

# Science Student Guide

## Georgia Performance Standards Version

A Guide for Students Preparing for the  
Georgia High School Graduation Tests



# Science

*Includes:*

Description of the Content of the Test  
Sample Science Test Items and Explanations  
Practice Questions

**NOTE:** This document is intended as a student aid.  
Please photocopy as necessary for student use.



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State School Superintendent  
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## INTRODUCTION

### **Georgia High School Graduation Tests**

To earn a high school diploma in Georgia, all students must pass tests in English language arts, mathematics, science, social studies, and writing. The content tests are referred to as the Georgia High School Graduation Tests (GHSGT). The writing test is referred to as the Georgia High School Writing Test (GHSWT). Students take all five tests for the first time in the 11th grade.

For a detailed explanation of the GHSGT, refer to the Department of Education Web site: [http://www.gadoe.org/ci\\_testing.aspx?PageReq=CI\\_TESTING\\_GHSGT](http://www.gadoe.org/ci_testing.aspx?PageReq=CI_TESTING_GHSGT).

### **The Georgia High School Graduation Test in Science**

This document is designed to help you prepare for the Georgia Performance Standards (GPS) version of the graduation test in science. This test was administered to first-time test-takers in spring 2008. The *Science Student Guide—GPS* can be viewed at the Web site provided above.

If you took the science test prior to spring 2008, you will take the dually aligned GPS/QCC (Transitional) version. Look for the GPS and GPS/QCC designations in the document title. You may also use this document.

If you are an 11th-grade student, you must take the test in the spring of the 11th grade. Students who are unsure when they should take the test should contact their school counselor.

Students who have taken the test without passing may retest at any administration. You will have up to five opportunities to take and pass the test between the spring administration of your 11th-grade year and the summer after your 12th grade year.

If you do not pass the science test but have met all other graduation requirements, you may be eligible for a certificate of performance or a special education diploma. If you leave school with a certificate of performance or a special education diploma, you may retake the test as often as necessary to qualify for a high school diploma.

Students who meet certain criteria may be eligible to apply to the State Board of Education for a waiver or variance. Refer to the [Georgia Department of Education Web site](http://www.gadoe.org) for more information at [www.gadoe.org](http://www.gadoe.org).

## CONTENT COVERED ON THE SCIENCE GHSGT

### Reference Resource

The GHSGT in science allows students the use of a page of common equations and the Periodic Table, printed in the test booklets and available to the students during testing.

The *GHSGT Science Test Content Descriptions for 2011* refer to the GPS, which can be accessed at <https://www.georgiastandards.org>. Additional information about the GHSGT program can be found at [http://www.gadoe.org/ci\\_testing.aspx?PageReq=CI\\_TESTING\\_GHSGT](http://www.gadoe.org/ci_testing.aspx?PageReq=CI_TESTING_GHSGT).

### Science Domains: Descriptions of associated content and nature of items

#### Cells and Heredity (26% of the test)

*Students of science must understand the importance of cells to all living things. Cells are made up of many organelles, each with a specific function in cell processes such as reproduction and homeostasis. DNA stores and transmits cellular information making it possible for traits to change or be passed on to other generations. Students demonstrate understanding by identifying, analyzing, and explaining various cell structures and relating these structures to their functions. Students also relate cell structure to the complexity of organisms and systems and their ability to survive. Assessment of this domain focuses on students' abilities to understand specialized cell parts, to analyze elements in living cells, and to compare diffusion and osmosis. Assessments focus on concepts not specific laws, on essential elements and processes, on genetic terms and expressions at a chemical level, and practical applications of genetics.*

*Items in the domain of cells and heredity test student knowledge of the importance of cells to all living things. Items in this domain focus on how cells perform basic processes, such as reproduction, homeostasis, and the storage and transmission of cellular information.*

#### Ecology and Biodiversity (17% of the test)

*Students of science must understand the concept of interdependence among organisms, especially with regard to the flow of matter and energy within ecosystems. Students must understand biome types as they relate to the climate, geography, and vegetation of given areas, but not simply locate biome types on maps. In addition, it is important for students to evaluate change over time and relate natural selection to changes in organisms. Students will examine the role of natural selection in the success of species. Assessment in this domain focuses on students identifying, analyzing, and evaluating relationships among organisms, populations, communities, ecosystems, and biomes. Further, students must recognize that modern ideas about evolution provide a scientific explanation for the history of life on Earth as described by the fossil record.*

*Items in the domain of Ecology and biodiversity test student knowledge of the concept of interdependence among organisms, especially the flow of matter and energy within ecosystems and the modern ideas about evolution. Items in this domain focus on the ability to identify, analyze, and evaluate relationships among organisms, populations, communities, ecosystems, and biomes. Items in this domain also focus on natural selection, biochemical and fossil support of the theory of evolution, the role of evolution in biological resistance, and the history of life on Earth.*

**Structure and Properties of Matter** (14% of the test)

*Knowledge of atomic structure and the relationship between the motion of atoms and the states of matter is fundamental to understanding concepts in courses included in the 2008 science graduation requirements. Assessment in this domain includes knowledge about the locations of subatomic particles, the effects of changes in the number or arrangement of subatomic particles in elements, and the characteristics of different elements and substances. Students examine atoms with different numbers of neutrons and protons and use the first 20 elements of the Periodic Table to examine atomic mass and atomic number. Students also compare and contrast the atomic and molecular motion of solids, liquids, gases, and plasmas.*

*Items in structure and properties of matter test student knowledge of changes in the number or arrangement of subatomic particles in elements and the characteristics of different elements and substances. Assessment in this domain focuses on the conceptual examination of the atom, including the nucleus, protons, neutrons, and electrons.*

**Energy Transformations** (17% of the test)

*Students of science must understand the various forms in which energy exists and how it may be transformed from one form to another. Questions assess conceptual understanding of energy transformation and radioactivity.*

*Items test student knowledge of the various forms in which energy exists and how it may be transformed from one form to another. Assessment in this domain focuses on the phases of matter and energy transformations.*

