

Glencoe Science

Student Edition

**Mastering the
Georgia
Physical Science
End-of-Course Test
(EOCT)**

Grade 9



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Introduction to the Student

Your teachers will incorporate the standards and the appropriate course content into the classroom curriculum, and they will thoroughly familiarize you with the reference materials you will need to answer some questions on the Physical Science End-of-Course Test (EOCT). For your reference, this book contains a copy of the Academic Standards for Physical Science.

The questions in this booklet are aligned with the Georgia Academic Standards for Physical Science and are designed to assess your mastery of these standards. These Academic Standards and questions encompass the nature of science, inquiry, chemistry, and physics.

The sample questions in this workbook are representative of the questions used on the EOCT. These questions are only a sample of what you should expect to encounter on the actual examination.

Overview

The material in this booklet is designed to prepare you for the Physical Science End-of-Course Test (EOCT). It contains a Student Recording Chart, the Georgia Physical Science Standards, a Diagnostic Test, Indicator Practice for each indicator, and a Self-Assessment Test.

How to Use this Book

Diagnostic Test This test will help you identify any content that you need to review as you prepare to take the Physical Science End-of-Course Test. Once you've taken the Diagnostic Test and it's been graded, complete the Student Recording Chart on page vi. Circle each question that you answered incorrectly. If there is a circle marked for an indicator, write **YES** in the **Need Practice** question box. Then complete the practice page for that indicator.

Standards Practice If you incorrectly answered questions for a particular indicator, you could probably use some extra practice with that indicator. The Student Recording Chart lists a practice page for each indicator. Complete the appropriate practice page. If you are unsure about how to answer some of the questions, you might want to refer to your science book.

Self-Assessment Test After you have completed your practice worksheet(s), take the Self-Assessment Test on pages 95–107.

Test-Taking Tips

Before the Test:

- Be sure to get plenty of sleep the week before the test. A healthy amount of sleep is eight to nine hours every night.
- On the night before the test, try to do something relaxing but stimulating, such as playing a board game, exercising, or reading an enjoyable book. Cramming the night before the test often can hamper your memory and make you tired.
- On the morning of the test, eat a healthy breakfast with fresh foods that are high in protein and carbohydrates.
- On the morning of the test, clear your mind of any outside distractions so that you will be better able to focus on the test. If breaks are given during the test, use that time to relax and clear your mind.

During the Test:

1. Listen and read all directions.
2. Be sure you understand the questions before reading the answer choices. Then, make sure to read and consider **every** answer choice.
3. Remember to consider carefully all the information presented in the test's graphics.
4. If the test is timed, be sure to pace yourself.
5. Always choose an answer. By eliminating as many incorrect choices as possible, you will have a good chance at guessing correctly and obtaining more points.

Georgia Performance Standards

High School Physical Science

Characteristics of Science

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.	
SCSh1a.	Exhibit the above traits in their own scientific activities.
SCSh1b.	Recognize that different explanations often can be given for the same evidence.
SCSh1c.	Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.	
SCSh2a.	Follow correct procedures for use of scientific apparatus.
SCSh2b.	Demonstrate appropriate techniques in all laboratory situations.
SCSh2c.	Follow correct protocol for identifying and reporting safety problems and violations.

SCSh3. Students will identify and investigate problems scientifically.	
SCSh3a.	Suggest reasonable hypotheses for identified problems.
SCSh3b.	Develop procedures for solving scientific problems.
SCSh3c.	Collect, organize and record appropriate data.
SCSh3d.	Graphically compare and analyze data points and/or summary statistics.
SCSh3e.	Develop reasonable conclusions based on data collected.
SCSh3f.	Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

SCSh4. Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.	
SCSh4a.	Develop and use systematic procedures for recording and organizing information.
SCSh4b.	Use technology to produce tables and graphs.
SCSh4c.	Use technology to develop, test, and revise experimental or mathematical models.

SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.	
SCSh5a.	Trace the source on any large disparity between estimated and calculated answers to problems.
SCSh5b.	Consider possible effects of measurement errors on calculations.
SCSh5c.	Recognize the relationship between accuracy and precision.
SCSh5d.	Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.
SCSh5e.	Solve scientific problems by substituting quantitative values, using dimensional analysis, and/or simple algebraic formulas as appropriate.

SCSh6. Students will communicate scientific investigations and information clearly.	
SCSh6a.	Write clear, coherent laboratory reports related to scientific investigations.
SCSh6b.	Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
SCSh6c.	Use data as evidence to support scientific arguments and claims in written or oral presentations.
SCSh6d.	Participate in group discussions of scientific investigation and current scientific issues.

SCSh7. Students will analyze how scientific knowledge is developed.	
Students will recognize that:	
SCSh7a.	The universe is a vast single system in which the basic principles are the same everywhere.
SCSh7b.	Universal principles are discovered through observation and experimental verification.
SCSh7c.	From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.
SCSh7d.	Hypotheses often cause scientists to develop new experiments that produce additional data.
SCSh7e.	The universe is a vast single system in which the basic principles are the same everywhere.

SCSh8. Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:	
SCSh8a.	Scientific investigators control the conditions of their experiments in order to produce valuable data.
SCSh8b.	Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations' hypotheses, observations, data analyses, and interpretations.
SCSh8c.	Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.
SCSh8d.	The merit of a new theory is judged by how well scientific data are explained by the new theory.
SCSh8e.	The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.
SCSh8f.	Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.

