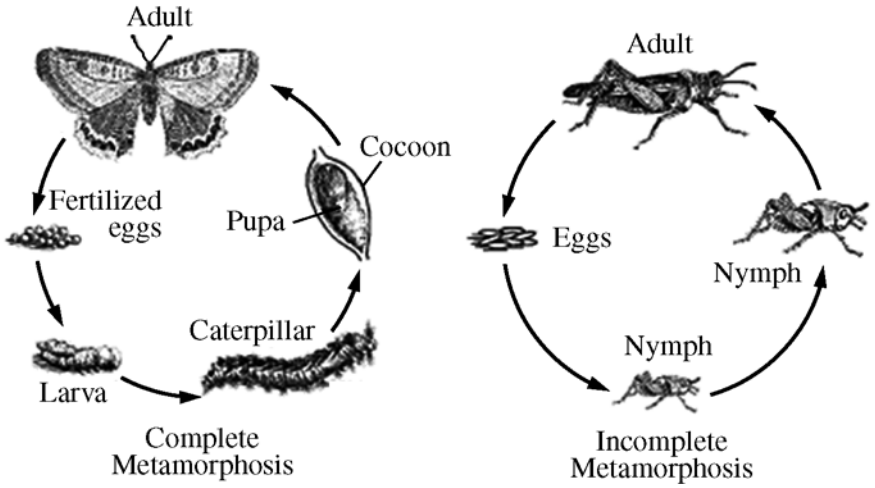
On the following pages, you will find descriptions of these commonly used question formats, along with suggested approaches for responding to each type of question. In the actual testing situation, if you are taking the paper-based version of the test, you may mark the test questions and/or write in the margins of your test booklet. **Your final response must be indicated on the answer sheet provided.** If you are taking the test via computer, you may write on the scratch paper provided at the testing center. **Your final response must be selected on the computer.**

SINGLE QUESTIONS

In the single-question format, a problem is presented as a direct question or an incomplete statement, and four answer options appear below the question. The following question tests knowledge of Life Science 8–12 Competency 013: *The teacher understands that, at all levels of nature, living systems are found within other living systems, each with its own boundaries and limits.*

EXAMPLE

Use the illustrations below to answer the question that follows.



Compared to incomplete metamorphosis, complete metamorphosis in an insect species most likely contributes to the survival and reproductive success of the species in which of the following ways?

A. In species with complete metamorphosis, immature members of the species can avoid predators more easily

B. In species with complete metamorphosis, growth and development occurs more rapidly and the individual reaches sexual maturity at an earlier age

C. In species with complete metamorphosis, immature members of the species can disperse over a wider area after hatching

D. In species with complete metamorphosis, immature and adult life stages can utilize different parts of the larger environment

SUGGESTED APPROACH

Read the question carefully and critically. Think about what it is asking and the situation it is describing. Eliminate any obviously wrong answers, select the correct answer choice and mark your answer.

For example, the diagram given with this question illustrates differences between the life cycles of insect species that undergo complete metamorphosis as they grow and those species in which metamorphosis is incomplete. It is clear from the diagram that a major difference between the two types of life cycles is the degree to which immature members of the species resemble adults. In species with complete metamorphosis, immature individuals are very different in appearance from adults. In contrast, in species with incomplete metamorphosis, immature individuals and adults differ in size but are very similar in appearance. Now look at the response options and consider how this difference between the life cycles relates to each of the responses. **The correct response is option D.**

Option A suggests that in species with complete metamorphosis, immature individuals can avoid predators more easily. In fact, the opposite is more likely to be true, since the nymphs in species with incomplete metamorphosis are likely to be much more mobile than the larvae, caterpillars and pupae in species with complete metamorphosis.

Option B suggests that in species with complete metamorphosis, immature individuals grow and develop more rapidly. In fact, the rate of growth in an insect species is not determined by the type of metamorphosis, but by the adaptive strategy of the individual species. Some species with incomplete metamorphosis grow rapidly and reach maturity quickly, while others grow much more slowly. Some species with complete metamorphosis can grow and reach maturity in a single season, while others winter over as cocoons.

Option C suggests that in species with complete metamorphosis, immature individuals can disperse over a wider area after hatching. In fact, the mobile nymphs in species with incomplete metamorphosis are more able to disperse than the larvae, caterpillars and pupae of species with complete metamorphosis.

Option D, which is the correct response, suggests that in species with complete metamorphosis, immature and adult individuals can utilize different parts of the environment. Since immature individuals and adults in species with complete metamorphosis differ strongly in morphology, they can exploit different ecological niches. For example, caterpillars eat leaves and other vegetation, while butterflies primarily eat nectar. In species with incomplete metamorphosis, immature individuals resemble adults and are more likely to exploit similar ecological niches.

QUESTIONS WITH STIMULUS MATERIAL

Some questions on this test are preceded by stimulus material that relates to the question. Some types of stimulus material included on the test are reading passages, descriptions of experiments, graphics, tables or a combination of these. In such cases, you will generally be given information followed by questions that ask you to analyze the material, solve a problem or make a decision.

You can use several different approaches to respond to these types of questions. Some commonly used strategies are listed below.

Strategy 1 Skim the stimulus material to understand its purpose, its arrangement and/or its content. Then read the question and refer again to the stimulus material to verify the correct answer.

Strategy 2 Read the question *before* considering the stimulus material. The theory behind this strategy is that the content of the question will help you identify the purpose of the stimulus material and locate the information you need to answer the question.