**Forces, Waves, and Electricity** (26% of the test)

*Students of science must understand the relationship of force, mass, and motion through Newton's Laws of Motion. Assessment in this domain focuses on students' abilities to apply the concepts of inertia, equal and opposite forces, and gravitational force, velocity and acceleration, waves, magnetism, and electricity. Students demonstrate understanding of these concepts in several ways including calculating velocity and acceleration. Students analyze factors affecting the transfer of energy by heat, light, sound, or mechanical waves including reflection, refraction, interference, and diffraction. Students apply knowledge of magnetism and electricity as they relate to the movement of electrical charges in electromagnets and simple motors.*

*These items test your knowledge of the relationship of force, mass, and motion through Newton's laws of motion. Assessment in this domain focuses on concepts of inertia, forces, and gravitational force, velocity and acceleration, mechanical advantage, waves, magnetism, and electricity.*

The Science 2011 Test Content Descriptions Georgia Performance Standards Version describes the content that will appear on the science GHS GT. This document appears on the Georgia Department of Education Web site at this address:

[http://www.gadoe.org/ci\\_testing.aspx?folderID=227&m=links&ft=Content%20Descriptions](http://www.gadoe.org/ci_testing.aspx?folderID=227&m=links&ft=Content%20Descriptions).

For students taking the GPS/QCC version of the GHS GT, the test content descriptions are provided at the same Web site provided above.

## PREPARING FOR THE TEST

The [GHS GT Science Test 2011 GPS Version](#) describes the content that you can expect to find on the test. To review what you have learned in your science courses, you may use any high school textbook that covers physical science and biology.

The sample test items that appear on pages 9 through 14 are representative of test items that assess content knowledge of each of the five domains. There is also a practice test of 33 questions on pages 15 through 25 to help you prepare to take the actual test.

Finally, you may use questions in the [Georgia Online Assessment System](#) for further practice. You may locate a link to the Georgia Online System on the Georgia Department of Education home page at [www.gadoe.org](http://www.gadoe.org).

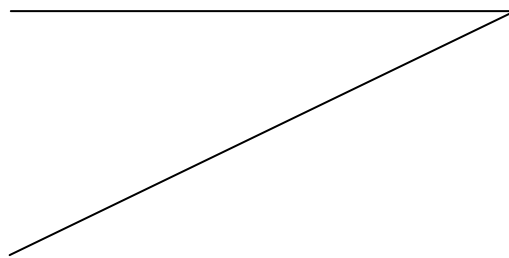
### What You Will Find on the Test

The science test consists of between 70 and 80 multiple-choice questions. Each question has four possible answers; only **one** of the four choices is the correct answer. You should be able to complete the test in 90 minutes. However, you have up to 3 hours if needed.

The following sample item explains the parts of a test question:

Use this part of the periodic table to answer question 1.

5
<b>B</b>
Boron
10.811
2, 3



Stimulus

1. To what does the number 5 refer?

Stem

- A. the element's atomic mass < Distractor
- B. the element's atomic number < Correct Response
- C. the element's number of neutrons < Distractor
- D. the element's number of electron shells < Distractor

Answer  
choices

**Stimulus:** information you must use to answer the question (e.g., a map, graph, picture)

**Stem:** the question or statement to be answered (pay particular attention to **bold** words)

**Distractors:** answer choices you might select; one of the four choices is the correct answer

## DEPTH OF KNOWLEDGE

The items on the test vary in difficulty; they also vary in the type of thinking skill demanded by the item. We use the term ***Depth of Knowledge*** to describe the degree of mental processing that is necessary to answer an item correctly.

### Level 1

These items will ask you to recall facts; these items include who, what, when, and where questions. They are often connected to standards that ask you to *identify*; these questions measure your ability to recall important facts contained in the test content description.

For example, Structure and Properties of Matter Standard SPS1a states that a student will be able to “investigate the structure of the atom in terms of proton, electron, and neutron locations.” A question connected to this standard might ask where a positively charged subatomic particle is located in an atom. Since the item asks for the location of positive charges in an atom, you should **recall** that protons are positively charged and they are located inside the nucleus.

### Level 2

These questions involve more complex mental processes than simply recalling facts. You may be asked to describe or explain concepts, to demonstrate understanding of cause and effect, to contrast or compare, give examples, or classify.

For example, Cells and Heredity Standard SB2b states that students will analyze how biological traits are passed on to successive generations by explaining the role of DNA in storing and transmitting cellular information.

A question connected to this standard might ask why it is necessary for the DNA of a cell to be replicated before cell division occurs. By choosing the correct answer you are explaining that each new cell formed during cell division requires a complete set of information to carry out normal daily activity for that cell type.

### Level 3

You should expect to see many challenging questions on the test. Some questions will require you to analyze or evaluate information. You may be asked to draw conclusions, show evidence, apply concepts to new situations, use concepts to solve problems, analyze similarities and differences in issues and problems, or make connections.

For example, Force, Waves & Electricity Standard SPS9b states that a student will be able to “investigate the properties of waves related to frequency and wavelength to the energy of different types of electromagnetic waves.”

Radio waves are a type of electromagnetic wave. All electromagnetic waves travel through space at approximately  $3.00 \times 10^8$  m/s. A question connected to this standard might include estimating or predicting the frequency and wavelength of radio waves transmitted by FM radio stations. After reviewing some provided information about frequency, you may be asked to make a general prediction about wavelength. Or after reviewing some provided information about wavelength, you may be asked to predict wave frequency or wave energy.

Specific examples of questions that represent these three levels can be found in the Sample Items and Explanations section on pages 9 through 14.

## TAKING THE TEST

The science test includes a periodic table and a Science Facts and Formulas sheet to be used as references. (Samples of the periodic table and the Science Facts and Formulas sheet are found on pages 32 and 33.) You cannot use dictionaries, textbooks, or other materials while taking the test. The only exceptions are English Language Learning students whose Test Participation Plan (TPP) requires the use of word-to word translation dictionaries. Furthermore, you are not permitted to use any electronic communication devices, such as cell phones, PDAs, or other devices that receive, store, and/or transmit text. Please do not take these devices into the room. Students who attempt to use these devices during testing will be in danger of having their tests invalidated.