SCSh9. Students will enhance reading in all curriculum areas by:	
SCSh9a.	<p>Reading in All Curriculum Areas</p> <ul style="list-style-type: none"> • Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas. • Read both informational and fictional texts in a variety of genres and modes of discourse. • Read technical texts related to various subject areas.
SCSh9b.	<p>Discussing books</p> <ul style="list-style-type: none"> • Discuss messages and themes from books in all subject areas. • Respond to a variety of texts in multiple modes of discourse. • Relate messages and themes from one subject area to messages and themes in another area. • Evaluate the merit of texts in every subject discipline. • Examine author’s purpose in writing. • Recognize the features of disciplinary texts.
SCSh9c.	<p>Building vocabulary knowledge</p> <ul style="list-style-type: none"> • Demonstrate an understanding of contextual vocabulary in various subjects. • Use content vocabulary in writing and speaking. • Explore understanding of new words found in subject area texts.
SCSh9d.	<p>Establishing context</p> <ul style="list-style-type: none"> • Explore life experiences related to subject area content. • Discuss in both writing and speaking how certain words are subject area related. • Determine strategies for finding content and contextual meaning for unknown words.

Georgia Performance Standards High School Physical Science

Physical Science

SPS1. Students will investigate our current understanding of the atom.	
SPS1a.	Examine the structure of the atom in terms of <ul style="list-style-type: none"> • proton, electron, and neutron locations. • atomic mass and atomic number. • atoms with different numbers of neutrons (isotopes). • explain the relationship of the proton number to the element's identity.
SPS1b.	Compare and contrast ionic and covalent bonds in terms of electron movement.

SPS2. Students will explore the nature of matter, its classifications, and its system for naming types of matter.	
SPS2a.	Calculate density when given a means to determine a substance's mass and volume.
SPS2b.	Predict formulas for stable binary ionic compounds based on balance of charges.
SPS2c.	Use IUPAC nomenclature for transition between chemical names and chemical formulas of <ul style="list-style-type: none"> • binary ionic compounds (containing representative elements). • binary covalent compounds (i.e. carbon dioxide, carbon tetrachloride).
SPS2d.	Demonstrate the Law of Conservation of Matter in a chemical reaction.
SPS2e.	Apply the Law of Conservation of Matter by balancing the following types of chemical equations: <ul style="list-style-type: none"> • Synthesis • Decomposition • Single Replacement • Double Replacement

SPS3. Students will distinguish the characteristics and components of radioactivity.	
SPS3a.	Differentiate among alpha and beta particles and gamma radiation.
SPS3b.	Differentiate between fission and fusion.
SPS3c.	Explain the process half-life as related to radioactive decay.
SPS3d.	Describe nuclear energy, its practical application as an alternative energy source, and its potential problems.

SPS4. Students will investigate the arrangement of the Periodic Table.	
SPS4a.	Determine the trends of the following: <ul style="list-style-type: none"> • Number of valence electrons • Types of ions formed by representative elements • Location of metals, nonmetals, and metalloids • Phases at room temperature
SPS4b.	Use the Periodic Table to predict the above properties for representative elements.

SPS5. Students will compare and contrast the phases of matter as they relate to atomic and molecular motion.	
SPS5a.	Compare and contrast the atomic/molecular motion of solids, liquids, gases and plasmas.
SPS5b.	Relate temperature, pressure, and volume of gases to the behavior of gases.

SPS6. Students will investigate the properties of solutions.	
SPS6a.	Describe solutions in terms of <ul style="list-style-type: none"> • solute/solvent • conductivity • concentration
SPS6b.	Observe factors affecting the rate a solute dissolves in a specific solvent.
SPS6c.	Demonstrate that solubility is related to temperature by constructing a solubility curve.
SPS6d.	Compare and contrast the components and properties of acids and bases.

SPS7. Students will relate transformations and flow of energy within a system.	
SPS7a.	Identify energy transformations within a system (e.g. lighting of a match).
SPS7b.	Investigate molecular motion as it relates to thermal energy changes in terms of conduction, convection, and radiation.
SPS7c.	Determine the heat capacity of a substance using mass, specific heat, and temperature.
SPS7d.	Explain the flow of energy in phase changes through the use of a phase diagram.

SPS8. Students will determine relationships among force, mass, and motion.	
SPS8a.	Calculate velocity and acceleration.
SPS8b.	Apply Newton's three laws to everyday situations by explaining the following: <ul style="list-style-type: none"> • Inertia • Relationship between force, mass and acceleration • Equal and opposite forces
SPS8c.	Relate falling objects to gravitational force.
SPS8d.	Explain the difference in mass and weight.
SPS8e.	Calculate amounts of work and mechanical advantage using simple machines.

SPS9. Students will investigate the properties of waves.	
SPS9a.	Recognize that all waves transfer energy.
SPS9b.	Relate frequency and wavelength to the energy of different types of electromagnetic waves and mechanical waves.
SPS9c.	Compare and contrast the characteristics of electromagnetic and mechanical (sound) waves.
SPS9d.	Investigate the phenomena of reflection, refraction, interference, and diffraction.
SPS9e.	Relate the speed of sound to different mediums.
SPS9f.	Explain the Doppler Effect in terms of everyday interactions.

SPS10. Students will investigate the properties of electricity and magnetism.	
SPS10a.	Investigate static electricity in terms of <ul style="list-style-type: none"> • friction • induction • conduction
SPS10b.	Explain the flow of electrons in terms of <ul style="list-style-type: none"> • alternating and direct current. • the relationship among voltage, resistance and current. • simple series and parallel circuits.
SPS10c.	Investigate applications of magnetism and/or its relationship to the movement of electrical charge as it relates to <ul style="list-style-type: none"> • electromagnets • simple motors • permanent magnets

Name _____

Student Recording Chart

Directions: Circle each question from the Diagnostic Test that you answered *incorrectly*. If there are one or two circles marked for an indicator, write *Yes* in the *Need Practice?* box. Then complete the practice pages for that indicator.

SCSh1.

SCSh2.

Indicator	SCSh1a	SCSh1b	SCSh1c	SCSh2a	SCSh2b	SCSh2c
Diagnostic Test Questions	2	3	45	14	37	72
Need Practice?						
Practice Pages	15	16	17	18	19	20

SCSh3.

