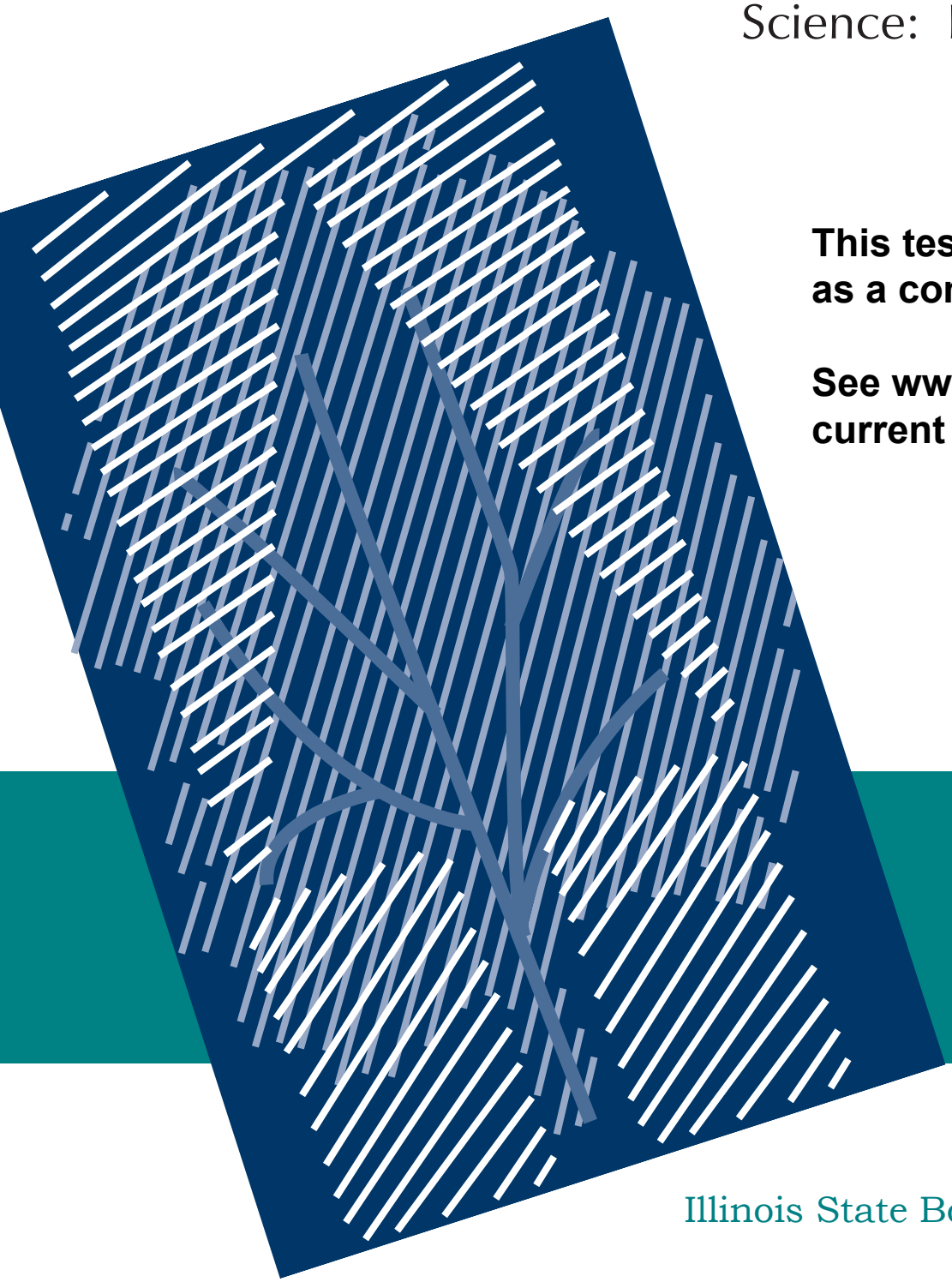
Illinois Licensure Testing System

STUDY GUIDE

Science: Biology (105)



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Illinois State Board of Education

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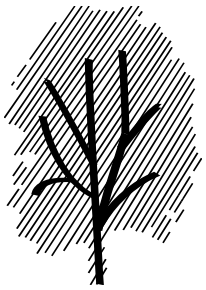
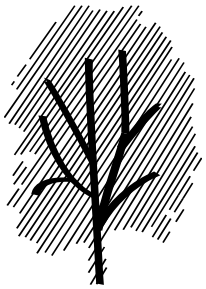


General Information About the Illinois Licensure Testing System

The first section of the study guide is available in a separate PDF file. Click the link below to view or print this section.

General Information About the Illinois Licensure Testing System



Field-Specific Information

- **Test Subareas and Objectives**
- **Practice Test Questions**
- **Explanation of the Test Score Report**

INTRODUCTION

The content tests are designed to assess a candidate's knowledge of content in the specific teaching, school service personnel, or administrative field in which licensure is sought. The tests are based on current and relevant expectations for teacher preparation students and for teachers in Illinois as defined by the Illinois Content Area Standards for Educators. This study guide is designed to focus your preparation by helping you become familiar with the format and content to be covered on the tests.

This section includes a list of the test subareas and objectives, practice test questions for the field covered by this study guide, an answer key, and an explanation of the test score report.

TEST SUBAREAS AND OBJECTIVES

The content covered by the test is organized into subareas. You will find a list of subareas at the beginning of the list of test objectives. Within each subarea, the content is further defined by a set of objectives. Each objective comprises two major parts:

1. the *objective statement*, which broadly defines the knowledge and skills that an entry-level educator needs to know; and

2. the *descriptive statements*, which describe in greater detail the types of knowledge and skills covered by the test objective.