### Use these strategies to help you succeed on the test:

#### Read everything carefully.

Many of the GHS GT questions involve diagrams, pictures, tables, and graphs. You should carefully read all parts of each test item, including directions, stimuli, questions, and all four answer choices.

#### Remember that there are no trick questions.

The questions are **not** designed to be tricky. If you read the entire question, including all accompanying material, and think carefully about what the question is asking, the meaning should be clear. Also, remember that each question has only one answer that content experts agree is the correct answer. However, you may be looking for the **best** answer among the choices. If so, the word **best** will be emphasized in the question.

Sometimes questions ask you for the choice among the options that is **not** correct. Always notice words such as **not**, **except**, or **but** in the question. These words tell you to look for a choice that does not answer or complete the item stem correctly. For example, you might be asked, "Which statement does **not** describe an energy change?" You should look for the statement that does not describe an energy change; three of the choices will be about energy changes.

#### Consider every choice.

Given four answer choices, you must choose the one that **best** answers the question. Some of the alternative choices (distractors) will be attractive because they include an irrelevant detail, a common misconception, or the correct information applied in the wrong way.

#### Guess intelligently.

There is no penalty for guessing on any GHS GT. If you are not certain of the correct answer, then reread the material. If you are still uncertain, make your best guess. Guessing is easier if you can eliminate one or more distractors as clearly incorrect. Be warned, however, that many of the distractors are very attractive because they are based on common mistakes students make.

#### Spend test time wisely.

Many tests are arranged so that the easier items are first and the harder items are last. The GHS GT is not arranged in this way. Therefore, it is possible to find several difficult questions followed by a set of easier questions later. If you come to a few hard questions, do not get discouraged. It would be better to move on, answer as many questions as possible, and then go back to answer the remaining questions. You may have up to three hours to take the science GHS GT. If you finish early, use the time to check your answers. However, it is still important to use your time wisely.



## SAMPLE ITEMS AND EXPLANATIONS

The items provided in this section are sample items. These items should be considered **examples** of items and types of items that may be found on the science test.

Items that address cells and heredity will test your understanding of relating cell structure to the complexity of organisms and systems and their ability to survive. Assessment of this domain focuses on analyzing the nature of the relationships between cell structures and their functions in living cells. The assessment also focuses on the difference between prokaryotes and eukaryotes, the roles of DNA and RNA in heredity, the uses of DNA technology, the differences and similarities among all kingdoms of living things, and practical applications of genetics.

Items that address ecology and biodiversity will test your understanding of how environmental conditions influence organisms' adaptations; how energy and matter flow through an ecosystem; the relationships among organisms, populations, and communities; natural selection; and the history of life on Earth. You will also analyze and evaluate changes over time.

Items that address the structure and properties of matter will test your knowledge of atoms with different numbers of neutrons and protons and require you to use the first 20 elements of the periodic table to examine atomic mass and atomic number. Items will also compare and contrast the atomic and molecular motions of solids, liquids, gases, and plasmas.

Items address the various forms in which energy exists, how it may be transformed from one form to another.

Items that address forces, waves, and electricity will test your knowledge of these concepts in several ways. Items will test your ability to use formulas to calculate velocity, and acceleration. You will analyze factors affecting the transfer of energy by heat, light, sound, or mechanical waves, including reflection, refraction, interference, and diffraction. You will also apply knowledge of magnetism and electricity as they relate to the movement of electrical charges in electromagnets and simple motors.

**Domain 1:** Cells and Heredity

1. Which cell structure is a passageway for materials, provides protection, and allows cell recognition?
- A. \* cell membrane
  - B. Golgi apparatus
  - C. mitochondrion
  - D. nucleus

**Explanation and Correct Answer: A.** The cell membrane surrounds a cell, making it the first line of defense against invaders. The membrane has gates and channels that are highly specific. Only special molecules can cross the membrane. Short chains of sugars involved in cell recognition are attached to the membrane. Answers B, C, and D all have membranes, but these organelles are within the cytoplasm inside the cell.

**Depth of Knowledge:** This is a Level 1 item.

**Domain 2:** Ecology and Biodiversity

2. Gopher tortoises are native to longleaf pine forests in the southeastern United States. Each tortoise digs and uses from nine to twenty burrows. These burrows not only house the tortoise but also provide shelter and protection for over 300 other animals, such as snakes, mice, insects, and burrowing owls.

Based on this information, why is the gopher tortoise important to the longleaf pine forest ecosystem?

- A. The tortoise keeps the forest clear of invasive species.
- B. The tortoise provides food for over 300 species.
- C. The tortoise protects other herbivore species.
- D.\*The tortoise maintains species diversity.

**Explanation and Correct Answer: D.** The gopher tortoise is considered a keystone species; it plays a fundamental role in maintaining its ecosystem. Its burrows are essential for the lives of other animals in the longleaf forest. If the tortoise population is reduced, other populations of species will be directly affected.

**Depth of Knowledge:** This is a Level 3 item.

**Domain 3:** Structure and Properties of Matter

3. This table shows the numbers of protons and neutrons of atoms in four samples.

<b>Sample</b>	<b>Number of Protons</b>	<b>Number of Neutrons</b>
1	15	15
2	15	16
3	16	16
4	17	17

What can be correctly concluded from the data?

- A. \* Each sample has a different mass number.
- B. Each sample is an atom of a different element.
- C. Each sample is an isotope of the same element.
- D. Each sample has the same number of electrons as it does protons.

**Explanation and Correct Answer:** A. Each sample's different atomic mass is created by adding the number of protons and neutrons. Option B is incorrect because two of the samples have the same number of protons, so they are atoms of the same element. Option C is incorrect because the only samples that are isotopes of the same element are Samples 1 and 2 (they have the same number of protons). Option D is incorrect because each sample could have the same number of electrons as it does protons, but that conclusion cannot be inferred from the information given in the table.