Indicator	SCSh3a	SCSh3b	SCSh3c	SCSh3d	SCSh3e	SCSh3f
Diagnostic Test Questions	61	4	40	11	38	13
Need Practice?						
Practice Pages	21	22	23	24	25	26

SCSh4.

SCSh5.

Indicator	SCSh4a	SCSh4b	SCSh4c	SCSh5a	SCSh5b	SCSh5c	SCSh5d	SCSh5e
Diagnostic Test Questions	46	12	5	7	62	39	6	36
Need Practice?								
Practice Pages	27	28	29	31	33	34	35	36

SCSh6.

SCSh7.

Indicator	SCSh6a	SCSh6b	SCSh6c	SCSh6d	SCSh7a	SCSh7b	SCSh7c	SCSh7d	SCSh7e
Diagnostic Test Questions	70	65	18	73	69	74	66	9	35
Need Practice?									
Practice Pages	37	38	39	40	41	42	43	44	45

Name _____

Student Recording Chart *(continued)*

SCSh8.

SCSh9.

Indicator	SCSh8a	SCSh8b	SCSh8c	SCSh8d	SCSh8e	SCSh8f	SCSh9a	SCSh9b	SCSh9c	SCSh9d
Diagnostic Test Questions	57	67	24	9	77	68	34	44	56	23
Need Practice?										
Practice Pages	46	47	48	49	50	51	52	54	55	56

SPS1.

SPS2.

SPS3.

Indicator	SPS1a	SPS1b	SPS2a	SPS2b	SPS2c	SPS2d	SPS2e	SPS3a	SPS3b	SPS3c	SPS3d
Diagnostic Test Questions	71	55	22	37	33	51	30	32	21	50	54
Need Practice?											
Practice Pages	57	58	59	60	61	62	63	64	65	66	67

SPS4.

SPS5.

SPS6.

Indicator	SPS4a	SPS4b	SPS5a	SPS5b	SPS6a	SPS6b	SPS6c	SPS6d	SPS6e
Diagnostic Test Questions	60	20	29	19	49	43	18	28	10
Need Practice?									
Practice Pages	68	69	70	71	72	73	74	75	76

SPS7.

SPS8.

Indicator	SPS7a	SPS7b	SPS7c	SPS8d	SPS8a	SPS8b	SPS8c	SPS8d	SPS8e
Diagnostic Test Questions	42	59	17	48	53	64	8	27	47
Need Practice?									
Practice Pages	77	78	79	80	81	82	83	84	85

Name _____

Student Recording Chart *(continued)*

SPS9.

SPS10.

Indicator	SPS9a	SPS9b	SPS9c	SPS9d	SPS9e	SPS9f	SPS10a	SPS10b	SPS10c
Diagnostic Test Questions	58	15	16	63	52	25	41	26	1
Need Practice?									
Practice Pages	86	87	88	89	90	91	92	93	94

Diagnostic Test:

Pre Test



- Which area of physical science is most closely related to the development of radio?
A electromagnetism
B gravity
C optics
D statistics
- Johannes Kepler believed that all the planets must circle the Sun in perfectly circular orbits. However, the data did not match Kepler's original theory. Because Kepler displayed the scientific trait of honesty, he _____.
A abandoned the theory
B changed the data to match his theory
C changed his theory to match the data
D made new measurements until he found the numbers he wanted

Time (min:s)	Train speed (km/h)
0:00	98
0:10	95
0:20	91
0:30	91
0:40	98

- A train slows down and then speeds up as it travels over a hill each day. You want to determine if the train ever slows to less than 90 km/h. You collect data and record it in a table. What could you do to determine if the train slows to less than 90 km/h?
A Measure the speed of the train between the 20 second and 30 second interval.
B Measure the speed of the train between the zero and 10 second interval.
C Measure the speed of the train between the 30 second and 40 second interval.
D Measure the speed of the train between the 10 second and 20 second interval.

- A(n) _____ shows how concepts are related. Words are written in circles, and the relation between the words is indicated by overlapping of the circles.
A events chain
B cycle map
C Venn diagram
D network tree

Use the table to answer question 5.

Year on Penny	Mass of Penny (g)
1965	3.1
1989	2.5
1997	2.5
1980	3.0
1983	2.5
1976	3.1
2006	2.5
2000	2.5

- You decide to use an electronic balance and a water displacement vessel to measure the density of pennies, but you run into a problem. Examine the table to discover the nature of the problem. How does this new information change your investigation?
A Because the mass of the penny depends on the year it was made, finding the density of the penny is not possible.
B Because the mass of the penny depends on the year it was made, the density you measure will depend on the age of your pennies.
C Because the mass of the penny depends on the year it was made, you cannot do the experiment.
D Because the mass of the penny depends on the year it was made, you must throw out all your old data and start again.



Diagnostic Test: *(continued)*

Pre Test



6. A light-year is a unit that astronomers use to measure large distances in space. A light-year is equal to 9.461×10^{12} kilometers. How many meters is in a light-year?
- A 9.461×10^{15} m
 - B 9.461×10^9 m
 - C 9.461×10^{13} m
 - D 9.461×10^{11} m
7. Group A measures the density of a block of metal to be 42 g/cm^3 . Group B measures the density of the same block to be 84 g/cm^3 . Your job is to discover the source of the discrepancy. Which factor is probably NOT the source of the discrepancy? (Density is mass/volume)
- A At least one group may have measured the mass incorrectly.
 - B At least one group may have measured the volume incorrectly.
 - C At least one group may have used the wrong formula for finding density.
 - D At least one group may have measured the density in a place where gravity has a different value.

Use the table to answer question 9.

