



Georgia Assessments for the Certification of Educators®



GACE® Study Companion

Middle Grades Science Assessment

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About the Assessment

Assessment Name	Middle Grades Science
Grade Level	4–8
Test Code	014
Testing Time	2 hours
Test Duration	2.5 hours
Number of Selected-response Questions	65
Number of Constructed-response Questions	0
Test Format	Computer delivered

The GACE Middle Grades Science assessment is designed to measure the professional knowledge of prospective teachers of science in middle schools in the state of Georgia.

The testing time is the amount of time you will have to answer the questions on the test. Test duration includes time for tutorials and directional screens that may be included in the test.

The questions in this assessment assess both basic knowledge across content areas and the ability to apply principles.

The total number of questions that are scored is typically smaller than the total number of questions on the test. Most tests that contain selected-response questions also include embedded pretest questions, which are not used in calculating your score. By including pretest questions in the assessment, ETS is able to analyze actual test-taker performance on proposed new questions and determine whether they should be included in future versions of the test.

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Content Specifications

This assessment is organized into content **subareas**. Each subarea is further defined by a set of **objectives** and their **knowledge statements**.

- The objectives broadly define what an entry-level educator in this field in Georgia public schools should know and be able to do.
- The knowledge statements describe in greater detail the knowledge and skills eligible for testing.
- Some tests also include content material at the evidence level. This content serves as descriptors of what each knowledge statement encompasses.

See a breakdown of the subareas and objectives for this assessment on the following pages.

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Test Subareas

Subarea	Approx. Percentage of Test
I. Scientific Inquiry, Processes, Technology, and Society	20%
II. Physical Science	30%
III. Life Science	30%
IV. Earth and Space Science	20%

Test Objectives

Subarea I: Scientific Inquiry, Processes, Technology, and Society

Objective 1: Understands the nature of scientific inquiry and processes, including the collection and analysis of data

The beginning Middle Grades Science teacher:

- A. Understands methods of scientific inquiry and design
 - Identifying problems based on observations
 - Forming and testing hypotheses
 - Development of theories, models, and laws
 - Experimental design, including independent and dependent variables, controls, and sources of error
 - Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding
- B. Understands the history and nature of scientific knowledge
 - Subject to change and consistent with evidence
 - Based on reproducible evidence
 - Unifying concepts and processes such as systems, models, constancy and change, equilibrium, and form and function
 - Accepted principles and models develop over time
 - Major developments in science such as atomic theory and genetics
 - Contributions of major historical figures such as Darwin and Newton
- C. Understands the processes involved in collecting and analyzing scientific data
 - Common units of measurement (metric and English) including unit conversion and prefixes such as milli and kilo

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- Organization and presentation of data
 - Trends in data
 - Relationships between variables such as direct/indirect
 - Predictions and valid conclusions based on data
 - Basic data and error analysis, including determining mean, accuracy, precision, and sources of error
- D. Understands the procedures for safe and correct use of laboratory and field materials and equipment
- Appropriate and safe preparation, use, storage, and disposal of materials such as chemicals and lab specimens
 - Appropriate and safe use of equipment such as glassware and microscopes
 - Preparations for demonstrations, activities, or field use
 - Basic use and maintenance of equipment such as microscopes and balances
 - Use of standard safety equipment such as eyewash stations and shower
 - Laboratory safety rules for students
 - Appropriate apparel and conduct in the laboratory
 - Emergency procedures for events such as fires, chemical spills, and injuries

Objective 2: Understands the relationship of science and technology to society and the environment

The beginning Middle Grades Science teacher:

- A. Understands that science and technology impact the environment and society
- Acid rain
 - Air and water pollution
 - Greenhouse gases
 - Ozone layer depletion
 - Waste disposal and recycling
 - Green chemistry
 - Irrigation
 - Reservoirs and levees
 - Depletion of aquifers
 - Loss of biodiversity

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- B. Understands major issues associated with energy production and the management of natural resources
- Renewable and nonrenewable energy resources
 - Conservation, recycling, and sustainability
 - Pros and cons of power generation based on various sources such as fossil and nuclear fuel, hydropower, wind power, solar power, and geothermal power
 - Issues associated with the use and extraction of Earth's resources; e.g., mining, land reclamation, and deforestation
- C. Understands applications of science and technology in daily life and public health
- Chemical properties of household products
 - Communication technologies; e.g., wireless devices, GPS, satellites
 - Basic science principles applied in commonly used consumer products such as batteries and sunglasses
 - Water purification
 - Common agricultural practices, such as the use of herbicides, insecticides, and genetically modified crops.
 - Medical technologies, such as medical imaging, X rays, and radiation therapy