**Depth of Knowledge:** This is a Level 3 item.

**Domain 4:** Energy Transformations

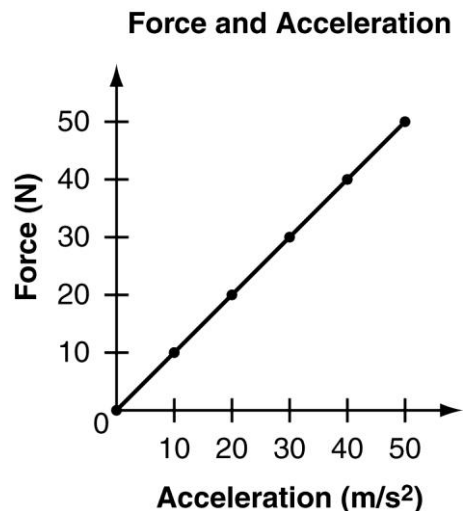
4. Which statement describes a conversion of one form of mechanical energy into another form of mechanical energy in a nuclear power plant?
- A. Large atoms split into smaller atoms and release heat.
  - B. Smaller atoms release beta and gamma radiation.
  - C. A generator turns and creates electricity.
  - D.\*Steam expands and turns a turbine.

**Explanation and Correct Answer: D.** Mechanical energy is any form of energy that is directly associated with motion or force. Option D is correct because the pressure of the steam is used to turn the blades of a turbine. Option A and B are incorrect because both describe the results of the process of nuclear fission. Option C, describes mechanical energy being changed to electrical energy.

**Depth of Knowledge:** This is a Level 2 item.

**Domain 5: Forces, Waves, & Electricity**

5. This graph shows the results of an experiment testing the affect force and acceleration have on an object.



What does the slope of the graph represent?

- A. \*the mass of the object
- B. the density of the object
- C. the velocity of the object
- D. the position of the object

**Explanation and Correct Answer: A.** Based on  $F$  (force) =  $m$  (mass)  $\times$   $a$  (acceleration), there is a direct relationship between force, acceleration, and the mass of an object. When given  $F$  and  $a$  on a graph, the slope of the line represents the mass of the object. Options B, C, and D are incorrect because the variables needed to determine density, velocity, and position are not the variables contained in this graph.

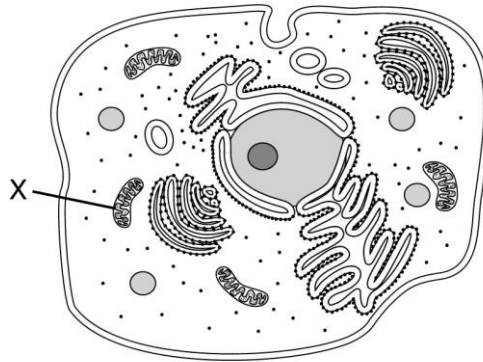
**Depth of Knowledge:** This is a Level 3 item.

## PRACTICE QUESTIONS

**Directions:** These questions are representative of some of the types of questions you will answer on the GHSGT for science. Read each question carefully. Then read each answer choice and choose the best answer. When you are finished, check your answers on pages 26 through 29.

1. Where is a positively charged subatomic particle located in an atom?
  - A. outside the nucleus
  - B. inside the nucleus
  - C. around an electron and near a neutron
  - D. between an electron and a gamma ray
  
2. This diagram represents structures within an animal cell.

**Animal Cell**



- What is the function of structure X?
- A. to make new cells
  - B. to release cellular energy
  - C. to store information
  - D. to control movement
3. What makes two isotopes of the same element different?
    - A. the number of protons
    - B. the number of neutrons
    - C. the strength of the electrons' charge
    - D. the distance between the electrons and protons

4. A radioactive sample of bismuth-212 initially emits radiation at a rate of 80 disintegrations per second. Two hours later, the sample is emitting radiation at a rate of 21 disintegrations per second.

What is the approximate half-life of bismuth-212?

- A. 1 hour
- B. 2 hours
- C. 3 hours
- D. 4 hours

Use this table to answer question 5.

**Elements' Atomic Masses**

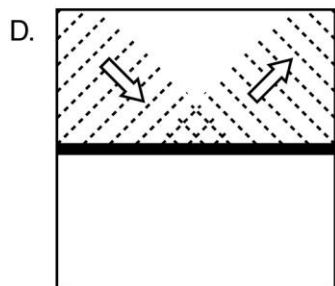
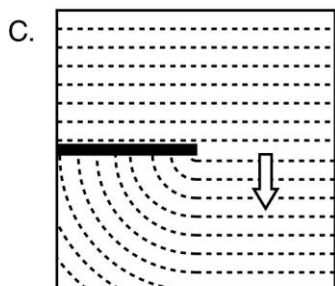
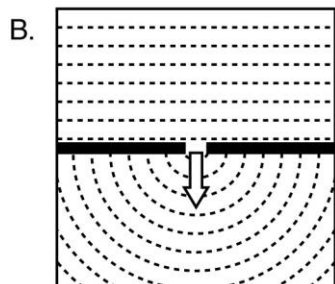
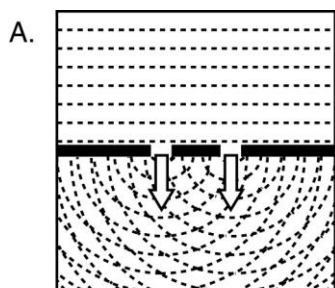
Element	Atomic Mass
Carbon	12
Nitrogen	14
Oxygen	16
Neon	20

5. The addition of which subatomic particles accounts for the increase, from top to bottom, in the average atomic masses of the elements listed in the table?
- A. two protons
  - B. two neutrons
  - C. one proton and one neutron
  - D. one proton and one electron



6. An isotope of carbon has 12 neutrons. What is this isotope's atomic number?
- A. 6
  - B. 10
  - C. 12
  - D. 18
7. Which organelle allows glucose to enter cells?
- A. cell membrane
  - B. mitochondrion
  - C. nucleus
  - D. ribosome
8. Which macromolecule functions as stored energy in seeds?
- A. DNA
  - B. chlorophyll
  - C. lipid
  - D. protein
9. What is one important function of proteins?
- A. They form cell membranes.
  - B. They store genetic information.
  - C. They act as catalysts in cellular reactions.
  - D. They control DNA replication in the nucleus.
10. Which quantity remains constant when the net force on an object is increased?
- A. acceleration
  - B. displacement
  - C. mass
  - D. velocity