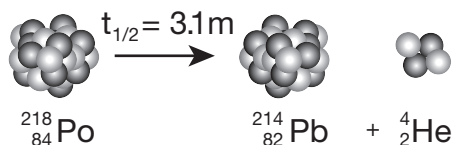
Ball	Horizontal speed
A	50 meters/second
B	90 meters/second
C	100 meters/second

8. Three identical tennis balls are fired from ball cannons at the same instant. The barrels of all three ball cannons are parallel to the ground. The table shows the horizontal speeds of the balls. What is true of their falling speeds?
- A Ball A falls fastest.
 - B Ball B falls fastest.
 - C Ball C falls fastest.
 - D All three balls fall at the same rate.
9. Because light has wave properties, at one time, scientists thought that just like water waves or sound waves, light must move through some sort of material. They hypothesized the existence of a substance called “luminiferous ether,” which carried light through space. Experiments were carried out to find the speed of Earth through the ether, but no evidence of the ether could be found. These experiments led eventually to Albert Einstein’s theory of special relativity, in which the speed of light is assumed to be constant for all observers. Which statement does NOT describe the importance of the ether hypothesis?
- A Incorrect hypotheses are never corrected, only expanded upon.
 - B Incorrect hypotheses often cause scientists to develop new experiments that produce additional data.
 - C Incorrect hypotheses can give scientists ideas about what to study in the future.
 - D Incorrect hypotheses must be corrected to form better hypotheses.
10. Which substance will be located farthest toward the alkaline side of the pH scale?
- A vinegar
 - B carbonated beverage
 - C spaghetti sauce
 - D baking soda



Diagnostic Test: (continued)

Pre Test



11. According to the diagram, which is true?
- A Compounds cannot be broken down into simpler substances.
 - B Elements can be broken down into molecules.
 - C Heterogenous mixtures have a uniform composition throughout.
 - D An element can change into a different element when redioactive decay occurs.

Use the table to answer question 12.

Isotope Ratios in a Sample of Uranium

Isotope	Atomic Number	Percent of Sample
Uranium-234	234	10%
Uranium-235	235	30%
Uranium-238	238	60%

12. The data shown in the table is to be turned into a graph with a computer program. Which type of graph would best represent this information?
- A bar graph
 - B distance-time graph
 - C acceleration graph
 - D circle graph

13. In a chemical reaction in which two reactants yield a single product, what is a reasonable beginning and ending mass for the reaction?
- A reactant 1 = 10 grams, reactant 2 = 5.1 grams, product = 15 grams
 - B reactant 1 = 5.0 grams, reactant 2 = 5.0 grams, product = 5.0 grams
 - C reactant 1 = 10.0 grams, reactant 2 = 10.0 grams, product = 10.0 grams
 - D reactant 1 = 7.9 grams, reactant 2 = 10.0 grams, product = 17 grams
14. When doing a classroom investigation laboratory, when should you substitute other equipment from those listed in the materials?
- A never
 - B only if instructed by the teacher
 - C only if you've run out of material
 - D only if you test with a small amount first
15. In 5 seconds, 5 wavelengths of a wave pass a certain point. What is the wave's frequency?
- A 0 Hz
 - B 1 Hz
 - C 5 Hz
 - D 10 Hz
16. What do electromagnetic waves and sound waves have in common?
- A They both transmit energy.
 - B They both travel through solids.
 - C They both move at the speed of sound.
 - D They both move at the speed of light.



Diagnostic Test: *(continued)*

Pre Test



Use the table to answer question 17.

Substance	Specific Heat [J/(kg°C)]
Water	4184
Wood	1760
Carbon (graphite)	710
Glass	664
Iron	450

17. According to the table, what material requires the least heat to raise its temperature by 10°C?
- A glass
 - B iron
 - C water
 - D wood

Use the table to answer question 18.

Solubility of Compounds (in grams per 100 grams of water)

Compound	0°C	20°C	100°C
Sodium chloride	35.7	35.9	39.2
Sucrose (sugar)	179.2	203.9	487.2
Potassium chloride	28.0	34.0	56.3
Copper (II) sulfate	23.1	32.0	114.0

18. Based on the information in the table, what is the approximate solubility of potassium chloride at 12°C?
- A between 28.0 and 34.0 grams
 - B between 179.2 and 28.0 grams
 - C between 34.0 and 56.3 grams
 - D between 56.3 and 114.0 grams

Use the formula to answer question 19.

$$V_1/T_1 = V_2/T_2$$

where T is temperature and V is volume.

19. At constant pressure, the volume of a gas is reduced from 1.0 liters to 0.9 liters. If the beginning temperature is 298 K, what is the final temperature?
- A 301 K
 - B 293 K
 - C 331 K
 - D 268 K

Use the table to answer question 20.

Elements in the Same Group

Element	Valence
Helium	8
Argon	8
Neon	8
Krypton	8
Xenon	8

20. The table above represents several elements that have the same valence. To which groups do these elements belong?
- A alkali metals
 - B alkaline earth metals
 - C halogens
 - D noble gases
21. Nuclear fission converts small amounts of matter into_____.
- A large amounts of mass
 - B small amounts of mass
 - C small amounts of energy
 - D large amounts of energy



Diagnostic Test: *(continued)*

Pre Test

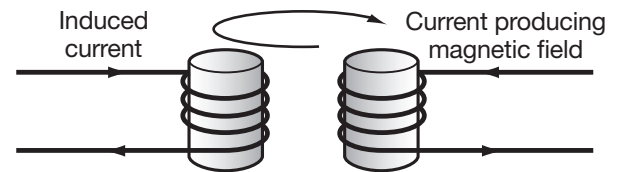


Use the table to answer question 22.