Strategy 3 Use a combination of both strategies. Apply the "read the stimulus first" strategy with shorter, more familiar stimuli and the "read the question first" strategy with longer, more complex or less familiar stimuli. You can experiment with the sample questions in this manual and then use the strategy with which you are most comfortable when you take the actual test.

Whether you read the stimulus before or after you read the question, you should read it carefully and critically. If you are taking the paper-based version of the test, you may want to underline its important parts to help you answer the question.

As you consider questions set in educational contexts, try to enter into the identified teacher's frame of mind and use that teacher's point of view to answer the questions that accompany the stimulus. Be sure to consider the questions in terms of only the information provided in the stimulus — not in terms of your own class experiences or individual students you may have known.

EXAMPLE

First read the stimulus (a description of a classroom activity, building a compost heap).

> **Read the description below of a classroom activity; then answer the two questions that follow.**
>
> As part of a unit on recycling, a high school science class builds a compost heap with lawn clippings, garden residue and litter from the cages of guinea pigs and other class pets. After several weeks of turning the heap and keeping it moist, the class produces a quantity of finished compost.

Now you are prepared to address the first of the two questions associated with this stimulus. The first question measures Life Science 8–12 Competency 016: *The teacher understands the relationships between abiotic and biotic factors of terrestrial and aquatic ecosystems, habitats and biomes, including the flow of matter and energy.*

1. Some of the students wonder why the volume of the finished compost is considerably smaller than that of the plant residues and animal wastes used to form the original heap. Which of the following is the best explanation for this result?

   A. Bacterial digestion shreds the coarse material in the heap into finer particles that can be more closely packed

   B. Bacterial respiration converts some of the carbon in the heap to carbon dioxide that is released into the atmosphere

   C. Heat produced by spontaneous combustion in the heap converts much of the original mass into energy

   D. Bacterial digestion converts the large molecules of cellulose and other carbon compounds in the heap to smaller and simpler carbon compounds

SUGGESTED APPROACH

Consider carefully the information presented in the stimulus about how the students build and maintain the compost heap. Then read and consider this first question, which asks why the volume of the finished compost is smaller than that of the material used to form the original heap. Consider which of the response options correctly explains the reduction in the size of the heap as composting proceeds. **The correct response is option B.**

Option A suggests that bacteria shred the materials into finer particles during the composting process. However, bacteria process their food chemically rather than physically and have no mechanisms that allow physical shredding of materials.

Option B, which is the correct response, suggests that the heap decreases in size as bacterial respiration converts some of the carbon in the heap to carbon dioxide gas. According to the stimulus, the students turn the heap, which would keep it aerated. Aerobic decomposition involves respiration, and carbon dioxide is a byproduct of this process. During the decomposition of the compost heap, the solid form of carbon that is bound in tissues of plants and animals is converted to carbon dioxide and lost from the heap to the atmosphere.

Option C suggests that heat produced by spontaneous combustion in the heap converts mass into energy. The conversion of mass into energy is characteristic of nuclear reactions, which are not occurring in the compost heap.

Option D suggests that bacteria convert the large molecules of cellulose and other compounds into smaller and simpler carbon compounds. While this statement is true, this process would not lead to a reduction in the quantity of matter during decomposition. Furthermore, the size of a piece of matter is not necessarily related to the size of its constituent molecules. Conversion of cellulose to simpler compounds does not imply that individual pieces of matter in the heap are reduced in size, allowing them to pack more closely and reduce the volume of the heap.

Now you are ready to answer the next question. The second question measures Life Science 8–12 Competency 019: *The teacher understands research-based theoretical and practical knowledge about teaching science, how students learn science and the role of scientific inquiry in science instruction.*

2. The classroom activity described previously would most likely help students satisfy which of the following student expectations from the Texas Essential Knowledge and Skills (TEKS) statements?

   A. The student knows that relationships exist between properties of matter and its components

   B. The student uses scientific methods during field and laboratory investigations

   C. The student knows that interdependence and interactions occur within an ecosystem

   D. The student knows the significance of plants in the environment

SUGGESTED APPROACH

Again, consider carefully the information presented in the stimulus, especially with regard to identifying instructional goals of the composting activity. Then read and consider this second question, which asks which student expectation from the Texas Essential Knowledge and Skills (TEKS) statements would most likely be satisfied by this activity. **The correct response is option C.**

Option A suggests that the activity would help the student know that relationships exist between properties of matter and its components. However, the activity does not involve learning about either the properties of matter or the components of matter.

Option B suggests that the activity teaches students how to use scientific methods during field and laboratory investigations. However, the activity, as it is stated, does not involve application of any scientific methodology involving the development and testing of a hypothesis.

Option C suggests that the activity helps students know that interdependence and interactions occur within an ecosystem. Option C is the correct answer because the composting activity illustrates the role of decomposers in recycling nutrients through an ecosystem so that they can be used by other organisms.

Option D suggests that the activity helps students know the significance of plants in the environment. However, this activity does not involve analysis of plants or their role in the environment.

CLUSTERED QUESTIONS

You may have one or more questions related to a single stimulus. When you have at least two questions related to a single stimulus, the group of questions is called a cluster.

Chapter 5

Multiple-Choice Practice Questions

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SAMPLE MULTIPLE-CHOICE QUESTIONS

This section presents some sample test questions for you to review as part of your preparation for the test. To demonstrate how each competency may be assessed, each sample question is accompanied by the competency that it measures. While studying, you may wish to read the competency before and after you consider each sample question. Please note that the competency statements will not appear on the actual test.