The test objectives are broad, conceptual, and meaningful statements, written in language that reflects the skills, knowledge, and understanding that an entry-level teacher needs in order to teach effectively in an Illinois classroom. A test consists of test questions that measure an examinee's mastery of these test objectives.

Below is an example of a test objective statement and its accompanying descriptive statements for the Elementary/Middle Grades test.

Objective Statement

Understand word analysis strategies and vocabulary development and how to use effective, developmentally appropriate approaches to promote students' word analysis and vocabulary skills.

Descriptive Statements

- Demonstrate knowledge of phonics and its role in decoding; of ways to assess students' phonic skills; and of effective instructional strategies, activities, and materials for promoting students' phonetic analysis skills.

- Demonstrate knowledge of word analysis strategies, including syllabication, morphology (e.g., use of affixes and roots), and context clues; of ways to assess students' use of word analysis strategies; and of effective instructional strategies, activities, and materials for promoting students' word analysis and contextual analysis skills.

- Demonstrate knowledge of the role of vocabulary development in reading; of ways to assess students' vocabulary development; and of effective instructional strategies, activities, and materials for promoting students' vocabulary development.

SPECIAL NOTE REGARDING SCIENCE TEST FIELDS

The test objectives for each of the science fields (i.e., Biology, Chemistry, Earth and Space Science, Environmental Science, and Physics) contain a set of common objectives in addition to objectives unique to the specialty field. The set of common objectives measures the candidate's core knowledge across all science fields. The test questions matched to these common objectives are identical across all science fields.

CALCULATORS

Examinees taking Science: Biology, Science: Chemistry, Science: Earth and Space Science, Science: Environmental Science, and Science: Physics will be provided with a scientific calculator at the test administration. Please consult the current version of the ILTS Registration Bulletin for more information on scientific calculators.

PRACTICE TEST QUESTIONS

The practice test questions included in this section are designed to give the examinee an introduction to the nature of the test questions included on the ILTS test for each field. The practice test questions represent the various types of test questions you may expect to see on an actual test; however, they are **not** designed to provide diagnostic information to help you identify specific areas of individual strengths and weaknesses or predict your performance on the test as a whole. Use the answer key located after the practice test questions to check your answers.

To help you identify which test objective is being assessed, the objective statement to which the question corresponds is listed in the answer key. When you are finished with the practice test questions, you may wish to go back and review the entire list of test objectives and descriptive statements once again.

SCIENCE: BIOLOGY TEST OBJECTIVES

I. Science and Technology
II. Life Science
III. Physical Science
IV. Earth Systems and the Universe
V. Cell Biology, Heredity, and Evolution
VI. Organismal Biology and Ecology

SUBAREA I—SCIENCE AND TECHNOLOGY

0001 Understand and apply knowledge of science as inquiry.

- Recognize the assumptions, processes, purposes, requirements, and tools of scientific inquiry.
- Use evidence and logic in developing proposed explanations that address scientific questions and hypotheses.
- Identify various approaches to conducting scientific investigations and their applications.
- Use tools and mathematical and statistical methods for collecting, managing, analyzing (e.g., average, curve fit, error determination), and communicating results of investigations.
- Demonstrate knowledge of ways to report, display, and defend the results of an investigation.

0002 Understand and apply knowledge of the concepts, principles, and processes of technological design.

- Recognize the capabilities, limitations, and implications of technology and technological design and redesign.
- Identify real-world problems or needs to be solved through technological design.
- Apply a technological design process to a given problem situation.
- Identify a design problem and propose possible solutions, considering such constraints as tools, materials, time, costs, and laws of nature.
- Evaluate various solutions to a design problem.

0003 Understand and apply knowledge of accepted practices of science.

- Demonstrate an understanding of the nature of science (e.g., tentative, replicable, historical, empirical) and recognize how scientific knowledge and explanations change over time.
- Compare scientific hypotheses, predictions, laws, theories, and principles and recognize how they are developed and tested.
- Recognize examples of valid and biased thinking in reporting of scientific research.
- Recognize the basis for and application of safety practices and regulations in the study of science.

0004 Understand and apply knowledge of the interactions among science, technology, and society.

- Recognize the historical and contemporary development of major scientific ideas and technological innovations.
- Demonstrate an understanding of the ways that science and technology affect people's everyday lives, societal values and systems, the environment, and new knowledge.
- Analyze the processes of scientific and technological breakthroughs and their effects on other fields of study, careers, and job markets.
- Analyze issues related to science and technology at the local, state, national, and global levels (e.g., environmental policies, genetic research).
- Evaluate the credibility of scientific claims made in various forums (e.g., the media, public debates, advertising).

0005 Understand and apply knowledge of the major unifying concepts of all sciences and how these concepts relate to other disciplines.

- Identify the major unifying concepts of the sciences (e.g., systems, order, and organization; constancy, change, and measurement) and their applications in real-life situations.
- Recognize connections within and among the traditional scientific disciplines.
- Apply fundamental mathematical language, knowledge, and skills at the level of algebra and statistics in scientific contexts.
- Recognize the fundamental relationships among the natural sciences and the social sciences.

SUBAREA II—LIFE SCIENCE

0006 Understand and apply knowledge of cell structure and function.

- Compare and contrast the structures of viruses and prokaryotic and eukaryotic cells.
- Identify the structures and functions of cellular organelles.
- Describe the processes of the cell cycle.
- Explain the functions and applications of the instruments and technologies used to study the life sciences at the molecular and cellular level.

0007 Understand and apply knowledge of the principles of heredity and biological evolution.

- Recognize the nature and function of the gene, with emphasis on the molecular basis of inheritance and gene expression.
- Analyze the transmission of genetic information (e.g., Punnett squares, sex-linked traits, pedigree analysis).
- Analyze the processes of change at the microscopic and macroscopic levels.
- Identify scientific evidence from various sources, such as the fossil record, comparative anatomy, and biochemical similarities, to demonstrate knowledge of theories about processes of biological evolution.