Material	Density (g/cm ³)
Aluminum	2.7
Iron	7.9
Gold	19.3

22. Densities of some metals are shown. A 10-gram sample of each metal must differ in _____.
- A shape
 - B weight
 - C mass
 - D size
23. Scientific papers often describe the meanings of words in great detail. Why?
- A to keep nonscientists from understanding them
 - B to communicate information clearly
 - C because most scientists don't speak English
 - D because the everyday meanings of most words are wrong
24. For scientists, what is the most important advantage of publishing research in a peer-reviewed journal instead of writing a book?
- A Only scientists are allowed to read peer-reviewed journals.
 - B Articles in peer-reviewed journals are checked for accuracy by many scientists.
 - C Articles in peer-reviewed journals contain only proven information.
 - D Articles in peer-reviewed journals are read by more people than books.

25. A scientist uses a spectrometer to measure the wavelength of two similar stars. One of the stars is moving away from Earth, and the other is moving toward Earth. What is the scientist most likely investigating?
- A the speed the stars are moving
 - B the size of the stars
 - C the distance of the stars from Earth
 - D the age of the stars



26. The diagram shows a transformer. What is true of transformers?
- A Transformers change the voltage and current of electricity.
 - B Transformers require direct current (DC) to work.
 - C Transformers will work only at high voltages.
 - D Transformers will work only at low voltages.



Diagnostic Test: *(continued)*

Pre Test



Use the table to answer question 27.

Weight on Venus	Weight on Earth	Weight on Mars	Weight on Jupiter	Weight on Saturn
90 N	100 N	38 N	254 N	116 N
450 N	500 N	190 N	1,270 N	580 N
900 N	1000 N	380 N	2,540 N	1,060 N

27. The table shows weight in newtons on different planets. For a person with a mass of 50 kg, on which planet would her weight be the least?

- A Venus
- B Earth
- C Mars
- D Jupiter

28. Which pH measurement is MOST acidic?

- A 7.0
- B 9.5
- C 5.5
- D 1.2

Use the table to answer question 29.

Rose made the following table in science class.

allowing a piece of metal to rust
burning a piece of paper
electrolysis of water into hydrogen and oxygen
browning sugar on the stove
CFCs breaking down atmospheric ozone

29. The purpose of Rose's list is to give_____.

- A examples of chemical changes
- B examples of physical changes
- C examples of chemical properties
- D examples of physical properties

30. Which is NOT a decomposition reaction?

- A $\text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- B $\text{SO}_2 \rightarrow \text{S} + \text{O}_2$
- C $2\text{HCl}_2 \rightarrow 2\text{H}_2 + \text{Cl}_2$
- D $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$

31. A helium nucleus is the same as a(n) _____.

- A alpha particle
- B hydrogen nucleus
- C beta particle
- D gamma particle

Use the table to answer question 32.

Positive Ions	Charge	Negative Ions	Charge
Na	1+	F	1-
K	1+	I	1-
Ca	2+	NO_3	1-
Mg	2+	SO_4	2-

32. Based on the table, which is the stable molecule?

- A Na_2SO_4
- B K_2NO_3
- C MgCa_4
- D Na_2F

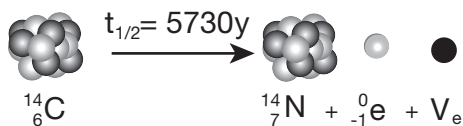
33. What is the chemical formula for carbon monoxide?

- A CO
- B CO_2
- C C_2O
- D C_2O_2



Diagnostic Test: *(continued)*

Pre Test



34. Carbon-14 provides a convenient marker for measuring the age of certain organic materials. While they are alive, organisms are constantly taking in and releasing carbon. A certain percentage of that carbon is radioactive carbon-14. Over time, that carbon-14 naturally decays into nitrogen-14 by ejecting an electron and a particle known as an antineutrino. As long as the organism is alive, the amount of carbon-14 in the body remains relatively constant. But when the organism dies, and therefore stops taking in carbon, the amount of carbon-14 in the body begins to drop. How is this information useful to scientists?
- A It can allow scientists to develop more nutritious food sources.
 - B It allows scientists to determine the weight of ancient organisms.
 - C Measuring the amount of carbon-14 and nitrogen-14 in the remains of organisms can tell scientist how long the organism has been dead.
 - D Measuring the amount of carbon-14 and nitrogen-14 allows scientists to determine the age of Earth.
35. Some researchers in a field known as string theory suggest that gravity might get weaker than expected at extremely small distances. If this hypothesis is verified repeatedly through reliable observations, which is NOT a likely consequence?
- A Scientists will have to take this into account when studying gravity at small scales.
 - B Scientists will have to determine when the old theories still apply.
 - C All old theories of gravity will be thrown out, and researchers will start over.
 - D Scientists will have to determine the conditions in which the new theories are most useful.

Use the table to answer question 36.

Half-Life of Carbon-14

Half-Life	Remaining mass of C-14 (g)	Time (yrs)
0	1	0
1	$\frac{1}{2}$	5700
2	$\frac{1}{4}$	11,400
3	$\frac{1}{8}$?
4	$\frac{1}{16}$	22,800
5	$\frac{1}{32}$	28,500

36. According to these data, after how many years would the mass of a one-gram sample of carbon-14 decay to $\frac{1}{8}$ gram?
- A 17,100 years
 - B 22,800 years
 - C 28,500 years
 - D 34,200 years
37. Which is NOT a general safety rule for the laboratory?
- A Obtain your teacher's permission to begin all investigations.
 - B Study the procedure before you begin, and ask questions to be sure you understand.
 - C Notify your teacher of allergies or other health conditions that could affect your participation.
 - D If you do not understand the instructions, watch your fellow students and model their behavior.



Diagnostic Test: *(continued)*

Pre Test



Use the table to complete question 38.