An answer key follows the sample questions. The answer key lists the question number and correct answer for each sample test question. Please note that the answer key also lists the competency assessed by each question and that the sample questions are not necessarily presented in competency order.

The sample questions are included to illustrate the formats and types of questions you will see on the test; however, your performance on the sample questions should not be viewed as a predictor of your performance on the actual test.

COMPETENCY 001

1. Students in a science class measure the heights of plant specimens and record their measurements to the nearest centimeter. The students then use calculators to determine the average height of the plants. The teacher notices that many students write down averages that extend to tenths or hundredths of centimeters and asks them to round the averages only to the nearest centimeter. Which of the following statements is the best explanation of why students should round their averages to the nearest centimeter?

   A. The amount of variation due to any inaccuracies in taking the measurements must be less than the actual differences in plant height

   B. Comparison of student results would be facilitated if all students calculate averages to the same number of places

   C. Extra digits are likely to make further calculations using the students' averages more difficult and time consuming

   D. Calculations based on the measurements of plant height can be only as precise as the original measurements

COMPETENCY 001

2. As part of a project on the effects of pollution on ecosystems, students in a science class measure air, soil and water quality in the area surrounding the school. They also make daily counts of various animal and plant species in the area. Which of the following types of computer software would be most useful for storing and analyzing the students' data?

   A. Web development software

   B. Spreadsheet software

   C. Interactive multimedia software

   D. Word processing software

COMPETENCY 002

3. A researcher has documented a decline in the population of wood frogs in an area in which bullfrogs have been introduced. According to the researcher's data, the wood frog population began to decline soon after the introduction of the bullfrogs, and the decline has accelerated since the bullfrog population began growing more rapidly. The researcher notes that bullfrogs are much larger and more aggressive than wood frogs and concludes that the wood frogs are being driven from their breeding areas. This conclusion is questionable because the researcher

   A. has not shown a correlation between the size of bullfrogs and the size of wood frogs.

   B. has not shown a causal relationship between the establishment of the bullfrog population and the decline of the wood frog population.

   C. has not suggested a mechanism for the proposed effect of the bullfrog population on the wood frog population.

   D. has not developed a hypothesis that can be experimentally tested.

COMPETENCY 003

4. Which of the following is one of the most important principles guiding the ethical conduct of research with human subjects?

   A. Subjects must be chosen to represent the racial, ethnic and gender composition of the population at large

   B. Before beginning the study, subjects must be informed of any known risks associated with participation

   C. Any treatments given to subjects must be known to improve their medical conditions

   D. Before beginning the study, subjects must sign a waiver limiting the legal responsibility of the researcher

COMPETENCY 004

5. Sucrase is an enzyme that catalyzes only one particular reaction, the splitting of sucrose molecules into glucose and fructose. Sucrase recognizes sucrose as its substrate, distinguishing it even from other closely related sugar molecules. This specificity depends on which of the following?

   A. The relative concentrations of sucrose, glucose and fructose

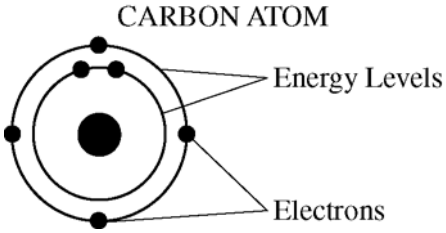
   B. The fit between the shape of the sucrase molecule's active site and the shape of the sucrose molecule

   C. The amount of energy released when a sucrose molecule is broken down

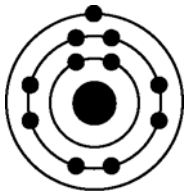
   D. The existence of optimal temperature and pH conditions for sucrase activity

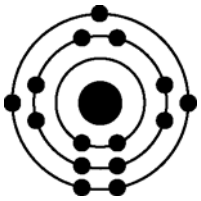
COMPETENCY 004

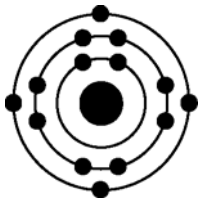
6. **Use the figure below to answer the question that follows.**

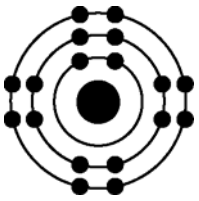


The electron configuration of carbon atoms is responsible for the characteristics that make carbon the basis for known living systems. On a planet where carbon is absent or in short supply, another element might conceivably become the building block for a system of life. Which of the following elements most closely matches those properties of carbon that are relevant for living systems?

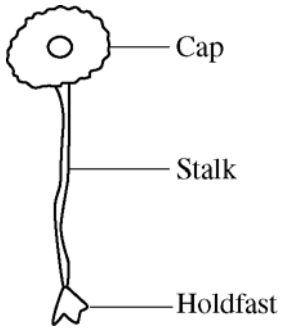
A. 

C. 

B. 

D. 

Use the figure and description below of an experiment to answer the three questions that follow.



Acetabularia are marine algae that grow as single, large cells 2 to 5 cm in length. At one end of the cell is a cap, in the middle a stalk and at the bottom a holdfast. If the cap of a cell is removed, it quickly grows back. Experiments have shown that if a stalk from species 1 is grafted onto a holdfast from species 2, a new cap will grow that is intermediate in shape between the caps of species 1 and 2. However, if this cap is removed, the next cap that grows will be characteristic of species 2, as will all additional caps that are grown if the cap is repeatedly removed.