Subarea II: Physical Science

Objective 1: Understands the organization of matter, the atomic model, and relationships involving energy and matter

The beginning Middle Grades Science teacher:

- A. Understands the organization of matter
- Elements, compounds, and mixtures
 - Atoms, molecules, and ions
 - Basic properties of solids, liquids, and gases.
 - Atomic structure, including nucleus, electrons, protons, and neutrons
 - Atomic number, atomic mass, isotopes
 - Electron arrangements
 - Nature of radioactive substances
 - Fission and fusion
- B. Understands basic concepts and relationships involving energy and matter
- Conservation of energy and conservation of matter
 - Kinetic and potential energy
 - Conversions between different forms of energy, such as thermal, chemical, and electrical

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- Chemical and physical properties/changes
 - Phase transitions and the energy changes involved such as heat of vaporization
 - Basic assumptions of the kinetic molecular theory
 - Temperature scales such as Celsius, Fahrenheit, and Kelvin
 - Conduction, convection, and radiation
 - Applications of energy and matter relationships in life and Earth/space science

Objective 2: Understands chemistry, including the periodic table, compounds, formulas, bonding, reactions, and solutions

The beginning Middle Grades Science teacher:

- A. Understands types of bonding and composition and the formulas of simple compounds
 - Covalent and ionic bonding
 - Naming simple compounds based on formula and writing formulas based on name
- B. Understands the organization of the periodic table and can use it to predict trends in physical and chemical properties
 - Symbols of the elements
 - Arrangement of elements on the table
 - Atomic number and atomic mass
 - Trends in physical and chemical properties of elements such as metals and nonmetals, based on their position on the table
- C. Understands basic concepts involved in chemical reactions
 - Balancing equations of simple chemical reactions
 - Types of reactions such as combustion, single or double replacement, and oxidation
 - Energy consumed or produced in reactions (endothermic and exothermic reactions)
 - Factors that affect reaction rates such as concentration, temperature, pressure, and catalysts
 - The basic concept of reaction equilibrium
- D. Understands acid-base chemistry
 - Chemical and physical properties of acids and bases
 - pH scale
 - Neutralization
 - Acid-base indicators, such as phenolphthalein, pH paper, and litmus paper
- E. Understands solutions and solubility
 - Dilute, concentrated, saturated, unsaturated, and supersaturated solutions
 - Understands that solutions can vary by concentration

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- Effect of temperature, pressure, particle size, and agitation on the rate of dissolving
 - Effect of temperature and pressure on solubility
 - Dissociation of ionic compounds such as salts in water; e.g., ionization, electrolytes
 - Conceptual understanding of freezing point depression

Objective 3: Understands physics, including mechanics, electricity and magnetism, and wave properties

The beginning Middle Grades Science teacher:

A. Understands basic concepts in mechanics

- Describe motion in terms of speed, velocity, acceleration, and displacement
- Newton's laws of motion
- Gravitational attraction and acceleration due to gravity
- Distinguish between mass and weight
- Friction
- Work, energy, and power
- Analyze motion and forces in applications such as inclined planes and projectile motion
- Periodic motion including pendulums, oscillating springs, planetary orbits, and satellites
- Conservation of momentum and collisions
- Simple machines such as the wedge, screw, and lever
- Forces and physical properties involving fluids including buoyancy, density, and pressure

B. Understands basic concepts in electricity and magnetism

- Electrostatic attraction and repulsion
- Conductivity, conductors, and insulators
- Direct current (DC) and alternating current (AC)
- Relationship among current, resistance, voltage, and power
- Basic series and parallel circuits
- Voltage sources such as batteries and generators
- Magnetic attractive and repulsive force and magnetic poles
- Magnetic materials and electromagnets

C. Understands concepts involving waves and optics

- Nature of light and the electromagnetic spectrum including visible, ultraviolet, infrared, microwave, and gamma