11. Which diagram represents interference?

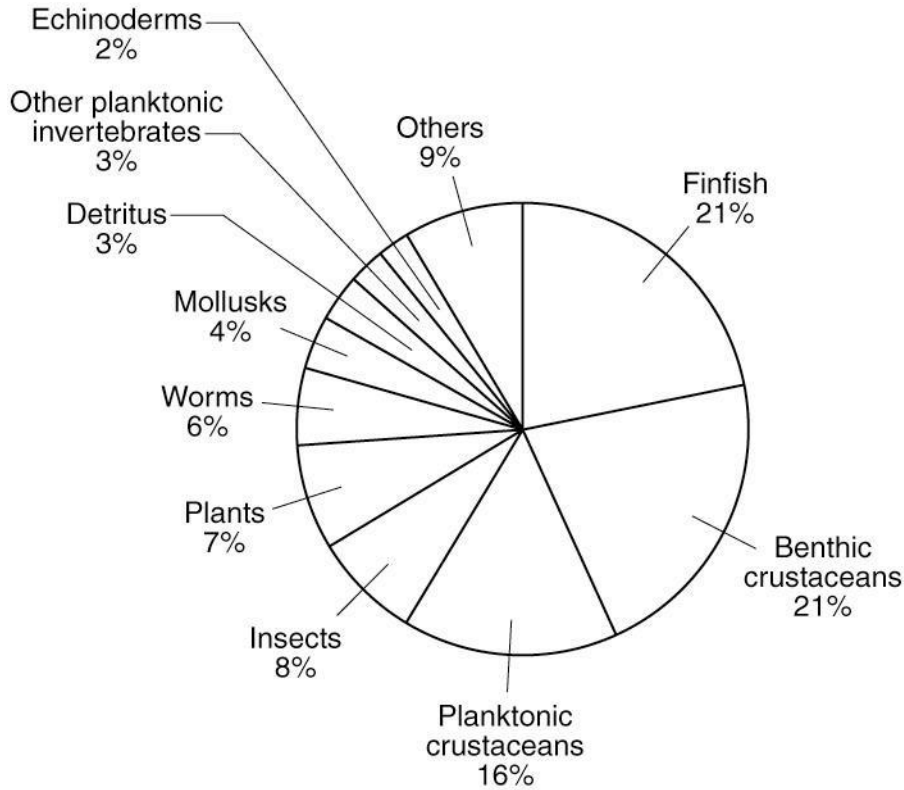


12. What do nucleic acids provide for a germinating seed?

- A. information to make a new plant
- B. energy for roots to grow
- C. energy for stems to grow
- D. nutrients to make leaves

13. A plant has the genotype Bb for a certain trait. Which statement about the seeds of this plant is correct?
- A. Half the seeds will inherit the B allele.
  - B. All of the seeds will have the genotype Bb.
  - C. Half the seeds will have the genotype b.
  - D. All of the seeds will inherit either the B or the b allele.
14. Which crime scene evidence would **most likely** contain DNA?
- A. blood
  - B. boot print
  - C. fingerprint
  - D. bullet casing
15. Noise-canceling headphones produce a sound wave that is equal to and opposite of incoming noise. The effect of this cancels the noise.
- What property of sound is used by noise-canceling headphones?
- A. diffraction
  - B. interference
  - C. reflection
  - D. resonance

16. This pie chart shows the percents of the types of organisms typically found in the stomach of a fish.

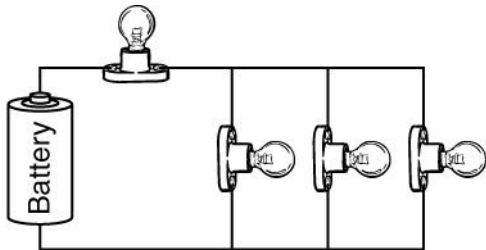


Based on the pie chart, which conclusion is supported by the contents of the stomach of a fish?

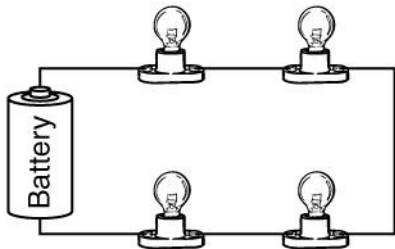
- A. A single fish is involved in a single food chain.
  - B. A single fish is involved in several food chains.
  - C. A single fish greatly affects an insect population.
  - D. A single fish is most affected by a mollusk population.
17. Which of the following is an example of a community in an ecosystem?
- A. all the plants and animals
  - B. all the soil and predators
  - C. all the water used by plants
  - D. all the sunlight used by plants

18. Which circuit has the brightest light bulbs?

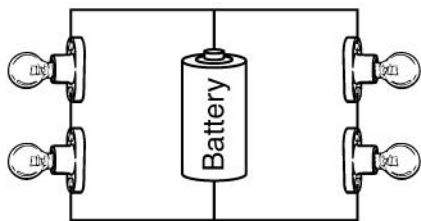
A.



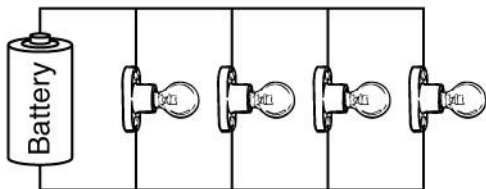
B.



C.



D.



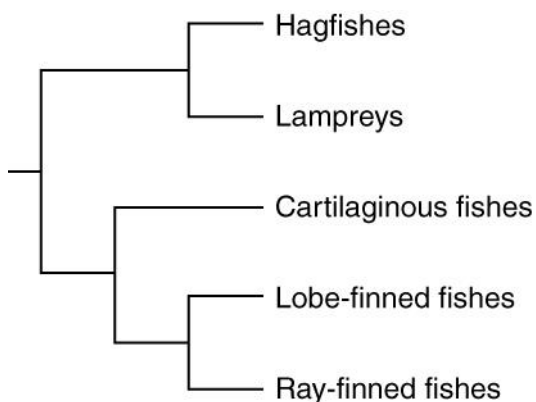
19. Which group of organisms would benefit the **most** from a population of fish being killed by pollution?