COMPETENCY 005

7. Given the experimental results described above, it is most likely that the holdfast contains a

   A. mitochondrion.

   B. chloroplast.

   C. lysosome.

   D. nucleus.

COMPETENCY 020

8. Asking students to perform the experiment with *Acetabularia* is most likely to be useful if the students have some prior knowledge of

   A. the mechanisms of genetic control of cellular activity.

   B. the relevance of cell biology to their daily lives.

   C. the relationship between structure and function in cells.

   D. the mechanisms of asexual reproduction.

COMPETENCY 019

9. After students complete the experiment, which of the following questions would be most likely to stimulate higher-level thinking about the experimental results?

   A. What is the likely result if *Acetabularia* is interbred with another unicellular organism?

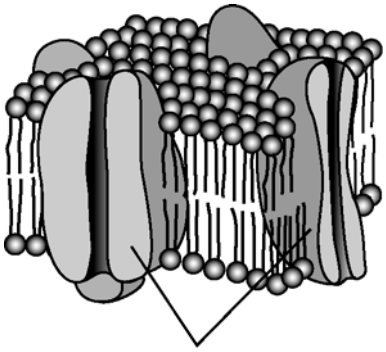
   B. Why does the first cap that regenerates have characteristics of both species?

   C. What is the function of the cap in *Acetabularia*?

   D. Why do many lower organisms regenerate, while vertebrates do not?

COMPETENCY 005

10. **Use the diagram below to answer the question that follows.**



Membrane Structure

The diagram is a model of a cell membrane. The most likely function of the labeled structure is to

A. synthesize the molecules comprising the membrane.

B. facilitate the transport of molecules through the membrane.

C. induce the formation of a lipid bilayer.

D. catalyze the production of energy for the membrane.

COMPETENCY 006

11. One difference between aerobic and anaerobic respiration is that

A. energy is released by aerobic respiration but consumed by anaerobic respiration.

B. net metabolic energy from aerobic respiration is higher than net metabolic energy from anaerobic respiration.

C. aerobic respiration occurs in eukaryotic cells and anaerobic respiration in prokaryotic cells.

D. aerobic respiration is used to obtain oxygen from air and anaerobic respiration is used to obtain oxygen from water.

COMPETENCY 006

12. Which of the following statements best describes how oxygen moves from the bloodstream into the cells where it is used in metabolic processes?

    A. Oxygen moves up the concentration gradient across cell membranes by facilitated diffusion

    B. Oxygen binds to protein molecules that transport it across cell membranes

    C. Oxygen is forced into the cells by the higher osmotic pressure of the blood

    D. Oxygen diffuses passively into the cells without the expenditure of energy

COMPETENCY 007

13. Which of the following examples best illustrates that cellular differentiation is, in certain instances, a reversible process?

    A. Vertebrate embryos resemble the adults of ancestral species

    B. In some plants, removing the terminal bud stimulates the growth of axillary buds

    C. In some animals, body parts that are lost from injury can be regenerated

    D. In plants, growth is indeterminate and continues throughout the lifetime of a plant

COMPETENCY 007

14. It has been observed that a prolonged episode of malnutrition has more severe and less reversible effects on human brain development if it occurs during the first year after birth, compared to an episode that occurs later in infancy or childhood. Which of the following is the most likely explanation for this observation?

    A. Brain cells can only form synaptic connections with other cells of the nervous system during the first year after birth

    B. The ratio of brain size to body weight is greatest for the first year after birth and decreases as the infant gets older

    C. Brain cells continue to divide rapidly during the first year after birth, while active cell division slows markedly after this time

    D. The functions of the different brain hemispheres are established during the first year after birth and cannot be extensively altered after this time

COMPETENCY 008

15. **Use the summary below of a life cycle to answer the question that follows.**

Step 1:	*X* attaches itself to the surface of a cell.
Step 2:	*X* then injects its own genetic material into the cell.
Step 3:	This destroys the host cell's genetic material.
Step 4:	The genetic material of *X* reprograms the host cell's metabolic activities to make multiple copies of *X*.
Step 5:	The host cell then breaks open, releasing the new copies of *X*.

X is best described as

A. a prokaryote.

B. an antigen.

C. a plasmid.

D. a virus.

COMPETENCY 008

16. A team of researchers has isolated a chemical from a tropical tree that causes insects to die when they ingest it. The researchers determine that the chemical deactivates the enzyme RNA polymerase. This chemical likely causes the insects to die by interfering directly with

A. transcription of RNA from the DNA template.

B. transport of RNA from the nucleus to the cytoplasm.

C. translation of polypeptides from RNA molecules.

D. excision of transcribed introns from an RNA molecule.

COMPETENCY 009

17. When red-flowered snapdragons are crossed with white-flowered snapdragons, all of the offspring have pink flowers. When these pink-flowered snapdragons are crossed, one-fourth of the F_2 offspring will have red flowers, one-fourth will have white flowers and one-half will have pink flowers. This pattern of inheritance is most likely due to

    A. codominance of both the red and white alleles.

    B. dominance of the red allele over the white allele.

    C. incomplete dominance of either the red or the white allele.

    D. crossing over of the two alleles during meiosis.

COMPETENCY 009

18. In 1909, Karl Correns found that the presence or absence of white or yellow patches on the leaves of an otherwise green plant was determined only by the maternal parent. Which of the following is the most likely explanation for this observation?