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- Transverse and longitudinal waves
 - Mechanical waves, such as sound waves
 - Wave properties, such as frequency, amplitude, wavelength, speed, and energy
 - Wave phenomena, such as reflection, refraction, diffraction, interference, and scattering
 - Sound properties, such as pitch/frequency, loudness/intensity, and resonance
 - The Doppler effect
 - Mirrors and prisms
 - Lenses and their applications, such as the human eye, microscope, and telescope

Subarea III: Life Science

Objective 1: Understand the structure of cells and cellular processes, basic genetics, and the mechanisms of evolution

The beginning Middle Grades Science teacher:

- A. Understands the basic structure and function of cells and their organelles
 - Structure and function of cell membranes
 - Structure and function of animal and plant cell organelles
 - Levels of organization; e.g., cells, tissues, organs, organ systems
 - Major features of common animal cell types
 - Prokaryotes and eukaryotes
 - Cell cycle
 - Mitosis, meiosis, cytokinesis
- B. Understands the basic biochemistry of life
 - Cellular respiration
 - Photosynthesis
 - Biological molecules such as DNA, carbohydrates, proteins, lipids, and enzymes
- C. Understands basic genetics
 - Structure and function of DNA and RNA
 - Chromosomes, genes, alleles
 - Dominant and recessive traits
 - Mendelian inheritance, including genotype, phenotype, use of Punnett squares, and pedigrees
- D. Understands the theory and key mechanisms of evolution
 - Mechanisms of evolution including natural selection

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- Isolation mechanisms and speciation
 - Supporting evidence, including the fossil record and homologous structures

Objective 2: Understands characteristics of organisms and principles of ecology

The beginning Middle Grades Science teacher:

- A. Understands the elements of the hierarchical classification scheme
 - Basic taxonomy
 - Characteristics of bacteria, animals, plants, fungi, and protists
- B. Understands the major structures of plants and their functions
 - Characteristics of vascular and nonvascular plants
 - Structure and function of roots, leaves, and stems
 - Asexual and sexual reproduction
 - Uptake and transport of nutrients and water
 - Responses to stimuli and homeostasis
- C. Understands the basic anatomy and physiology of animals, including the human body
 - Response to stimuli and homeostasis
 - Systems that exchange with the environment, including respiratory, excretory, and digestive systems
 - Internal transport and exchange, including circulatory system
 - Control systems, such as the nervous system and the endocrine systems
 - Movement and support, including the skeletal and muscular systems
 - Reproductive system
 - Reproductive patterns and life cycles of common organisms
 - Immune system
- D. Understands basic population dynamics
 - Growth curves and carrying capacity
 - Intraspecific relationships such as mating systems, social systems, and competition
- E. Understands basic community ecology
 - Niche and habitat
 - Interspecific relationships, such as predator-prey and parasitism
- F. Understands ecosystems
 - Biomes
 - Stability and disturbances, such as glaciation, climate change, and succession
 - Energy flow, such as trophic levels and food webs

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- Biogeochemical cycles, including water, nitrogen, and carbon cycles and biotic/abiotic interaction

Subarea IV: Earth and Space Science

Objective 1: Understands geology, including Earth's structure, rocks, minerals, plate tectonics, and historical geology

The beginning Middle Grades Science teacher:

- A. Understands the types and basic characteristics of rocks and minerals and their formation processes
 - The rock cycle
 - Characteristics of sedimentary, igneous, and metamorphic rocks and their formation processes
 - Characteristics and function of minerals
- B. Understands the processes involved in erosion, weathering, and deposition of Earth's surface materials and soil formation
 - Erosion and deposition
 - Chemical and physical weathering
 - Characteristics of soil
 - Porosity and permeability
 - Runoff and infiltration
- C. Understands Earth's basic structure and internal processes
 - Earth's layers, such as the crust, mantle, and core
 - Earth's shape and size
 - Geographical features
 - Earth's magnetic field
- D. Understands plate tectonic theory and evidence
 - Plate boundary interactions
 - Continental drift, lithospheric plates, seafloor spreading, magnetic reversals
 - Characteristics of volcanoes
 - Characteristics of earthquakes, including seismic waves
- E. Understands historical geology
 - Principle of uniformitarianism
 - Basic principles of relative age dating, including superposition and fossil succession
 - Geologic time scale

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- Fossil record as evidence of the origin and development of life, including fossilization methods, mass extinctions, ice ages, and meteor impacts