0008 Understand and apply knowledge of the characteristics and life functions of organisms.

- Identify the levels of organization of various types of organisms and the structures and functions of cells, tissues, organs, and organ systems.
- Analyze the strategies and adaptations used by organisms to obtain the basic requirements of life.
- Analyze factors (e.g., physiological, behavioral) that influence homeostasis within an organism.
- Demonstrate an understanding of the human as a living organism with life functions comparable to those of other life forms.

0009 Understand and apply knowledge of how organisms interact with each other and with their environment.

- Identify living and nonliving components of the environment and how they interact with one another.
- Recognize the concepts of populations, communities, ecosystems, and ecoregions and the role of biodiversity in living systems.
- Analyze factors (e.g., ecological, behavioral) that influence interrelationships among organisms.
- Develop a model or explanation that shows the relationships among organisms in the environment (e.g., food web, food chain, ecological pyramid).
- Recognize the dynamic nature of the environment, including how communities, ecosystems, and ecoregions change over time.
- Analyze interactions of humans with their environment.
- Explain the functions and applications of the instruments and technologies used to study the life sciences at the organism and ecosystem level.

SUBAREA III—PHYSICAL SCIENCE

0010 Understand and apply knowledge of the nature and properties of energy in its various forms.

- Describe the characteristics of and relationships among thermal, acoustical, radiant, electrical, chemical, mechanical, and nuclear energies through conceptual questions.
- Analyze the processes by which energy is exchanged or transformed through conceptual questions.
- Apply the three laws of thermodynamics to explain energy transformations, including basic algebraic problem solving.
- Apply the principle of conservation as it applies to energy through conceptual questions and solving basic algebraic problems.

0011 Understand and apply knowledge of the structure and properties of matter.

- Describe the nuclear and atomic structure of matter, including the three basic parts of the atom.
- Analyze the properties of materials in relation to their chemical or physical structures (e.g., periodic table trends, relationships, and properties) and evaluate uses of the materials based on their properties.
- Apply the principle of conservation as it applies to mass and charge through conceptual questions.
- Analyze bonding and chemical, atomic, and nuclear reactions (including endothermic and exothermic reactions) in natural and man-made systems and apply basic stoichiometric principles.
- Apply kinetic theory to explain interactions of energy with matter, including conceptual questions on changes in state.
- Explain the functions and applications of the instruments and technologies used to study matter and energy.

0012 Understand and apply knowledge of forces and motion.

- Demonstrate an understanding of the concepts and interrelationships of position, time, velocity, and acceleration through conceptual questions, algebra-based kinematics, and graphical analysis.
- Demonstrate an understanding of the concepts and interrelationships of force (including gravity and friction), inertia, work, power, energy, and momentum.
- Describe and predict the motions of bodies in one and two dimensions in inertial and accelerated frames of reference in a physical system, including projectile motion but excluding circular motion.
- Analyze and predict motions and interactions of bodies involving forces within the context of conservation of energy and/or momentum through conceptual questions and algebra-based problem solving.
- Describe the effects of gravitational and nuclear forces in real-life situations through conceptual questions.
- Explain the functions and applications of the instruments and technologies used to study force and motion in everyday life.

0013 Understand and apply knowledge of electricity, magnetism, and waves.

- Recognize the nature and properties of electricity and magnetism, including static charge, moving charge, basic RC circuits, fields, conductors, and insulators.
- Recognize the nature and properties of mechanical and electromagnetic waves (e.g., frequency, source, medium, spectrum, wave-particle duality).
- Describe the effects and applications of electromagnetic forces in real-life situations, including electric power generation, circuit breakers, and brownouts.
- Analyze and predict the behavior of mechanical and electromagnetic waves under varying physical conditions, including basic optics, color, ray diagrams, and shadows.

0014 Understand and apply knowledge of Earth's land, water, and atmospheric systems and the history of Earth.

- Identify the structure and composition of Earth's land, water, and atmospheric systems and how they affect weather, erosion, fresh water, and soil.
- Recognize the scope of geologic time and the continuing physical changes of Earth through time.
- Evaluate scientific theories about Earth's origin and history and how these theories explain contemporary living systems.
- Recognize the interrelationships between living organisms and Earth's resources and evaluate the uses of Earth's resources.

0015 Understand and apply knowledge of the dynamic nature of Earth.

- Analyze and explain large-scale dynamic forces, events, and processes that affect Earth's land, water, and atmospheric systems, including conceptual questions about plate tectonics, El Niño, drought, and climatic shifts.
- Identify and explain Earth processes and cycles and cite examples in real-life situations, including conceptual questions on rock cycles, volcanism, and plate tectonics.
- Analyze the transfer of energy within and among Earth's land, water, and atmospheric systems, including the identification of energy sources of volcanoes, hurricanes, thunderstorms, and tornadoes.
- Explain the functions and applications of the instruments and technologies used to study the earth sciences, including seismographs, barometers, and satellite systems.

0016 Understand and apply knowledge of objects in the universe and their dynamic interactions.

- Describe and explain the relative and apparent motions of the sun, the moon, stars, and planets in the sky.
- Recognize properties of objects (e.g., comets, asteroids) within the solar system and their dynamic interactions.
- Recognize the types, properties, and dynamics of objects external to the solar system (e.g., black holes, supernovas, galaxies).

0017 Understand and apply knowledge of the origins of and changes in the universe.

- Identify scientific theories dealing with the origin of the universe (e.g., big bang).
- Analyze evidence relating to the origin and physical evolution of the universe (e.g., microwave background radiation, expansion).
- Compare the physical and chemical processes involved in the life cycles of objects within galaxies.
- Explain the functions and applications of the instruments, technologies, and tools used in the study of the space sciences, including the relative advantages and disadvantages of earth-based versus space-based instruments and optical versus non-optical instruments.