- A. decomposers
- B. predators
- C. secondary consumers
- D. producers

20. What do food webs **best** represent?

- A. energy moving from the Sun to decomposers to plants to animals
- B. matter from organisms that is included in minerals from Earth
- C. matter and energy moving in one direction among organisms
- D. matter and energy from the Sun combining with energy from plants and animals

21. This cladogram shows a relationship among classes of fish.

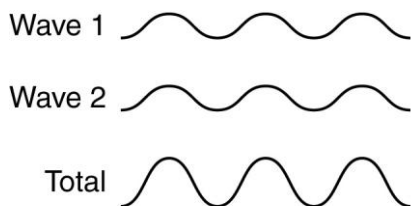


Based on the cladogram, which class of fish is most closely related to ray-finned fishes?

- A. hagfishes
  - B. lampreys
  - C. cartilaginous fishes
  - D. lobe-finned fishes
22. Which statement is **always** true of solids?
- A. Molecules do not have a strong attraction to one another.
  - B. Molecules are bound together to form a rigid shape.
  - C. Molecules fill the volume of a container.
  - D. Molecules are loosely packed.
23. Which electrical device must contain a magnet?
- A. a battery
  - B. a generator
  - C. a lightbulb
  - D. a resistor

24. An automobile accelerates from 2 m/s to 8 m/s in 2 s. What is the acceleration of the automobile?
- A.  $2 \text{ m/s}^2$
  - B.  $3 \text{ m/s}^2$
  - C.  $4 \text{ m/s}^2$
  - D.  $8 \text{ m/s}^2$
25. An astronaut weighs more on Earth than on the Moon, but the astronaut's mass does not change. Why does the astronaut weigh more on Earth than on the Moon?
- A. Earth has more mass than the Moon.
  - B. Earth has a larger diameter than the Moon.
  - C. The astronaut's body is denser on Earth than on the Moon.
  - D. The astronaut spent more time on Earth than on the Moon.
26. Which energy transformations occur when a television is turned on?
- A. Sound energy is changed to light and heat energy.
  - B. Light energy is changed to electrical and heat energy.
  - C. Electrical energy is changed to sound and light energy.
  - D. Heat energy is changed to sound and electrical energy.

27. This diagram shows two overlapping waves with the same wavelength and amplitude.



Which statement correctly explains the diagram?

- A. The waves overlap and increase in frequency.
  - B. The wave frequencies overlap and increase refraction.
  - C. Diffraction between the waves increases the amplitude.
  - D. Interference between the waves increases the amplitude.
28. What is the method of energy transfer that allows the Sun's energy to reach Earth's surface?
- A. conduction
  - B. nuclear currents
  - C. solar heat waves
  - D. radiation
29. What is the **main** reason DNA evidence is used to help solve crimes?
- A. DNA variations are unique to individuals.
  - B. DNA contains information that can be cloned.
  - C. DNA is found in many types of evidence.
  - D. DNA is used with other types of evidence.
30. How is the information needed to make proteins transferred **within** cytoplasm?
- A. Proteins move the information to the cytoplasm.
  - B. Lipids carry the information to the cytoplasm.
  - C. RNA carries the information to the cytoplasm.
  - D. DNA moves the information to the cytoplasm.



31. A softball is pitched at 15 m/s. The bat strikes the ball with an average force of 400 N, and the ball leaves the bat at 30 m/s.
- What is the average force the ball exerts on the bat?
- A. 100 N
  - B. 200 N
  - C. 400 N
  - D. 800 N
32. Which of the following **most likely** occurs when a sound wave travels from air to water?
- A. The wave frequency increases.
  - B. The wave frequency decreases.
  - C. The speed of the wave increases.
  - D. The speed of the wave decreases.
33. When does a mutation affect evolution?
- A. when the new DNA sequence is longer
  - B. when it reduces the gene pool of a population
  - C. when the new RNA produces the same amino acid
  - D. when it produces a variation that works within the environment

### ANSWERS AND EXPLANATIONS TO PRACTICE QUESTIONS

Question Number	Domain	Domain Number	GPS	Correct Answer	DOK Level	Explanation
1	Structure and Properties of Matter	3	SPS1A	B	1	The correct answer is <b>B</b> . The only location of positive charges in an atom is inside the nucleus.
2	Cells and Heredity	1	SB1A	B	1	The correct answer is <b>B</b> . Structure X represents a mitochondrion. The purpose of a mitochondrion is to make cellular energy.
3	Structure and Properties of Matter	3	SPS1A	B	1	The correct answer is <b>B</b> . The only difference between isotopes of the same element is the number of neutrons.
4	Energy Transformations	4	SPS3C	A	2	The correct answer is <b>A</b> . At each half-life, the emitted radiation is reduced by half. At the first half-life, the rate drops to 40 per second; then, at the second half-life, the rate drops to 20 per second.
5	Structure and Properties of Matter	3	SPS1A	C	1	The correct answer is <b>C</b> . The atomic mass gains two because a proton and a neutron are gained after each element in the table.
6	Structure and Properties of Matter	3	SPS1A	A	2	The correct answer is <b>A</b> . The atomic number of carbon does not change.
7	Cells and Heredity	1	SB1A	A	1	The correct answer is <b>A</b> . Proteins in the cell membrane allow glucose to enter a cell.
8	Cells and Heredity	1	SB1C	C	1	The correct answer is <b>C</b> . Seeds store energy as fatty acids, a subunit of lipids.