Objective 2: Understands the hydrosphere and the atmosphere, and astronomy

The beginning Middle Grades Science teacher:

A. Understands the water cycle

- Evaporation and condensation
- Precipitation
- Runoff and infiltration
- Transpiration
- Properties of water that affect Earth systems such as density, changes on freezing, high heat capacity, and solvent properties

B. Understands the characteristics and processes of Earth's oceans and other bodies of water

- Distribution and location of Earth's water
- Seawater composition
- Coastline topography and topography of ocean floor such as estuaries, barrier islands, and reefs
- Tides, waves, and currents
- Polar ice, icebergs, and glaciers
- Lakes, ponds, and wetlands
- Streams, rivers, and river deltas
- Groundwater, water table, wells, aquifers, geysers, and springs

C. Understands the basic composition of Earth's atmosphere and basic concepts of weather

- Layers and composition of the atmosphere
- Atmospheric pressure and temperature
- Relative humidity and dew point
- Wind
- Cloud types and formation
- Types of precipitation
- Air masses, fronts, storms, and severe weather such as hurricanes and tornadoes
- Development and movement of weather patterns

D. Understands the major factors that affect climate and seasons

- Effects of latitude, geographical location, and elevation

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

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- Effects of atmospheric circulation, such as trade winds and the jet stream
 - Effects of ocean circulation
 - Characteristics and locations of climate zones, such as the Tropics and the Arctic
 - Effect of the tilt of Earth's axis on seasons
- E. Understands the major features of the solar system
- Structure of the solar system
 - The laws of motion and gravity
 - Characteristics of the Sun, Moon, and planets
 - Characteristics of asteroids, meteoroids, comets, and dwarf/minor planets
 - Theories of origin of the solar system
- F. Understands the interactions of the Earth-Moon-Sun system
- Effect on seasons
 - Effect on tides
 - Earth's rotation and orbital revolution around the Sun
 - Phases of the Moon
 - Solar and lunar eclipses
- G. Understands major features of the universe
- Galaxies
 - Characteristics of stars and their life cycles
 - Theories about the origin of the universe
 - Contributions of space exploration and technology to our understanding of the universe

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Practice Questions

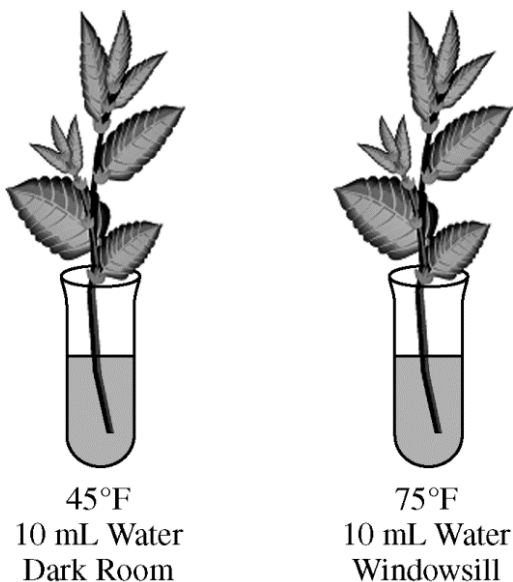
The practice questions in this study companion are designed to familiarize you with the types of questions you may see on the assessment. While they illustrate some of the formats and types of questions you will see on the test, your performance on these sample questions should not be viewed as a predictor of your performance on the actual test. Fundamentally, the most important component in ensuring your success is familiarity with the content that is covered on the assessment.

To respond to a practice question, choose one of the answer options listed. Be sure to read the directions carefully to ensure that you know what is required for each question. You may find it helpful to time yourself to simulate actual testing conditions. A correct answer and a rationale for each sample test question are in the section following the practice questions.

Keep in mind that the test you take at an actual administration will have different questions, although the proportion of questions in each subarea will be approximately the same. You should not expect the percentage of questions you answer correctly in these practice questions to be exactly the same as when you take the test at an actual administration, since numerous factors affect a person's performance in any given testing situation.

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case.