    A. The gene for colored patches is located in DNA found in the plastids of the cell rather than in the nucleus

    B. Colored patches are determined by a dominant allele located on the X chromosome

    C. The gene for colored patches is only expressed when the individual is exposed to female plant hormones

    D. Colored patches are produced by a viral infection of the ovum before fertilization by the pollen

COMPETENCY 010

19. *Geospiza fuliginosa* and *Geospiza fortis* are species of Galápagos finch with overlapping ranges. When only one of the two species is found on an island, it has a medium-sized beak. However, on islands where both species are found, *G. fuliginosa* has a smaller beak and *G. fortis* a larger one. This phenomenon is an example of

    A. interference competition.

    B. competitive exclusion.

    C. Batesian mimicry.

    D. character displacement.

COMPETENCY 010

20. Which of the following is the best example of the effects of balancing selection?

    A. In regions where malaria is endemic, individuals who are heterozygous for the sickle cell allele are more fit than either homozygote

    B. The range of genetic variation in humans is greater than that in all other species of primates

    C. In some species of deer, more female than male offspring are produced in times of stress

    D. Complex ecosystems such as tropical forests contain many more species than are found in simpler ecosystems

COMPETENCY 011

21. In the study of evolution, which of the following observations is likely to provide evidence in favor of the theory of *punctuated equilibrium*?

    A. A subpopulation that becomes geographically isolated from its parent population often undergoes rapid genetic change

    B. Natural selection takes place both at the species level and at higher levels of taxonomic classification

    C. Many effects of evolution occur at the molecular level without overtly affecting morphology or behavior

    D. Two species that could produce viable offspring may be prevented from interbreeding by geographic isolation

COMPETENCY 011

22. Which of the following adaptations was most essential for enabling aquatic algae to evolve into plants capable of surviving in a variety of terrestrial environments?

    A. The use of chlorophyll in plant leaves to absorb light energy

    B. The development of the calyx as a reproductive structure that protects seeds

    C. The use of turgor pressure to support cell structure

    D. The development of vascular tissue that transports water and nutrients

COMPETENCY 012

23. Which of the following is the most accurate method for classifying two organisms according to their degree of relationship?

    A. Compare similarities and differences in the DNA of both organisms

    B. Identify traits shared by both organisms during early embryonic development

    C. Compare similarities and differences in the behavior of both organisms

    D. Count the number of adaptive morphological traits shared by both organisms

COMPETENCY 012

24. A biologist has hypothesized that a structure in the digestive tract of birds is homologous to a structure in the digestive tract of certain mammals. Which of the following findings would provide the best evidence in favor of this view?

    A. The genes coding for the two structures utilize the same nitrogenous bases

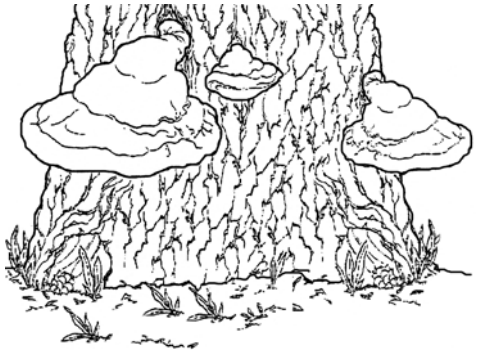
    B. The two structures appear almost identical at an early stage of embryonic development

    C. The structures are vestigial in the digestive tracts of both birds and mammals

    D. The structures perform similar digestive functions in birds and mammals

COMPETENCY 013

25. **Use the diagram below to answer the question that follows.**



On a class field trip, students encounter some brightly colored shelf-like structures attached to the trunk of a dead tree. Which of the following is the best description of how this organism obtains matter and energy from its environment?

A. It obtains energy from the dead wood and absorbs carbon dioxide and water vapor from the air

B. It obtains energy from sunlight, absorbs carbon from the dead wood, and obtains water vapor from the air

C. It obtains energy from sunlight and obtains carbon and water from the dead wood

D. It obtains energy, carbon and water from the dead wood

COMPETENCY 014

26. Human vegetarians who do not eat any animal products must pay close attention to their diets because

A. many plants lack the nucleic acids needed for the synthesis of human DNA.

B. no single plant species provides enough calories to sustain human metabolism.

C. most plants lack the saturated fats that are essential for storing energy.

D. no single plant species provides all of the amino acids essential for building proteins.

COMPETENCY 014

27. A scientist recruits human volunteers to spend several weeks as experimental subjects in her lab. The subjects will stay in a windowless area with no access to clocks or watches. Their activities will be unstructured, and they will be free to eat, sleep and exercise whenever they choose. The most likely purpose of this experiment is to determine whether

A. a lack of natural light improves or impairs mental functioning.

B. people alter the amount they eat when deprived of natural light.

C. the human wake/sleep cycle is regulated by internal or external signals.

D. behavior patterns will change in the absence of social pressures.

COMPETENCY 015

28. In various species of mammal, if a mother and her offspring are kept apart for a brief period after birth and then reunited, the mother will then reject the offspring. The likely function of this rejection by the mother is to

A. decrease the probability that she will expend resources raising offspring that are not her own.

B. teach the offspring that there are negative consequences to straying from its mother.

C. decrease the probability that harmful learned behaviors will be adopted by her other offspring.

D. protect herself from parasites and diseases that may have been acquired by the offspring.

COMPETENCY 015

29. An ethologist wishes to investigate the relative importance of innate and learned components of canine behavior. Which of the following criteria can be used to distinguish innate behaviors from learned behaviors?