0018 Understand and apply knowledge of the concepts of cell biology.

- Demonstrate an understanding of the structural and functional aspects of nucleic acids, proteins (including enzyme activity), carbohydrates, and lipids.
- Analyze, at the cellular level, the chemical processes by which organic materials are synthesized and used and relate these processes to energy production and utilization in living systems (e.g., photosynthesis, respiration).
- Demonstrate knowledge of the mechanisms and genetics of cellular differentiation in forming specialized tissues, organs, and complete organisms.

0019 Understand and apply knowledge of the molecular basis of heredity and the associated mathematical probabilities.

- Explain the structure and function of genes.
- Analyze the molecular basis of DNA replication, transcription, translation, and gene expression.
- Analyze the mechanisms and impacts of mutations.
- Demonstrate an understanding of genetic and mathematical explanations associated with probabilities of the transmission of traits and heritable defects in organisms (e.g., pedigrees, Punnett squares).
- Demonstrate knowledge of the concepts and consequences associated with recombinant DNA applications.

0020 Understand and apply knowledge of the historical progression of cellular biology and genetics and the basic research methods and technologies used in these areas.

- Analyze the historical progression of cellular biology and biotechnology, including the changes in knowledge due to advances in technology and the resulting societal implications.
- Demonstrate knowledge of the basic methods, processes, and tools used in cellular and molecular biology research (e.g., electrophoresis, transformation, polymerase chain reaction).

0021 Understand and apply knowledge of biological evolution and diversity.

- Demonstrate an understanding of biological diversity, with an emphasis on the evolutionary relationships among the major groups of organisms.
- Demonstrate an understanding of the processes of natural selection and speciation.
- Describe evidence (e.g., comparative anatomy, paleontology, genetics) supporting the theory of evolution and evolutionary relationships.
- Evaluate recent findings or research that are associated with the testing of the theory of evolution and its mechanisms.
- Analyze the historical progression of the study of biological evolution, including the changes in knowledge due to advances in technology and the resulting societal implications.

SUBAREA VI—ORGANISMAL BIOLOGY AND ECOLOGY

0022 Understand and apply knowledge of organismal biology, using examples from each kingdom.

- Recognize the basic physiological needs and requirements (e.g., energy, nutrients, oxygen) of organisms.
- Demonstrate knowledge of the biochemical and molecular biology of processes fundamental to metabolic function of various systems of living organisms.
- Analyze interrelationships of the functions of various organismal systems.
- Analyze how organisms recognize and localize various internal and external signals to maintain homeostasis.
- Demonstrate knowledge of various instruments and technologies that enhance the study of organisms on the microscopic and macroscopic levels.

0023 Understand and apply knowledge of biological diversity in terms of the structure, function, and nomenclature of the major groups of organisms.

- Analyze the relationships between structure and function in various organisms.
- Distinguish among organisms from different major taxonomic groups based on their characteristics.
- Demonstrate knowledge of the historical development of biological classification systems.
- Apply methods of biological classification and nomenclature.

0024 Understand and apply knowledge of ecological concepts.

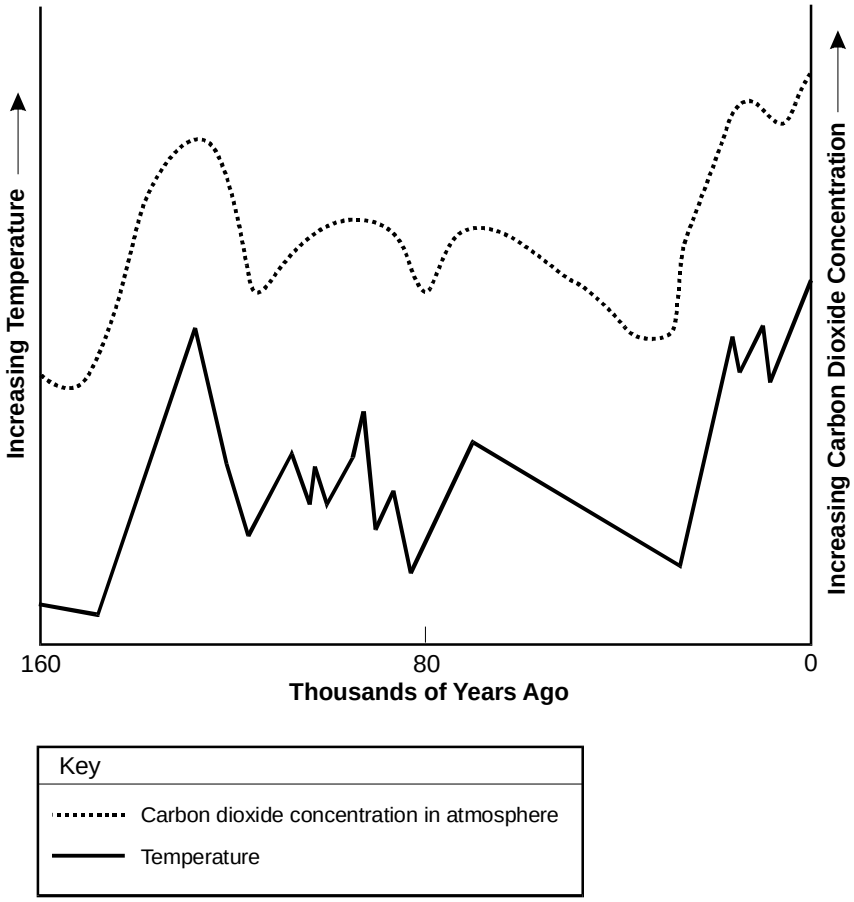
- Explain the interactions and interdependence of organisms in various ecosystems, including the environmental influences and limiting factors that affect them.
- Demonstrate an understanding of the concepts of population dynamics and the effects of population dynamics on environments and communities.
- Analyze ways in which humans influence and are influenced by the environment.
- Explain the functions and applications of the methods, instruments, and technologies used in the research of ecology.
- Analyze the risk/cost/benefit factors in environmental impact studies.