1. To see how long plant cuttings can live in water with the parameters shown in the diagram above, a student set up an experiment. Which of the following can be tested by this experiment?
 - A. Whether temperature affects how long a plant cutting can live
 - B. Whether light is necessary for a plant cutting to live
 - C. Whether light and temperature together affect how long a plant cutting can live
 - D. The effect of temperature and light cannot be determined

Answer and Rationale

2. In a classroom activity, a student lowers a steel bolt connected to a string into a graduated cylinder containing water. Which of the following properties is the student measuring?
 - A. Mass
 - B. Weight
 - C. Volume
 - D. Density

Answer and Rationale

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

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3. Eutrophication in bodies of water such as streams and lakes is usually caused by
- A. a buildup of nutrients resulting from runoff containing fertilizer.
 - B. a decrease in average annual temperatures.
 - C. overfishing.
 - D. acid rain.

Answer and Rationale

4. Which of the following could be the pH of a sample of vinegar?
- A. 4
 - B. 7
 - C. 9
 - D. 14

Answer and Rationale

5. Which of the following processes is involved when the arrangement of molecules in a substance changes from regular and closely packed to random and close together?
- A. Thermal contraction
 - B. Melting
 - C. Condensation
 - D. Freezing

Answer and Rationale

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

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6. Some substances have no noticeable odor because they
- A. are soluble in water.
 - B. cannot lose the heat that must be lost before an odor can be detected.
 - C. have relatively few molecules escaping into the air.
 - D. do not have molecules with one of the two molecular arrangements required to give an odor.

Answer and Rationale

7. Of the following metals, which has the lowest chemical reactivity?
- A. Aluminum
 - B. Gold
 - C. Iron
 - D. Sodium

Answer and Rationale

8. Finding that a solution conducts an electric current shows conclusively that the solution
- A. has a high boiling point.
 - B. contains molecules.
 - C. is a good oxidizing agent.
 - D. contains ions.

Answer and Rationale

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

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9. An imbalance between positive and negative charges in an object is known as
- A. electrical resistance.
 - B. magnetism.
 - C. kinetic energy.
 - D. static electricity.

Answer and Rationale

10. Several vehicles, initially at a complete stop, begin a long race at the same starting point. The vehicle that has a constant value for which of the following is most likely to win?
- A. Linear speed
 - B. Linear velocity
 - C. Linear acceleration
 - D. Momentum

Answer and Rationale

11. A piece of paper that appears blue in sunlight is illuminated solely by a red light that is passed through a green filter. What color does the paper appear under this illumination?
- A. Blue
 - B. Green
 - C. Red
 - D. Black

Answer and Rationale

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

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12. Which of the following is most likely to increase the rate of photosynthesis in an ecosystem?
- A. Increased carbon dioxide (CO₂) in the air
 - B. Increased oxygen (O₂) in the air
 - C. Increased argon (Ar) in the air
 - D. Increased ozone (O₃) in the air

Answer and Rationale

13. Albinism is a condition caused by a recessive allele that follows normal Mendelian inheritance. If two nonalbino individuals have an albino child, what is the percent chance that their next child will be albino?
- A. 0%
 - B. 25%
 - C. 50%
 - D. 100%

Answer and Rationale

14. The primary function of mitochondria in eukaryotic cells is to produce
- A. hormones.
 - B. cholesterol.
 - C. sugars.
 - D. ATP.

Answer and Rationale

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

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15. Which of the following is most directly involved in controlling levels of sugar in blood?
- A. Hemoglobin
 - B. Calcitonin
 - C. Thyroid-stimulating hormone
 - D. Insulin

Answer and Rationale

16. Which of the following groups includes animals that have a backbone and a spinal cord?
- A. Mollusks
 - B. Chordates
 - C. Insects
 - D. Echinoderms

Answer and Rationale

17. In a particular area, both woodchucks and squirrels eat the same kind of nut. The relationship between the two animals is an example of
- A. parasitism.
 - B. mutualism.
 - C. competition.
 - D. predation.

Answer and Rationale

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

18. Which THREE of the following cycle within the global ecological system?

- A. Carbon
- B. Nitrogen
- C. Water
- D. Energy

Answer and Rationale

19. The agent most widely and consistently at work changing the appearance of Earth's surface is

- A. fire.
- B. volcanism.
- C. water.
- D. wind.

Answer and Rationale

20. Of the following locations, fossils are most likely to be found

- A. dissolved in ocean water.
- B. in granite.
- C. in diamonds.
- D. in sedimentary rock.

Answer and Rationale

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

21. Which of the following statements is true of hurricanes but not true of tornadoes?

- A. They form only over warm oceans.
- B. They have very high winds.
- C. They may cause great property damage.
- D. They may cause human fatalities.