Element	Symbol	Flame Color	Description of Element
Barium	Ba	yellow-green	silver-white metal
Lithium	Li	red	silver-white metal
Potassium	K	violet	silver-white metal
Strontium	Sr	red	silver-white metal
Copper	Cu	blue-green	pinkish red metal

38. According to the table, a substance that burns with a greenish flame most likely contains _____.
- A barium or lithium
 - B copper or strontium
 - C potassium or barium
 - D copper or barium
39. Using their feet, Mary and Eliza both measure the length of a football field five times. While Mary is the more accurate of the two, Eliza is more precise. What statement explains this relationship?
- A Mary's measurements are on average closer to the actual length, while Eliza's measurements are on average farther from one another.
 - B Mary's measurements are on average closer to one another, while Eliza's measurements are on average closer to the actual length.
 - C Mary's measurements are on average further from one another, while Eliza's measurements are on average closer to the actual length.
 - D Mary's measurements are on average closer to the actual length, while Eliza's measurements are on average closer to one another.
40. You are investigating battery life for various brands of batteries. What piece of data is probably NOT important to your investigation?
- A the voltage of each battery you test
 - B the amount of time each battery is used
 - C the color of each battery in your investigation
 - D the type of equipment the battery powers in your investigation
41. During a rainstorm, lightning strikes a radio tower. This is an example of _____.
- A thunder
 - B a static discharge
 - C a radio current
 - D a radio discharge
42. The temperature is higher inside a parked car on a sunny day than outside because of the conversion of _____.
- A light energy into thermal energy
 - B thermal energy into light energy
 - C nuclear energy into thermal energy
 - D electrical energy into thermal energy
43. Solubility increases with temperature and decreases with amount of solute. If you stirred sugar into each substance, which would be able to dissolve the least?
- A a cold glass of distilled water
 - B a warm glass of distilled water
 - C a cold mixture of sugar and water
 - D a warm mixture of sugar and water
44. A scientific paper describing an experiment will most likely describe all EXCEPT _____.
- A opinions held
 - B methods used
 - C procedure followed
 - D conclusions determined

Go on 

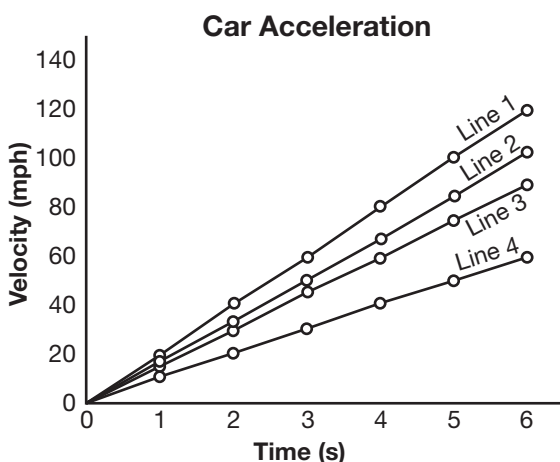
Diagnostic Test: *(continued)*

Pre Test



45. Which statement is NOT true?
- A If two scientific theories make exactly the same predictions, there is no way for an experiment to distinguish between the two theories.
 - B If two scientific theories both explain the same set of data, scientists will often prefer the simpler of the two theories.
 - C If two scientific theories explain data under different conditions, then the two theories cannot both be right.
 - D If two scientific theories each explain data under different conditions, then the two theories might be combined into a third theory.

Use the table to complete question 46.



46. Consider the graph shown here. What is one benefit of displaying scientific information with a graph?
- A A graph is more precise than a list or a table.
 - B A graph is easier to produce than a list or a table.
 - C A graph can more clearly show relationships among variables.
 - D A graph conveys extra information not found in lists or tables.

47. The efficiency of a machine is a measure of how much of the work put into a machine is converted to useful output work by the machine. Which statement is true?
- A No machine is 100 percent efficient.
 - B Electrical machines are more efficient than nonelectrical machines.
 - C Electrical machines are 100 percent efficient.
 - D All machines are 100 percent efficient.
48. While a pan of water is boiling, the temperature of the water _____.
- A goes up
 - B goes down
 - C remains constant
 - D varies depending on conditions
49. Pure water is not a good conductor of electricity. How can its conductivity be increased?
- A mixing an ionic compound into the water
 - B separating the hydrogen from the oxygen
 - C magnetizing the water
 - D mixing a covalent compound into the water



Diagnostic Test: *(continued)*

Pre Test



Use the table to answer question 50.

Isotope	Half-Life
Thorium-234	24 days
Carbon-14	5730 years
Uranium-235	713 million years
Potassium-40	1.3 billion years

50. Which radioisotope in the table above would be LEAST useful for determining the age of the remains of a living thing?
- A thorium-234
 - B carbon-14
 - C uranium-235
 - D potassium-40
51. Jodi wants to test the law of conservation of mass by burning a sample of charcoal. When should Jodi measure the mass of the reactants?
- A before burning the charcoal
 - B after burning the charcoal
 - C before and after burning the charcoal
 - D while burning the charcoal
52. From fastest transmission to slowest, three media that transmit sound are _____.
- A water, steel, and air
 - B steel, water, and air
 - C air, steel, and water
 - D steel, air, and water
53. If they have the same diameter and the same force is applied to the following objects, which one will have the MOST acceleration?
- A an aluminum ball
 - B a lead ball
 - C a glass ball
 - D a plastic ball
54. Why is high-level radioactive waste from nuclear power plants often buried deep underground?
- A because it emits greenhouse gases
 - B because it can remain radioactive for several thousand years
 - C because it may cause light pollution
 - D because in nature, radioactive elements are often found underground
55. Ionic compounds are usually formed by ionic bonding between metals and nonmetals. Which is an ionic compound?
- A $C_2H_{12}O_6$
 - B H_2O
 - C $MgCl_2$
 - D CO_2
56. The best place to find a scientific definition of the word reaction is _____.
- A the internet
 - B a college dictionary of the English language
 - C a dictionary of chemistry terms
 - D figuring it out from context



Diagnostic Test: *(continued)*

Pre Test



Use the table to answer question 57.