### ANSWERS AND EXPLANATIONS TO PRACTICE QUESTIONS

Question Number	Domain	Domain Number	GPS	Correct Answer	DOK Level	Explanation
9	Cells and Heredity	1	SB1C	C	2	The correct answer is <b>C</b> . Many proteins are enzymes that influence reactions in organisms.
10	Forces, Waves, and Electricity	5	SPS8B2	C	1	The correct answer is <b>C</b> . The mass does not change when the force acting on an object increases.
11	Forces, Waves, and Electricity	5	SPS9D	A	1	The correct answer is <b>A</b> . Sound-wave interference cancels or amplifies sounds depending on their wavelengths.
12	Cells and Heredity	1	SB1C	A	2	The correct answer is <b>A</b> . Nucleic acids make up DNA, which stores information to make new plants.
13	Cells and Heredity	1	SB2C	D	3	The correct answer is <b>D</b> . All the seeds will inherit either the B or b allele based on Mendelian patterns.
14	Cells and Heredity	1	SB2F	A	1	The correct answer is <b>A</b> . Blood contains cells that contain DNA.
15	Forces, Waves, and Electricity	5	SPS9D	B	2	The correct answer is <b>B</b> . Two waves, one coming from the noise-canceling headphones and one associated with the ambient noise, have the same amplitude and frequency, but the crests and troughs (compressions and rarefactions) are arranged so that the crests (compressions) of one wave line up with the troughs (rarefactions) of the other wave and vice versa. The two waves cancel each other out.
16	Ecology and Biodiversity	2	SB4B1	B	3	The correct answer is <b>B</b> . A fish eats a variety of organisms that eat other organisms.
17	Ecology and Biodiversity	2	SB4A	A	1	The correct answer is <b>A</b> . A community consists of all the organisms (biotic factors) in an area.
18	Forces, Waves, and Electricity	5	SPS10B3	D	2	The correct answer is <b>D</b> . Each lightbulb receives the same amount of voltage from the battery.
19	Ecology and Biodiversity	2	SB4A	A	2	The correct answer is <b>A</b> . Decomposers obtain food directly from dead organisms and would therefore have an ample food supply during a mass extinction.

### ANSWERS AND EXPLANATIONS TO PRACTICE QUESTIONS

Question Number	Domain	Domain Number	GPS	Correct Answer	DOK Level	Explanation
20	Ecology and Biodiversity	2	SB4B1	C	1	The correct answer is <b>C</b> . Food webs represent matter and energy moving in one direction through the consumption of organisms.
21	Cells and Heredity	1	SB3C	D	2	The correct answer is <b>D</b> . Lobe-finned fish and ray-finned fish are part of the same clade.
22	Structure and Properties of Matter	3	SPS5A	B	2	The correct answer is <b>B</b> . Solids are rigid because their molecules have a strong attraction to one another and are densely packed.
23	Forces, Waves, and Electricity	5	SPS10C2	B	1	The correct answer is <b>B</b> . In a generator, spinning magnets cause a changing magnetic field through the wire coil, producing an electric current. Rotating a wire coil in a magnetic field also produces a current in the wire.
24	Forces, Waves, and Electricity	5	SPS8A	B	2	The correct answer is <b>B</b> . $a = \frac{v_f - v_i}{t}$ $a = \frac{8 \text{ m/s} - 2 \text{ m/s}}{2 \text{ s}} = 3 \text{ m/s}^2$
25	Forces, Waves, and Electricity	5	SPS8D	A	2	The correct answer is <b>A</b> . The mass of Earth and the distance from the center of the astronaut's mass determine the amount of gravitational force the astronaut experiences as weight.
26	Energy Transformations	4	SPS7A	C	2	The correct answer is <b>C</b> . Electrical energy is changed to sound and light energy.

### ANSWERS AND EXPLANATIONS TO PRACTICE QUESTIONS

Question Number	Domain	Domain Number	GPS	Correct Answer	DOK Level	Explanation
27	Forces, Waves, and Electricity	5	SPS9D	D	2	The correct answer is <b>D</b> . Waves with overlapping crests and troughs increase the wave amplitude through interference.
28	Forces, Waves, and Electricity	5	SPS9A	D	1	The correct answer is <b>D</b> . The Sun's energy radiates through space and is intercepted by Earth's atmosphere. Some of the energy is absorbed and some is reflected.
29	Cells and Heredity	1	SB2F	A	2	The correct answer is <b>A</b> . DNA is unique to individuals, with a probability that is usually greater than the total population of humans on Earth (i.e., 1 in 10 billion).
30	Cells and Heredity	1	SB2A	C	2	The correct answer is <b>C</b> . RNA carries information from DNA in the nucleus to the cytoplasm.
31	Forces, Waves, and Electricity	5	SPS8B2	C	1	The correct answer is <b>C</b> . The ball exerts an equal and opposite force on the bat.
32	Forces, Waves, and Electricity	5	SPS9E	C	1	The correct answer is <b>C</b> . Sound waves generally travel faster in liquids than in gases.
33	Ecology and Biodiversity	2	SB5D	D	2	The correct answer is <b>D</b> . Mutations that occur in reproductive cells add to species variation affected by natural selection. If these mutations are beneficial to a population the changes will most likely be passed to the next generation.

## PERFORMANCE LEVEL DESCRIPTORS

### **Honors**

Student responses demonstrate an exceptionally high level of performance in all five GPS domains of science. Student responses demonstrate thorough understanding of concepts and challenging problems in biology and physical science by consistently responding correctly in all areas of the science content standards. Responses indicate the student has an above-average understanding of specialized cell parts, can explain essential elements of genetics, and can discuss concepts of ecology in depth. The student is able to solve complex mathematical problems involving velocity, acceleration, and radioactive half-lives. Responses demonstrate the ability to explain the structure of the atom, compare and contrast the molecular motion of the phases of matter, and apply the laws of motion to everyday experiences. Responses also indicate a thorough understanding of the application of the principles of magnetism and electricity to simple motors and the movement of electrical charges.

### **Advanced Proficiency**

Student responses exceed performance standards in all five GPS domains of science. Student responses demonstrate general understanding of concepts and routine problems in biology and physical science by consistently responding correctly in most areas of the science content standards. Responses indicate the student has an appropriate understanding of specialized cell parts, can explain essential elements of genetics, and can discuss many concepts of ecology. The student is able to solve mathematical problems involving velocity, acceleration, and radioactive half-lives. Responses demonstrate the ability to explain the structure of the atom, compare and contrast the molecular motion of the phases of matter, and apply the laws of motion to everyday experiences. Responses also indicate an adequate understanding of the application of the principles of magnetism and electricity to simple motors and the movement of electrical charges.