0025 Understand and apply knowledge of matter, energy, and organization in living systems.

- Analyze energy flow between biological systems and the physical environment.
- Analyze the effects of limited availability of resources on the distribution and abundance of organisms and populations.
- Demonstrate an understanding of the transfer and transformation of energy in various biological reactions.
- Analyze food webs, including the roles of and relationships among producers, consumers, and decomposers.
- Relate the varying complexity and organization of organisms to the means by which they obtain, transform, transport, and release matter and energy.

The periodic table provided with this test can be found on page 2-21.

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



The graph above shows the variation in the concentration of carbon dioxide in the atmosphere over the past 160,000 years and the average global temperature change during that same period. Which of the following is the best logical conclusion that can be drawn relying exclusively on these two data sets?

A. Increased global temperatures correlate with increases in atmospheric carbon dioxide, suggesting a connection between the two phenomena.

B. Increased atmospheric carbon dioxide promotes a general warming of the global climate through its role as a greenhouse gas.

C. Increased global temperatures increase the production of carbon dioxide from a variety of natural sources, including photosynthesis and erosion of carbonate rocks.

D. Increased carbon dioxide concentrations in the atmosphere are not related to the warming in the global climate.

2. Which of the following is a fundamental challenge in the design of complex systems?

   A. Feedback mechanisms in complex systems decrease the overall stability of the system.

   B. The more parts and connections that a complex system has, the more ways the system can fail.

   C. The cost of designing complex systems is excessive.

   D. The construction of complex systems is time consuming.

3. Newton's laws are considered laws and not theories because:

   A. they describe natural phenomena with unvarying uniformity under certain conditions.

   B. they can be used to explain the outcome of natural phenomena.

   C. over time, theories become laws.

   D. they are all true for all frames of reference discovered so far.

4. Major breakthroughs in science and technology during the nineteenth century were primarily the result of:

   A. inventions designed to solve a specific problem.

   B. basic research into the workings of the physical and natural world.

   C. accidental discoveries made when conducting research on other topics.

   D. grant-funded research projects seeking to reach a particular goal.

5. For an unordered system, such as a mixture of salt and pepper, to become more ordered, which of the following is required?

   A. the addition of heat

   B. an increase in the size of the system

   C. the expenditure of energy

   D. a decrease in the pressure in the system

6. Ribosomes are involved in which of the following cellular processes?

   A. maintaining structural integrity

   B. transporting waste

   C. digesting nutrients

   D. synthesizing proteins

7. There are four characteristic phenotypes for a feather color trait in parrots. The phenotypes exhibited by the parrots depend on two genes that assort independently. A cross between an individual of genotype AABb and an individual of genotype aaBb would result in which of the following phenotypic ratios?

   A. 3:1

   B. 9:3:3:1

   C. 1:2:1

   D. 2:1:1

8. A pitcher plant traps insects in a pitcher-shaped leaf from which the insect cannot escape. This strategy is best described as an evolutionary adaptation that:

   A. discourages insect predation.

   B. provides the plant with complex carbohydrates.

   C. attracts insect-eating pollinators.

   D. helps the plant survive in a nutrient-poor environment.

9. In order to maintain homeostasis, mammals require significantly higher metabolic rates per gram of body weight than fish. This is primarily because mammals have:

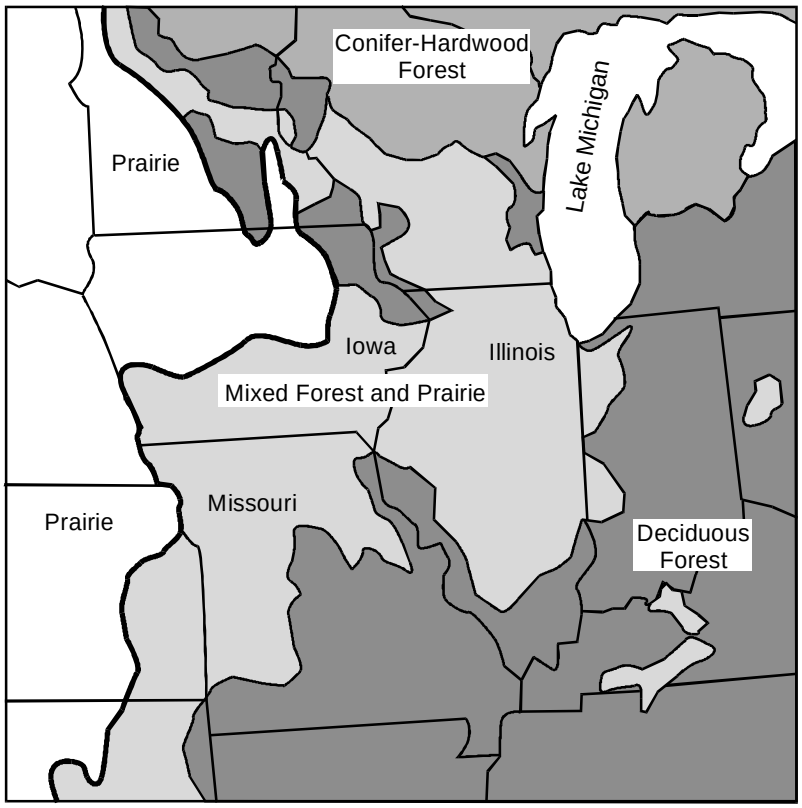
   A. more complex circulatory systems.