Plant	Water (L)	Fertilizer (mL)	Sunlight (hrs per day)
Peanut tree	2	200	2
Rose bush	2	200	6
Apple tree	2	200	8

57. Inigo plans to conduct an experiment using three plants. His hypothesis is that the plant receiving the most sunlight at the end of three months will show the most growth. In his plan above, he has listed the types of plants, and how much water, fertilizer, and sunlight each plant will receive. What could Inigo do to improve his experiment?
- A Use the same variety of plant.
 - B Give the plants the same amount of sunlight.
 - C Give the plants the same amount of water.
 - D Use different kinds of fertilizer.
58. Which probably transfers the least energy?
- A the vibration of an erupting volcano
 - B the sound of a loud stereo
 - C an ocean wave carrying a surfer
 - D the infrasonic rumble of an earthquake
59. Which statement is true?
- A Most of the energy produced by burning natural gas is turned into electricity.
 - B All of the energy produced by burning gasoline is wasted.
 - C Most of the energy produced by burning coal is wasted.
 - D All of the energy produced by burning wood becomes pollution.
60. Most metallic elements have all of these properties EXCEPT _____.
- A being highly ductile
 - B being a good electrical insulator
 - C being easily crumbled into pieces
 - D having a high density
61. The world's population has been increasing for most of recorded history. Which is the MOST likely hypothesis to explain this fact?
- A Better health care has allowed people to live longer.
 - B The number of children per family has been decreasing.
 - C Population statistics have been recorded with increasing accuracy.
 - D The number of countries in the world has increased.
62. Tali uses a graduated cylinder to measure a sufficient amount of an acidic solution to neutralize a basic solution, but after mixing the solutions, she finds the product is still basic. What is the most likely cause of her mistake?
- A The graduated cylinder she used was too big.
 - B She read the top of the meniscus instead of the bottom.
 - C The acid and base won't mix.
 - D The acidic solution wasn't acidic enough.
63. Which may be caused by destructive interference of sound waves?
- A quiet areas in a room with music playing
 - B louder areas in a room with music playing
 - C shaking walls in a room with music playing
 - D a breeze moving through a room with music playing

Go on 

Diagnostic Test: *(continued)*

Pre Test



64. According to Newton's second law of motion, mass times acceleration equals _____.
- A motion times time
 - B velocity
 - C distance times speed
 - D force
65. It was once argued that heat was a fluid, able to flow from hot objects to cold ones. One argument in favor of heat as a fluid was that it seemed to flow from a hot metal bar into cold water, resulting in hotter water and colder metal. What is one possible argument against the heat fluid theory?
- A The observation that hot objects cool down and cool objects heat up may be wrong.
 - B We can't see heat moving from one object to another, therefore it can't be happening.
 - C Heat can't be a fluid because hot air rises.
 - D Heat can be produced without the presence of a hot object; for instance, by rubbing your hands together.
66. Einstein's theory of general relativity was accepted because even though Newton's law of universal gravitation worked well for almost all measurements, it tended to predict motion inaccurately when gravitational forces were very strong. And yet, when a spacecraft is sent to the Moon or to a distant planet, it is Newton's law of universal gravitation, and not Einstein's theory of general relativity, that is used to predict the path of the spacecraft. Why?
- A Einstein's general relativity works only on the scale of galaxies.
 - B Einstein's general relativity is untested.
 - C Newton's theory of universal gravitation works well under the conditions likely to be encountered by spacecraft.
 - D Einstein's general relativity makes poor predictions for the motions of spacecraft.
67. A team of researchers records the progress of a chemical change by watching the color change of the products. What is one way to avoid bias in this research?
- A Use a spectrometer to measure the color change precisely.
 - B Have only one researcher record the color change.
 - C Increase the number of times the color change will be recorded.
 - D Repeat the experiment many times.



Diagnostic Test: *(continued)*

Pre Test



68. What branch of the sciences is most often concerned with the basic particles that make up matter?

- A physics
- B astronomy
- C geology
- D chemistry

69. Even though the speed of light is 1,079,252,848.8 km/h, scientists know it can take hundreds or even millions of years for starlight to reach Earth. Which statement is NOT consistent with this fact?

- A The stars are very far away.
- B The Sun and stars are very old.
- C The laws of science are universal.
- D Different scientific laws apply on the stars and on Earth.

Use the table to answer question 70.

Time	Temperature	Weight
0.0	15	12
1.0	20	0.0
2.0	0.0	15
3.0	10	20

70. What is one problem with this portion of a lab report?

- A Significant digits are not used correctly.
- B The numbers should be written in scientific notation.
- C Temperature should be measured in Celsius.
- D The relationship among the data points is unclear.

71. If you wanted to know whether an atom is oxygen or nitrogen, you should find out how many _____ it has.

- A electrons
- B photons
- C protons
- D neutrons

72. Under what circumstances should you report an injury during a classroom investigation laboratory?

- A only if the injury happens to you
- B only if the injury is serious
- C only if you see the injury yourself
- D always, under all circumstances, no matter how minor the injury is

73. In a debate on alternative fuels, which argument would be in favor of increased use of solar power instead of oil or coal?

- A Solar power is a renewable resource.
- B The energy stored in oil comes from the Sun.
- C Burning oil and coal will not require investment in new technologies.
- D Solar power is less efficient than oil or coal.