A. The age at which the behavior is first detected

B. The degree to which the behavior can be repeated in a stereotypic manner

C. The success with which the behavior is performed the first time it is attempted

D. The extent to which the behavior can be triggered by releasers in inappropriate circumstances

Read the passage below; then answer the two questions that follow.

Some of the most compelling data on the link between lifestyle factors and heart disease come from large-scale studies by public health researchers. The most famous of these studies is the Framingham Heart Study, which has followed 5,209 men and women from the town of Framingham, Massachusetts, since 1948. On the basis of survey data and medical information collected from this group, the Framingham researchers have developed a questionnaire to assess an individual's risk for coronary disease. Respondents are assigned a score on the basis of cholesterol level (which is determined in large part by diet and exercise), age, blood pressure, whether the respondent is a smoker and whether the respondent has diabetes. Men with the fewest risk factors have about a 2% chance of developing coronary disease within the next ten years, while women with the fewest risk factors have about a 1% chance. On the other hand, men with the most risk factors have a greater than 53% chance of developing coronary disease within ten years, while women with the most risk factors have a greater than 27% chance.

5

COMPETENCY 003

30. Which of the following conclusions about the risk of heart disease can be inferred from the above passage?

    A. Lifestyle factors account for up to 53% of the cases of heart disease in men and up to 27% of the cases in women

    B. Genetic factors play almost no role in determining the risk of heart disease

    C. As a man's risk factors increase, the chance that he will develop heart disease rises by up to 50%

    D. Men are about twice as likely as women to develop heart disease, given similar lifestyles and overall health

COMPETENCY 002

31. A scientist proposes that there is a gene that both predisposes people to smoke and contributes to heart disease. She claims that the association between smoking and heart disease is explained by the presence of this gene, and she disputes the conclusion of the Framingham Study that smoking by itself increases the risk of heart disease. Which of the following types of scientific investigation would provide the best evidence against this scientist's genetic explanation of the link between smoking and heart disease?

    A. Interviews with smokers indicating that cardiac symptoms are most acute when they have been smoking heavily

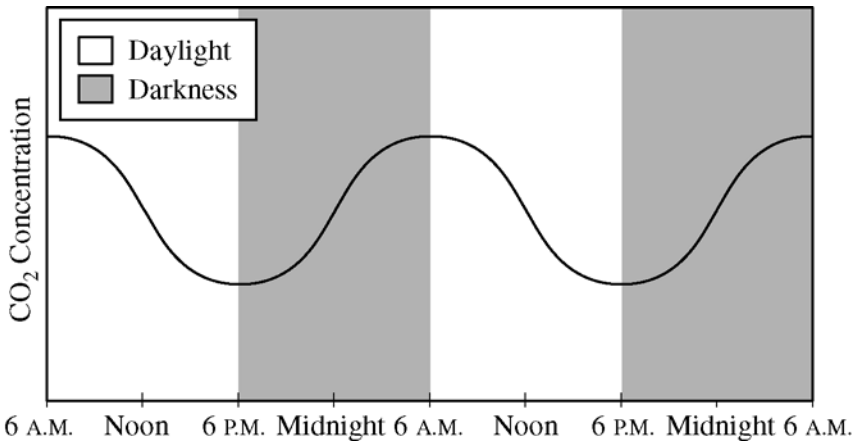
    B. Observational studies showing that heart disease risk increases only after an individual has begun smoking

    C. Controlled experiments showing that lab rats exposed to cigarette smoke are more likely to develop heart disease

    D. Gene-sequencing studies indicating that there is a gene related to heart disease that is carried by some nonsmokers

COMPETENCY 016

32. **Use the graph below to answer the question that follows.**



This graph shows variation in CO_2 level at one location over a two-day period. Based on the pattern shown in the graph, it is likely that the measurements of carbon dioxide concentration were taken in which of the following locations?

A. Near dense, actively growing vegetation

B. Above the surface of a body of nutrient-poor water

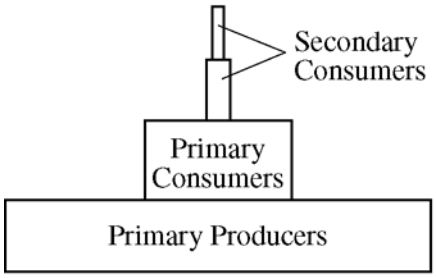
C. At a high elevation with low barometric pressure