Answer and Rationale

22. Earth's seasons can be attributed primarily to which of the following in conjunction with Earth's revolution around the Sun?

- A. The tilt of Earth's axis of rotation relative to the ecliptic
- B. The varying amount of sunspot activity
- C. The elliptical shape of Earth's orbit around the Sun
- D. The rotation of Earth during a 24-hour day

Answer and Rationale

23. Which of the following best describes the Sun?

- A. White dwarf star
- B. Red giant star
- C. Yellow main sequence star
- D. Blue giant star

Answer and Rationale

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Answer Key and Rationales

Question Number	Correct Answer	Rationale
1	D	<p>Option D is correct. The setup of the experiment shows that one of the plant cuttings was placed in a dark room and set in cool water, while the other was placed on a windowsill in sunlight and was set in warm water. The design of the experiment is flawed because two different conditions, rather than only one, are varied between the samples. For the experiment to be effective, either both plant cuttings need to be placed in water of the same temperature but in different locations, or both plant cuttings need to be in the same location but in water of different temperatures.</p> <p>Back to Question</p>
2	C	<p>Option C is correct. The process described in the activity is indirectly measuring the volume of the steel bolt by measuring the volume of the water displaced when the bolt is completely lowered into the water. The student can determine the volume of the bolt by determining the difference between the original volume reading and the volume reading after the bolt is put in the water.</p> <p>Back to Question</p>

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Question Number	Correct Answer	Rationale
3	A	<p>Option A is correct. Eutrophication is the process by which water acquires a high concentration or enrichment of plant nutrients, especially nitrogen and phosphorus. This leads to oxygen depletion by algal blooms, which often destroy aquatic life and alter the ecosystem in the affected area. Nitrogen and phosphorus are commonly used in agricultural fertilizers to help increase crop production. Excessive fertilizer use has led to a large influx of these nutrients into freshwater systems.</p> <p>Back to Question</p>
4	A	<p>Option A is correct. The pH of vinegar must be less than 7 because it is a mixture of water and acetic acid, along with some other trace chemicals. The pH can be as low as 2 depending on the concentration of the acetic acid in the water.</p> <p>Back to Question</p>
5	B	<p>Option B is correct. When a substance melts, it changes from a solid to a liquid. In a molecular solid, the molecules are in a regular and closely packed arrangement. In a molecular liquid, the molecules are close together but can move randomly.</p> <p>Back to Question</p>

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Question Number	Correct Answer	Rationale
6	C	<p>Option C is correct. In order to smell a particular substance, it must enter the nasal cavity via the air. In addition, it must be sufficiently soluble in water to dissolve in the fluid coating of the cells lining the nasal cavity.</p> <p>Back to Question</p>
7	B	<p>Option B is correct. Gold is less chemically reactive than sodium (which reacts with cold water), aluminum (which reacts with steam or acids), or iron (which reacts with acids). Gold only reacts with very strong oxidizing agents.</p> <p>Back to Question</p>
8	D	<p>Option D is correct. Substances whose water solutions conduct an electric current are called electrolytes. Electrolytes, when in solution, break down into smaller charged particles called ions.</p> <p>Back to Question</p>

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Question Number	Correct Answer	Rationale
9	D	<p>Option D is correct. An excess of positive or negative charge that has accumulated on an object is referred to as static electricity.</p> <p>Back to Question</p>
10	C	<p>Option C is correct. The vehicle having a constant value for linear acceleration would constantly increase its speed over time. Therefore, a vehicle that constantly accelerated would cover a given distance in the shortest time and most likely win a race against vehicles with constant values for the other parameters listed.</p> <p>Back to Question</p>
11	D	<p>Option D is correct. The green filter absorbs the red light and all other colors except green light, which passes through the filter. Therefore, since the red light is blocked by the filter, the paper will not be illuminated and will appear black.</p> <p>Back to Question</p>