### **Basic Proficiency**

Student responses meet fundamental performance standards in all five GPS domains of science. Responses demonstrate rudimentary understanding of concepts and simple problems in biology and physical science by inconsistently responding correctly in most areas of the science content standards. Responses indicate the student has a fundamental understanding of specialized cell parts, can explain elements of genetics, and can discuss some concepts of ecology. The student is able to solve simple mathematical problems involving velocity, acceleration, and radioactive half-lives. Responses demonstrate the ability to recognize the structure of the atom and the molecular motion of the phases of matter, and to apply the laws of motion to everyday experiences. Responses also indicate an ability to apply some principles of magnetism and electricity to simple motors and the movement of electrical charges.

**Below Proficiency**

Student responses do not meet fundamental performance standards in all five GPS domains of science. Student responses demonstrate limited understanding of essential concepts and problems in biology and physical science by unsatisfactorily responding in most areas of the science content standards. Responses indicate the student has less than a fundamental understanding of specialized cell parts, understands few elements of genetics, and can discuss elementary concepts of ecology. The student is able to solve a few uncomplicated mathematical problems. Responses demonstrate limited ability to recognize the structure of the atom, the molecular motion of the phases of matter, and the laws of motion as they relate to everyday experiences. Responses also indicate a lower-than-average ability to apply principles of magnetism and electricity.

PERIODIC TABLE

PERIODS	GROUP 1 (Ia)		GROUP 2 (IIa)		GROUP 13 (IIIA) - 18 (VIIIA)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14 (IVa)	15 (Va)	16 (VIA)	17 (VIIa)	18 (VIIIA)	
1	<b>H</b> Hydrogen 1.00797																		<b>He</b> Helium 4.0026
2	<b>Li</b> Lithium 6.941	<b>Be</b> Beryllium 9.0122												<b>B</b> Boron 10.811	<b>C</b> Carbon 12.011	<b>N</b> Nitrogen 14.0067	<b>O</b> Oxygen 15.9994	<b>F</b> Fluorine 18.998	<b>Ne</b> Neon 20.183
3	<b>Na</b> Sodium 22.9898	<b>Mg</b> Magnesium 24.312												<b>Al</b> Aluminum 26.9815	<b>Si</b> Silicon 28.086	<b>P</b> Phosphorus 30.9738	<b>S</b> Sulfur 32.064	<b>Cl</b> Chlorine 35.453	<b>Ar</b> Argon 39.948
4	<b>K</b> Potassium 39.102	<b>Ca</b> Calcium 40.08	<b>Sc</b> Scandium 44.956	<b>Ti</b> Titanium 47.88	<b>V</b> Vanadium 50.942	<b>Cr</b> Chromium 51.996	<b>Mn</b> Manganese 54.938	<b>Fe</b> Iron 55.847	<b>Co</b> Cobalt 58.9332	<b>Ni</b> Nickel 58.71	<b>Cu</b> Copper 63.546	<b>Zn</b> Zinc 65.37	<b>Ga</b> Gallium 69.72	<b>Ge</b> Germanium 72.59	<b>As</b> Arsenic 74.9216	<b>Se</b> Selenium 78.96	<b>Br</b> Bromine 79.904	<b>Kr</b> Krypton 83.80	
5	<b>Rb</b> Rubidium 85.47	<b>Sr</b> Strontium 87.62	<b>Y</b> Yttrium 88.905	<b>Zr</b> Zirconium 91.22	<b>Nb</b> Niobium 92.906	<b>Mo</b> Molybdenum 95.94	<b>Tc</b> Technetium (97)	<b>Ru</b> Ruthenium 101.07	<b>Rh</b> Rhodium 102.905	<b>Pd</b> Palladium 106.4	<b>Ag</b> Silver 107.868	<b>Cd</b> Cadmium 112.40	<b>In</b> Indium 114.82	<b>Sn</b> Tin 118.69	<b>Sb</b> Antimony 121.75	<b>Te</b> Tellurium 127.60	<b>I</b> Iodine 126.9045	<b>Xe</b> Xenon 131.30	
6	<b>Cs</b> Cesium 132.905	<b>Ba</b> Barium 137.34	Lanthanide Series* 57-71	<b>Hf</b> Hafnium 178.49	<b>Ta</b> Tantalum 180.9468	<b>W</b> Tungsten 183.85	<b>Re</b> Rhenium 186.2	<b>Os</b> Osmium 190.2	<b>Ir</b> Iridium 192.2	<b>Pt</b> Platinum 195.08	<b>Au</b> Gold 196.967	<b>Hg</b> Mercury 200.59	<b>Tl</b> Thallium 204.37	<b>Pb</b> Lead 207.19	<b>Bi</b> Bismuth 208.9806	<b>Po</b> Polonium (209)	<b>At</b> Astatine (210)	<b>Rn</b> Radon (222)	
7	<b>Fr</b> Francium (223)	<b>Ra</b> Radium (226)	Actinide Series* 89-103																

**KEY**

atomic number - **5**

atomic symbol - **B**

name of element - **Boron**

atomic weight - **10.811**

electron arrangement - **2, 3**



## SCIENCE FACTS AND FORMULAS

Some of the questions in this test require you to solve problems. This page contains all the basic facts and formulas you will need to solve those problems. You may refer to this page as often as you wish while you take the test. Some questions may require information from the periodic table on the previous page.

### Basic Facts

Acceleration due to gravity = 9.8 meters/second/second ( $9.8 \text{ m/s}^2$ )

Weight = Mass (m)  $\times$  Acceleration due to gravity (g) ( $W = mg$ )

Density = Mass/Volume

Volume of a Rectangular Solid = Length  $\times$  Width  $\times$  Height

1 newton = 1 kilogram-meter/second/second

1 joule = 1 newton-meter

### Motion

Velocity:  $V = \frac{d}{t}$  where  $d$  = distance,  $t$  = time

Velocity:  $V_f = V_0 + at$ , where  $V_0$  = Initial Velocity,  $V_f$  = Final Velocity,  $a$  = Acceleration, and  $t$  = Time

Acceleration = Change in Velocity/Time Elapsed  $a = \frac{V_f - V_0}{t}$

### Force, Heat, Work

Force = Mass  $\times$  Acceleration ( $F = ma$ )

Work = Force  $\times$  Distance ( $W = Fd$ )

### Electricity

Voltage = Current  $\times$  Resistance ( $V = IR$ )