D. In an urban environment with high consumption of fossil fuels

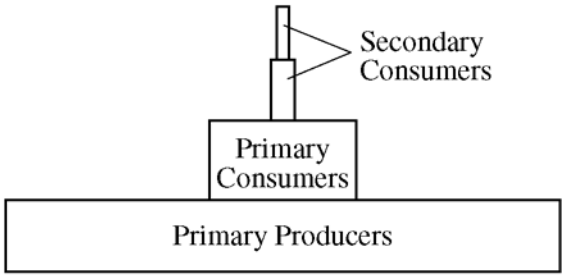
COMPETENCY 017

33. **Use the figures below to answer the question that follows.**

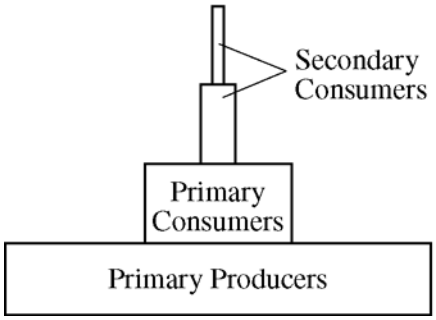
NET PRODUCTIVITY
IN A FLORIDA BOG



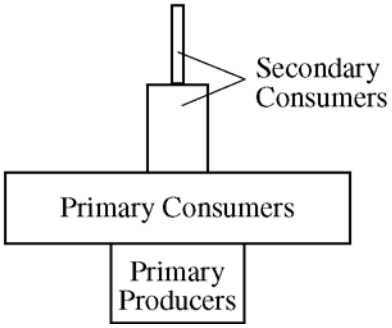
STANDING CROP BIOMASS
IN A FLORIDA BOG



NET PRODUCTIVITY
IN THE ENGLISH CHANNEL



STANDING CROP BIOMASS
IN THE ENGLISH CHANNEL



The above figures compare approximations of net productivity and standing crop biomass in two ecosystems, a Florida bog and the English Channel. The figures for net productivity in both ecosystems and the figure for standing crop biomass in the Florida bog all exhibit similar pyramid shapes, with productivity and biomass decreasing with each trophic level. However, the figure for standing crop biomass in the English Channel exhibits a different shape. Zooplankton, which are the primary consumers, exhibit a higher standing crop biomass than do phytoplankton, which are the primary producers. Which of the following is the most likely explanation for the different shape of the standing crop biomass pyramid for the English Channel?

A. The phytoplankton in the English Channel exhibit a high turnover rate because they are consumed very rapidly by the zooplankton

B. Individual phytoplankton in the English Channel are larger than zooplankton and provide such a rich nutrient source that relatively few are required to support many zooplankton

C. Phytoplankton are eaten by a wide variety of fish and marine mammals, while zooplankton are not

D. Zooplankton feed on detritus produced by other organisms as well as on phytoplankton, so that fewer phytoplankton are needed to support a large population of zooplankton

COMPETENCY 017

34. When an agricultural field is abandoned, it usually undergoes ecological succession involving a sequence of changes in vegetation. In most of North America, species of pine tree tend to be characteristic of early stages of succession, while hardwoods such as oak, beech and maple are more often found in later stages. Which of the following best explains this pattern of succession?

A. Pines are better adapted to the nutrient levels characteristic of abandoned fields; hardwoods eventually replace the pines when nutrient levels return to more normal levels

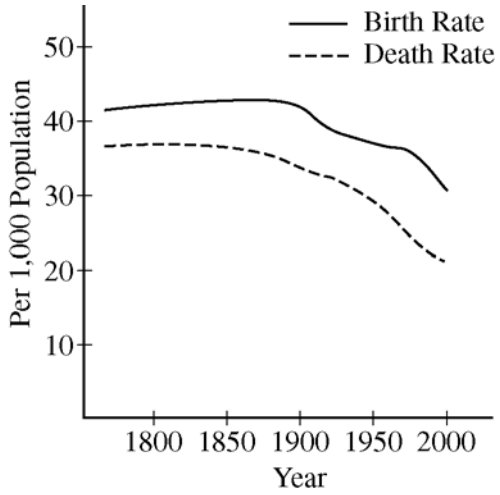
B. Pine seeds and seedlings germinate and grow more rapidly in open, sunny areas; the shade from the mature pine trees eventually favors the establishment and growth of the shade-tolerant hardwood species

C. Pine needles are better able to resist the many plant pests initially present in a field ecosystem; hardwoods are eventually able to grow as the insect population decreases

D. Pine seeds are more abundant than hardwood seeds in abandoned fields; the slow influx of hardwood seeds eventually allows these species to overtake the pines

COMPETENCY 018

35. **Use the graph below to answer the question that follows.**



On this graph, population increase is represented by the

A. solid line.

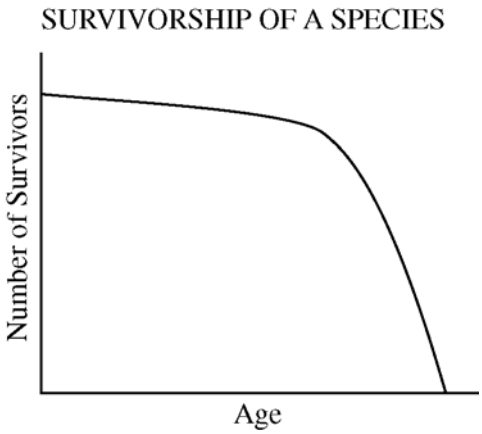
B. dotted line.

C. sum of the solid and dotted lines.

D. distance between the solid and dotted lines.

COMPETENCY 018

36. **Use the graph below to answer the question that follows.**



The graph above shows the survival curve for a particular species. Which of the following inferences is most likely true of the species?

A. It reproduces only once during its lifetime

B. It matures very rapidly

C. Its environment is subject to rapid and extreme fluctuations

D. It produces large numbers of offspring at one time

COMPETENCY 020

37. **Use the Texas Essential Knowledge and Skills (TEKS) student expectation below to answer the question that follows.**

> The student is expected to collect data and make measurements with precision.

Which of the following types of assessment would be most effective for measuring students' achievement of the above objective?