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Question Number	Correct Answer	Rationale
12	A	<p>Option A is correct. Since carbon dioxide is a key reactant in many forms of photosynthesis, an increase in carbon dioxide in the air is more likely to increase the rate of photosynthesis in an ecosystem than oxygen, argon, or ozone. Oxygen is a product of photosynthesis. Argon and ozone are not reactants or products in photosynthesis.</p> <p>Back to Question</p>
13	B	<p>Option B is correct. If the individuals are nonalbino but have an albino child, the individuals must be heterozygous (Aa) for the alleles of the particular gene involved. An albino individual has two copies of the recessive allele (aa). About 50% of each individual's gametes will contain the A allele and about 50% will contain the a allele. Hence, for each child, there is a 25% chance of a sperm with the recessive a allele fertilizing an egg with an a allele, thereby producing an albino child.</p> <p>Back to Question</p>
14	D	<p>Option D is correct. The primary function of the mitochondria in eukaryotic cells is to produce ATP. Hormones, cholesterol, and sugars are not produced in the mitochondria.</p> <p>Back to Question</p>

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Question Number	Correct Answer	Rationale
15	D	<p>Option D is correct. In response to rising levels of glucose in the blood, cells in the pancreas secrete the hormone insulin. Circulating insulin lowers blood sugar levels by enhancing the transport of glucose and other simple sugars into body cells, especially muscle cells.</p> <p>Back to Question</p>
16	B	<p>Option B is correct. Vertebrates belong to the phylum Chordata. All chordates have a notochord but only vertebrates have a backbone surrounding the spinal cord.</p> <p>Back to Question</p>
17	C	<p>Option C is correct. The relationship between the woodchucks and the squirrels is an example of direct competition, in which both species are harmed. Competing for the same food needed by both can potentially harm both animals.</p> <p>Back to Question</p>

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Question Number	Correct Answer	Rationale
18	A, B, C	<p>Options A, B, and C are correct. Within the global ecological system carbon, nitrogen, and water cycle, but energy does not. A net input of energy is required.</p> <p>Back to Question</p>
19	C	<p>Option C is correct. While the agents given in the other options do influence and change the appearance of Earth's surface, water is constantly acting on terrestrial features in the form of precipitation, glaciers, streams, rivers, and oceans. Therefore, it contributes to the chemical and mechanical weathering of the land surface in most parts of the globe.</p> <p>Back to Question</p>
20	D	<p>Option D is correct. Fossils are primarily found in sedimentary rock. Fossils are rarely found in granite and not found in diamonds. Fossils are never found dissolved in sea water because if they were dissolved then they would no longer be fossils.</p> <p>Back to Question</p>

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Question Number	Correct Answer	Rationale
21	A	<p>Option A is correct. The other options are true of both tornadoes and hurricanes. However, hurricanes require warm ocean surface waters in order to develop, and it is from these warm waters and the release of latent heat that they derive their energy. Tornadoes are associated with thunderstorms, form over land, and are most likely to occur when large differences in temperature and moisture exist between two air masses and the boundary between the air masses is sharp.</p> <p>Back to Question</p>
22	A	<p>Option A is correct. As Earth orbits around the Sun, which hemisphere is tilted toward or away from the Sun changes. The seasons change depending on the different concentrations of sunlight reaching Earth's surface as Earth orbits the Sun. Because Earth is tilted on an axis, summer occurs in the hemisphere tilted toward the Sun, which means more focused and concentrated sunlight for longer hours. The hemisphere tilted away from the Sun receives sunlight that is less concentrated, for shorter hours, thus atmospheric temperatures are cooler and that hemisphere experiences winter.</p> <p>Back to Question</p>
23	C	<p>Option C is correct. Main sequence stars, like the Sun, are stable and characterized by the fusion of hydrogen into helium in their cores. The Sun's color is related to its mass.</p> <p>Back to Question</p>

Note: After clicking on a link, right click and select "Previous View" to go back to original text.

Preparation Resources

The resources listed below may help you prepare for the GACE assessment 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 of these materials to obtain information on specific topics for study and review.

Guide to Taking a GACE Computer-delivered Assessment

This guide explains how to navigate through a GACE assessment and how to answer different types of test questions. This free download is available in the Test Preparation Resources section of the GACE website at www.gace.ets.org/prepare.

Reducing Test Anxiety

This guide provides practical help for people who suffer from test anxiety. Designed specifically for GACE test takers, but useful to anyone who has to take tests, this guide reviews the major causes of test anxiety and offers practical advice for how to counter each one.

Study Tips: Preparing for a GACE Assessment

This document contains useful information on preparing for selected-response and constructed-response tests. The instruction, tips, and suggestions can help you become a better-prepared test taker. See the Test Preparation Resources section of the GACE website at www.gace.ets.org/prepare for this free download.