   B. internal thermoregulation.

   C. water-conserving excretory systems.

   D. proportionally larger hearts.

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



The map above shows vegetation in the Midwest prior to the 1800s. Which of the following factors was critical in determining the extent of prairie in this region?

A. soil type

B. character of bedrock

C. precipitation

D. temperature

11. When hydrochloric acid reacts with calcium carbonate in a flask, the flask becomes noticeably warm to the touch. Which of the following best describes why this occurs?

A. The high rate at which the chemical reaction occurs generates infrared radiation.

B. The number of protons in the products is greater than the number of protons in the reactants.

C. The friction produced by the agitation of the reactants creates thermal energy.

D. The bond energies of the reactants are greater than the bond energies of the products.

12. A ball rolls down an incline and then across a flat, smooth surface until it stops. Which of the following best describes why the ball comes to a stop?

A. The ball's acceleration is balanced by its inertia.

B. Gravity no longer affects the ball's mass.

C. The ball's kinetic energy is changed into potential energy.

D. Frictional forces overcome the ball's inertia.

13. **Use the chemical equation below to answer the question that follows.**

$$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$$

Which of the following formulas represents the approximate number of grams of CO required to react completely with 200 g of Fe_2O_3?

A. $\frac{(200)(3)}{(28)(160)}$ g

B. **Error! Bookmark not defined.**$\frac{(200)(3)(28)}{160}$ g

C. $\frac{(200)(28)}{(3)(160)}$ g

D. $\frac{160}{(200)(28)(3)}$ g

14. Two trains pass each other. One train is going 70 km/h toward the east; the other train is traveling 50 km/h toward the west. A passenger on the eastbound train walks toward the back of the train at 5 km/h. Relative to the walking passenger, what is the speed of the westbound train?

    A. 75 km/h

    B. 115 km/h

    C. 120 km/h

    D. 125 km/h

15. An object that becomes charged by frictional contact with another object gains electric charge as a result of:

    A. the repulsion of positive charges in one object by the positive charges in the other object.

    B. magnetic fields produced by the relative motion of electrons and protons.

    C. the induction of charge in both objects by the generation of heat energy.

    D. the transfer of electrons from the surface of one object to the surface of the other object.

16. The composition of soils in Illinois is primarily the result of:

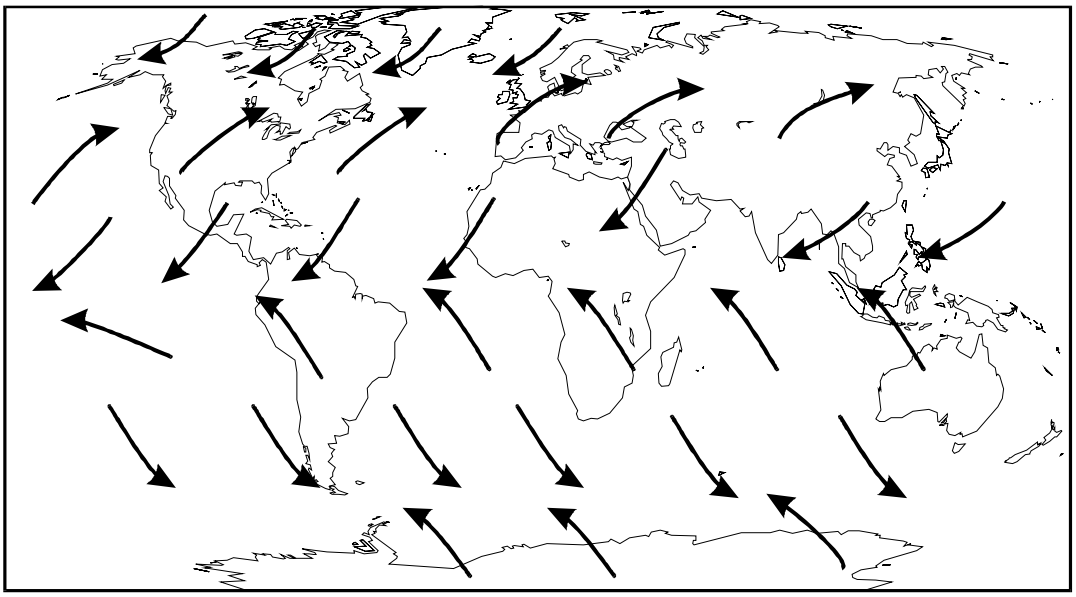
    A. the sediments covering the region from the Pleistocene glaciations.

    B. the abundance of granitic bedrock in the state.

    C. the various kinds of vegetation in the region.

    D. the climatic zones found within the state.

17. **Use the map below to answer the question that follows.**



As shown in the map above, major air currents in the Northern Hemisphere are always deflected toward the right, while in the Southern Hemisphere they are always deflected to the left. Which of the following causes this deflection?

A. the frictional drag on the atmosphere as Earth orbits the sun

B. the differences in atmospheric heating and wind flow caused by the proportion of land to water

C. the movement of Earth's spherical surface around its axis of rotation

D. the existence of semistable pressure systems in the middle and upper levels of the atmosphere

18. Which of the following is used to determine the location and magnitude of an earthquake?

A. the frequency and amplitude of earthquake waves recorded at a seismograph station

B. the size and direction of incoming earthquake waves recorded at two different seismograph stations

C. the arrival times and amplitudes of earthquake waves at three separate seismograph stations

D. the arrival times of three different kinds of earthquake waves at a seismograph station

19. Which of the following best explains why only one side of the moon is visible from Earth?

A. The moon does not rotate on its axis during its orbit of Earth.

B. The moon rotates at the same rate as Earth rotates.

C. The periods of the moon's rotation and revolution are the same.

D. The moon's axis of rotation is parallel to the plane of its orbit.

20. Which of the following is the major advantage of using space-based telescopes, rather than Earth-based telescopes, to observe extremely distant objects in the universe?