A. A written response, in which students explain significant figures and analyze how measurement errors are propagated through calculations

B. A portfolio, in which samples of students' more recent experimental designs are compared to previous designs in order to evaluate student improvement

C. A performance assessment, in which students input data into a spreadsheet, analyze the data using spreadsheet functions and display the data in appropriate graphic formats

D. A performance assessment, in which students use tools to measure the attributes of various objects at measurement stations located throughout the classroom

ANSWER KEY

Question Number	Correct Answer	Competency
1	D	001
2	B	001
3	B	002
4	B	003
5	B	004
6	B	004
7	D	005
8	A	020
9	B	019
10	B	005
11	B	006
12	D	006
13	C	007
14	C	007
15	D	008
16	A	008
17	C	009
18	A	009
19	D	010
20	A	010
21	A	011
22	D	011
23	A	012
24	B	012
25	D	013
26	D	014
27	C	014
28	A	015
29	C	015
30	D	003
31	C	002
32	A	016
33	A	017
34	B	017
35	D	018
36	C	018
37	D	020

Chapter 6

Are You Ready? – Last-Minute Tips

PREPARING TO TAKE THE TEST

CHECKLIST

Complete this checklist to determine if you are ready to take your test.

- ✓ Do you know the testing requirements for your teaching field?
- ✓ Have you followed the test registration procedures?
- ✓ Have you reviewed the test center identification document requirements in the *Registration Bulletin* or on the ETS TExES website at **www.texes.ets.org**?
- ✓ Do you know the test frameworks that will be covered in each of the tests you plan to take?
- ✓ Have you used the study plan sheet at the end of this manual to identify what content you already know well and what content you will need to focus on in your studying?
- ✓ Have you reviewed any textbooks, class notes and course readings that relate to the frameworks covered?
- ✓ Do you know how long the test will take and the number of questions it contains? Have you considered how you will pace your work?
- ✓ Are you familiar with the test directions and the types of questions for your test?
- ✓ Are you familiar with the recommended test-taking strategies and tips?
- ✓ Have you practiced by working through the sample test questions at a pace similar to that of an actual test?
- ✓ If constructed-response questions are part of your test, do you understand the scoring criteria for these questions?
- ✓ If you are repeating a test, have you analyzed your previous score report to determine areas where additional study and test preparation could be useful?

THE DAY OF THE TEST

You should have ended your review a day or two before the actual test date. Many clichés you may have heard about the day of the test are true. You should:

- Be well rested.
- Take the appropriate identification document(s) with you to the test center (identification requirements are listed in the *Registration Bulletin* and on the ETS TExES website at **www.texes.ets.org**).
- Take 3 or 4 well-sharpened soft-lead (No. 2 or HD) pencils with good erasers.
- Eat before you take the test.
- Be prepared to stand in line to check in or to wait while other test takers are being checked in.
- Stay calm. You can't control the testing situation, but you can control yourself. Test administrators are well trained and make every effort to provide uniform testing conditions, but don't let it bother you if a test doesn't start exactly on time. You will have the necessary amount of time once it does start. Using the *Reducing Test Anxiety* booklet in the days before you test may be helpful in mentally and emotionally preparing yourself to test. It is available free at **www.texes.ets.org**.

You can think of preparing for this test as training for an athletic event. Once you have trained, prepared and rested, give it everything you've got. Good luck.

Appendix A

Study Plan Sheet

STUDY PLAN						
Content covered on test	**How well do I know the content?**	**What material do I have for studying this content?**	**What material do I need for studying this content?**	**Where can I find the materials I need?**	**Dates planned for study of content**	**Date completed**

Appendix B

Preparation Resources

PREPARATION RESOURCES

The resources listed below may help you prepare for the TExES test in this field. These preparation resources have been identified by content experts in the field to provide up-to-date information that relates to the field in general. You may wish to use current issues or editions to obtain information on specific topics for study and review.

JOURNALS

American Biology Teacher, National Association of Biology Teachers.

American Scientist, Sigma XI, the Scientific Research Society.

Natural History, American Museum of Natural History.

Nature, The Nature Publishing Group.

Texas Science Teacher, Science Teachers Association of Texas.

The Science Teacher, National Science Teachers Association.

OTHER RESOURCES

Audesirk, T., Audesirk, G., and Byers, B. (2011). *Life on Earth with Physiology*, Ninth Edition. Benjamin Cummings.

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Cunningham, W. P., and Cunningham, M. A. (2009). *Environmental Science: A Global Concern*, Eleventh Edition. McGraw-Hill.

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Stern, K. R. (2008). *Introductory Plant Biology*, Eleventh Edition. McGraw-Hill.

Texas Education Agency. (2010). *Texas Essential Knowledge and Skills (TEKS)*.

Texas Education Agency. (2010). *Texas Safety Standards: Kindergarten through Grade 12*, Fourth Edition.

Trowbridge, L. W., Bybee, R. W., and Powell, J. C. (2008). *Teaching Secondary School Science: Strategies for Developing Scientific Literacy*, Ninth Edition. Prentice-Hall.

Volpe, E. P. (2010). *Understanding Evolution*, Seventh Edition. McGraw-Hill.

ONLINE RESOURCES

American Association for the Advancement of Science — www.aaas.org

American Institute of Biological Sciences — www.aibs.org

National Association of Biology Teachers — www.nabt.org

National Science Teachers Association — www.nsta.org

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