Journals

Science and Children, National Science Teachers Association.

Science Scope, National Science Teachers Association.

The Science Teacher, National Science Teachers Association.

Other Resources

Arons, A. B. (1997). *Teaching Introductory Physics*. Wiley.

Campbell, N. A., Reece, J. B., et al. (2007). *Biology*, Eighth Edition. Benjamin/Cummings. Center for Science, Mathematics, and Engineering Education

National Research Council. (2000). *Inquiry and the National Science Education Standards: A Guide for Teaching and Learning*. Washington, District of Columbia: National Academy Press.

Chang, R. (2010). *Chemistry*, Tenth Edition. McGraw-Hill.

Chiappetta, E. L., Koballa, T. R., and Collette, A. T. (2009). *Science Instruction in the Middle and Secondary Schools*, Seventh Edition. Allyn & Bacon.

Crotts, D. (1995). *Critical Thinking Skills: Science*. Frank Schaffer Publications, Inc.

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

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- Halliday, D., Resnick, R., and Walker, J. (2010). *Fundamentals of Physics*, Ninth Edition. Wiley.
- Hamblin, W. K., and Christiansen, E. H. (2003). *Earth's Dynamic Systems*, Tenth Edition. Prentice-Hall.
- Hewitt, P., Suchocki, J., and Hewitt, L. A. (2007). *Conceptual Physical Science*, Fourth Edition. Addison-Wesley.
- Joyce, B. R., Weil, M., and Calhoun, E. (2003). *Models of Teaching*, Seventh Edition. Allyn & Bacon.
- Levin, H. L. (2010). *The Earth Through Time*, Ninth Edition. Wiley.
- National Research Council. (1996). *National Science Education Standards*. Washington, District of Columbia: National Academy Press.
- Ostlund, K. L. (1992). *Science Process Skills: Assessing Hands-On Student Performance*. Menlo Park, Calif.: Addison-Wesley Publishing Company, Inc.
- Project 2061 (American Association for the Advancement of Science) (1993). *Benchmarks for Science Literacy*. New York, N.Y.: Oxford University Press. B 66 TExES Preparation Manual — Science 4–8.
- Rakow, S. J. (Ed.). (1998). *NSTA Pathways to the Science Standards: Guidelines for Moving the Vision into Practice*, Middle School Edition. Arlington, Va.: National Science Teachers Association.
- Ramig, J., Bailer, J., and Ramsey, J. (1995). *Teaching Science Process Skills*. Torrence, Calif.: Frank Schaffer Publications, Inc.
- Rezba, R., et al. (2008). *Learning and Assessing Science Process Skills*, Fifth Edition. Kendall/Hunt Publishing Company.
- Santa, C. M., and Alverman, D. E. (Eds.). (1991). *Science Learning: Processes and Applications*. Newark, Del.: International Reading Association, Inc.
- Serway, R. A., Vuille, C., and Faughn, J. S. (2009). *College Physics*, Eighth Edition. Brooks Cole.
- Starr, C., Taggart, R., and Evers, C. (2009). *Biology: The Unity and Diversity of Life*, Twelfth Edition. Brooks Cole.
- Tarback, E. J., Lutgens, F. K., and Tasa, D. (2007). *Earth: An Introduction to Physical Geology*, Ninth Edition. Prentice-Hall.
- Thompson, G., and Turk, J. (2009). *Earth Science and the Environment*, Fourth Edition. Brooks Cole.
- Whitten, K. W., Davis, R. E., Peck, L., and Stanley, G. G. (2006). *General Chemistry*, Eighth Edition. Brooks Cole.
- Wright, R. T. (2008). *Environmental Science: Toward a Sustainable Future*, Ninth Edition. Prentice-Hall.
- Zumdahl, S. S., and Zumdahl, S. A. (2007). *Chemistry*, Seventh Edition. Houghton Mifflin.

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Online Resources

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

American Association of Physics Teachers — www.aapt.org

American Astronomical Society — www.aas.org

American Chemical Society — www.acs.org

American Institute of Biological Sciences — www.aibs.org

American Physical Society — www.aps.org

National Association of Biology Teachers — www.nabt.org

National Association of Geoscience Teachers — www.nagt.org

National Science Teachers Association — www.nsta.org

The Geological Society of America — www.geosociety.org

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