A. There is no distortion from gas and dust in the atmosphere.

B. They are closer to the objects being viewed.

C. There is no light pollution to disrupt x-ray and radio-wave signals.

D. They are easier to maintain in the low-gravity, dust-free conditions of space.

21. A particular enzyme functions optimally at pH 6.5. As the pH increases, the rate of the enzyme-catalyzed reaction quickly drops. Which of the following best explains this drop in reaction rate as pH increases?

A. The weak bonds and interactions that give the enzyme its three-dimensional shape are disrupted, causing the enzyme to lose its active conformation.

B. The substrate becomes bound to the ions in the surrounding fluid, causing it to precipitate and become unavailable to the enzyme.

C. The ions in the surrounding fluid occupy the active site, preventing the substrate molecules from binding to the active site and being acted upon by the enzyme.

D. The enzyme switches its function to that of a buffer to resist the pH change, making it unavailable for catalysis.

22. **Use the information below to answer the question that follows.**

$ATP \rightleftharpoons ADP + P_i$

The primary significance to living organisms of the reversible reaction shown above is that it:

A. is the main method of long-term storage of energy.

B. lowers the activation energy of chemical reactions in a cell.

C. mediates energy coupling between anabolic and catabolic reactions.

D. regenerates water molecules for hydrolysis reactions in a cell.

23. Two parents have the genotypes AaBbCc and aaBbCC. Which of the following mathematical expressions calculates the probability that one of their offspring will be AabbCc?

A. $\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3}$

B. $\frac{2}{3} \times \frac{1}{2} \times \frac{1}{4}$

C. $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4}$

D. $\frac{1}{2} \times \frac{1}{4} \times \frac{1}{2}$

24. Which of the following characteristics of DNA molecules make gel electrophoresis an effective technique for genetic analysis?

A. the affinity of nucleic acids for fatty acids and their rapid movement when exposed to a high voltage

B. the different lengths of DNA molecules and the negative charge of their phosphate groups

C. the hydrogen bonds between nucleic acids and their differing molecular weights

D. the chemical reactivity of DNA molecules and their varying molecular structures

25. A geologic event splits a small population into two isolated populations. When the populations come back into contact many generations later, they can no longer interbreed and produce fertile offspring. This is an example of which of the following processes?

A. stabilizing selection

B. allopatric speciation

C. disruptive selection

D. sympatric speciation

26. A plant in a sealed container in the dark would die from a lack of which of the following?

A. O_2

B. CO_2

C. H_2O

D. $C_6H_{12}O_6$

27. Which of the following best explains how marine fish maintain homeostasis while living in salt water?

A. They excrete large amounts of urine that contains high concentrations of sodium and chloride ions.

B. They maintain high levels of salts in their interstitial fluids, while actively transporting pure water into cells.

C. They consume large amounts of sea water and pump excess salts out of the body through the gill epithelium.

D. They derive most of their water from the food they eat and remove excess salts along with feces.

28. The field of systematics as developed during the last 100 years differs from the original Linnaean classification system by its:

A. use of the anatomical features of organisms as the basis for defining relationships between species.

B. utilization of behavioral characteristics and interspecies interactions to define subspecies.

C. reliance on a more detailed trinomial system for characterizing different organisms.

D. incorporation of evolutionary history as a central principle in taxonomy.

29. The alcohol content of wine is typically less than 13 percent because the wine-producing yeast cells cannot tolerate a higher ethanol concentration. Which of the following density-dependent factors affecting population growth is best illustrated by this example?

A. Environmental stress reduces an organism's vigor.

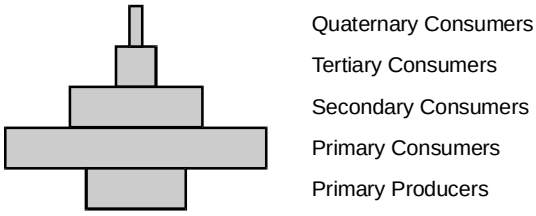
B. Metabolic wastes can accumulate to toxic levels.

C. Rates of reproduction decrease in crowded conditions.

D. Nutrients available to a population are limited.

30. **Use the biomass pyramid of a marine ecosystem below to answer the question that follows.**

Marine Ecosystem Biomass Pyramid



Which of the following best explains how the marine ecosystem represented by the biomass pyramid above can be maintained with so little biomass in the lowest level of the food chain?

A. The consumers thrive due to the efficiency of their ectothermic physiology and their generally high reproductive rates.

B. The large amounts of detritus from dead and decaying primary producers directly support consumers.

C. The high concentration of nutrients contained in marine producers can support a large number of low-level consumers.

D. The greater reproductive rate of the primary producers compared with consumers maintains adequate food supplies for low-level consumers.

PERIODIC TABLE OF THE ELEMENTS

1 **IA**																	18 **VIIIA**
1 **H** 1.01	2 **IIA**											13 **IIIA**	14 **IVA**	15 **VA**	16 **VIA**	17 **VIIA**	2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 23.0	12 **Mg** 24.3	3 **IIIB**	4 **IVB**	5 **VB**	6 **VIB**	7 **VIIB**	8	9 **VIIIB**	10	11 **IB**	12 **IIB**	13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 39.9
19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98.9)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57–71	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89–103	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (264)	108 **Hs** (277)	109 **Mt** (268)	110 **Ds** (271)	111	112	113	114	115	116	117	118

Lanthanide Series	57 **La** 138.9	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
Actinide Series	89 **Ac** (227)	90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

Some of the elements 111 and above have been reported but not fully authenticated and named.

ANSWER KEY

This section contains the answers to the practice test questions in the previous section.

After you have worked through the practice test questions, check the answers given in this section to see which questions you answered correctly.

Question Number	Correct Response	Test Objective
1.	A	Understand and apply knowledge of science as inquiry.
2.	B	Understand and apply knowledge of the concepts, principles, and processes of technological design.
3.	A	Understand and apply knowledge of accepted practices of science.
4.	B	Understand and apply knowledge of the interactions among science, technology, and society.
5.	C	Understand and apply knowledge of the major unifying concepts of all sciences and how these concepts relate to other disciplines.
6.	D	Understand and apply knowledge of cell structure and function.
7.	A	Understand and apply knowledge of the principles of heredity and biological evolution.
8.	D	Understand and apply knowledge of the characteristics and life functions of organisms.
9.	B	Understand and apply knowledge of the characteristics and life functions of organisms.
10.	C	Understand and apply knowledge of how organisms interact with each other and with their environment.
11.	D	Understand and apply knowledge of the nature and properties of energy in its various forms.
12.	D	Understand and apply knowledge of the nature and properties of energy in its various forms.
13.	B	Understand and apply knowledge of the structure and properties of matter.
14.	B	Understand and apply knowledge of forces and motion.
15.	D	Understand and apply knowledge of electricity, magnetism, and waves.
16.	A	Understand and apply knowledge of Earth's land, water, and atmospheric systems and the history of Earth.
17.	C	Understand and apply knowledge of the dynamic nature of Earth.
18.	C	Understand and apply knowledge of the dynamic nature of Earth.

(continued on next page)

Question Number	Correct Response	Test Objective
19.	C	Understand and apply knowledge of objects in the universe and their dynamic interactions.
20.	A	Understand and apply knowledge of the origins of and changes in the universe.
21.	A	Understand and apply knowledge of the concepts of cell biology.
22.	C	Understand and apply knowledge of the concepts of cell biology.
23.	D	Understand and apply knowledge of the molecular basis of heredity and the associated mathematical probabilities.
24.	B	Understand and apply knowledge of the historical progression of cellular biology and genetics and the basic research methods and technologies used in these areas.
25.	B	Understand and apply knowledge of biological evolution and diversity.
26.	A	Understand and apply knowledge of organismal biology, using examples from each kingdom.
27.	C	Understand and apply knowledge of organismal biology, using examples from each kingdom.
28.	D	Understand and apply knowledge of biological diversity in terms of the structure, function, and nomenclature of the major groups of organisms.
29.	B	Understand and apply knowledge of ecological concepts.
30.	D	Understand and apply knowledge of matter, energy, and organization in living systems.

OVERVIEW

The score report indicates whether or not you passed the test and how you performed on each test subarea. The passing scores for the Illinois Licensure Testing System were established by the Illinois State Board of Education based on recommendations from panels of Illinois educators. The passing score for each content-area test is designed to reflect the level of content knowledge and skills required to perform the job of an educator receiving an initial license in Illinois.

Passing Score

To pass a content-area test you must obtain a scaled total test score of 240 or above.

Total Test Score

The total test score is based on your performance on the entire test, specifically the number of multiple-choice questions you answered correctly.

Subarea Scores

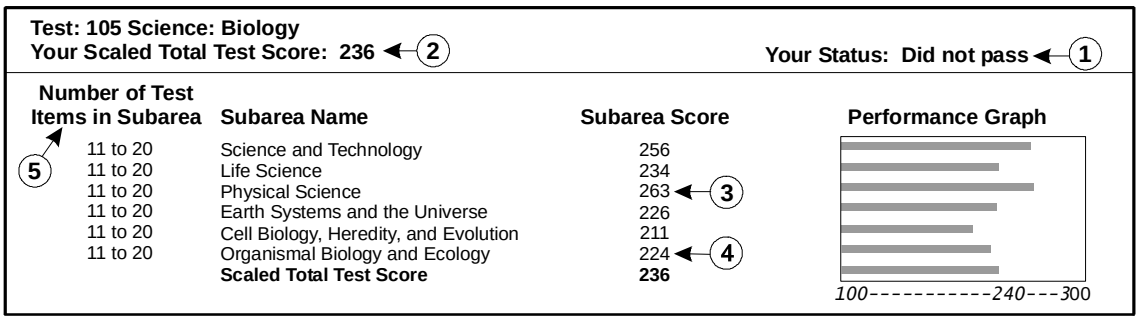
- Subarea scores are presented on the same scale as the total test score.
- Subarea scores contain different numbers of questions and are weighted differently in the computation of the total test score; therefore, the average of the subarea scaled scores generally will not equal the scaled total test score.
- Subarea scores will help you assess your areas of relative strength and weakness.

Reporting of Scores

Your results will be forwarded to the Illinois State Board of Education and to the Illinois institution(s) you indicate during the registration process. You should keep the score report you receive for your own records.

READING YOUR REPORT: A SAMPLE

A sample of a Science: Biology test score report is provided below.



Test: 105 Science: Biology
Your Scaled Total Test Score: 236 ← (2)
Your Status: Did not pass ← (1)

Number of Test Items in Subarea	Subarea Name	Subarea Score
11 to 20	Science and Technology	256
11 to 20	Life Science	234
11 to 20	Physical Science	263 ← (3)
11 to 20	Earth Systems and the Universe	226
11 to 20	Cell Biology, Heredity, and Evolution	211
11 to 20	Organismal Biology and Ecology	224 ← (4)
	Scaled Total Test Score	**236**

(5) ↗ Number of Test Items in Subarea

Performance Graph

100----------240---300

According to the above sample, the examinee did not pass the Science: Biology test ①, because the examinee's total test score of 236 ② is below the passing score of 240.

The examinee did better on the Physical Science section ③ of the test than on the Organismal Biology and Ecology section ④. The examinee will need to retake the test and achieve a total test score of 240 or higher to pass the test. The score report indicates the number of items for each subarea on the test ⑤.