Diagnostic Test: *(continued)*

Pre Test



74. Albert Einstein developed a new theory of gravity several centuries after Isaac Newton. Most scientists did not accept Einstein's theory of gravity until observations were made, showing that light beams from distant stars were bent by the Sun's gravity, as predicted by Einstein's theory. What is the best reason scientists could have had to prefer Newton's theory?
- A Newton's theory is the one they had learned about it in school.
 - B Newton's theory was easier to use.
 - C There was no way to choose between the theories without observational evidence.
 - D Einstein would become more famous than Newton if his theory were shown to be true.
75. Science is our attempt to understand the _____.
- A natural universe
 - B origin of life
 - C meaning of existence
 - D Earth we live on
76. Why is the use of quantitative data important in scientific arguments?
- A The use of quantitative data allows researchers to compare their observations.
 - B The use of quantitative data ensures that conclusions are correct.
 - C The use of quantitative data avoids critical analysis by other researchers.
 - D The use of quantitative data makes the argument look more scientific.
77. One reason that science is always changing is that _____.
- A past scientists made more mistakes than modern scientists
 - B new data is always being gathered
 - C scientific theories depend on the dominant culture
 - D the goal of science is to create new ideas



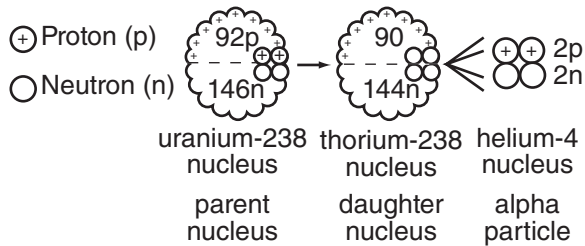
Standards Practice:

SCSh1

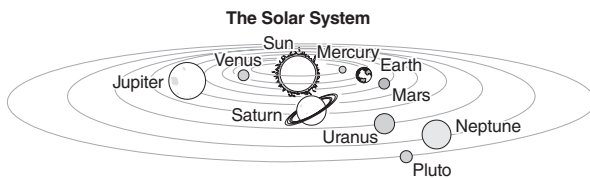


Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

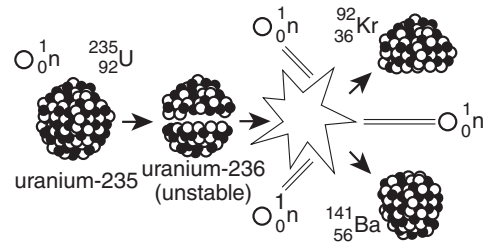
a. Exhibit the above traits in their own scientific activities.



- Henri Becquerel is famous for the discovery of natural radioactivity. While studying fluorescence in minerals, he found that photographic plates stored in a dark drawer with a mineral containing uranium became fogged. Rather than throwing away the plates as ruined, Becquerel studied the new phenomenon and made an important discovery. What scientific trait did Becquerel demonstrate?
 - A curiosity
 - B openness
 - C honesty
 - D skepticism



- Johannes Kepler thought the planets circled the Sun in circular orbits. However, new data did not support this theory. Rather than change the data to match his theory, Kepler changed his theory to match the data. What scientific trait did Kepler display?
 - A curiosity
 - B skepticism
 - C honesty
 - D curiosity



- Lise Meitner is famous for the discovery of nuclear fission. Experiments showed that the large uranium nucleus could change into smaller nuclei. No theory at the time could explain how this could happen. Meitner examined the problem and developed a new theory to explain the phenomenon. What scientific trait did Meitner possess?
 - A openness
 - B curiosity
 - C honesty
 - D skepticism
- Richard Feynman, a Nobel Prize-winning physicist, was asked to help investigate the *Challenger* space shuttle disaster. Feynman asked if the below-freezing weather during the launch could have caused the shuttle failure, and NASA officials assured him that the cold weather was not unsafe. Feynman took a piece of rubber of the same type as the rubber o-rings found on the shuttle and placed the rubber in a glass of ice water. He then showed that at the temperature of ice water, the rubber became stiff and brittle. It was eventually determined that leaky o-rings had caused the *Challenger* shuttle disaster. What scientific trait did Feynman display in this instance?
 - A honesty
 - B skepticism
 - C openness
 - D curiosity



Standards Practice: *(continued)*

SCSh1



Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

- b. Recognize that different explanations often can be given for the same evidence.**

Use the table to complete question 1.

Time	Temperature(°C)
8:00 A.M.	-6
10:00 A.M.	-3
12:00 P.M.	0
2:00 P.M.	0
4:00 P.M.	-2
6:00 P.M.	-4
8:00 P.M.	-6

1. You collect temperature data using a remote sensor on a frozen pond. What conclusions could you draw from these data?
 - A The pond remained ice-covered all day.
 - B The surface of the pond melted in the middle of the day.
 - C Either the pond remained ice-covered all day or the surface melted in the middle of the day.
 - D The Sun was shining from 12:00 P.M. to 2:00 P.M.
2. Suppose you see a photograph of a solid steel ball in the air. Which conclusions about the ball are equally valid?
 - A Either the ball is floating in air or it is falling due to gravity.
 - B Either the ball was dropped from an airplane or fired from a cannon.
 - C Either the ball is traveling at 50 m/s or -50 m/s.
 - D The ball is traveling upward, traveling downward, or momentarily suspended between up and down motion.

3. At ordinary speeds, Isaac Newton's laws of motion and Albert Einstein's special relativity give the same answers. How do we decide which theory is correct?

- A There is no way to decide between the two theories.
- B Further experiments at higher speeds might show which of the two theories better matches the data.
- C The newer theory is more likely to be the correct one.
- D The older theory is more likely to be the correct one.

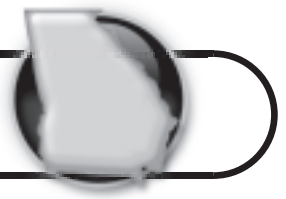
Time (minutes:seconds)	Train speed (km/h)
0:00	90
0:10	95
0:20	98
0:30	98
0:40	95

4. A train speeds up and then slows down as it travels through a valley. To determine if a train ever exceeds a speed of 100 km/h, you collect data and record it in a table. Which would be the best strategy to determine if the train exceeds 100 km/h?
 - A Measure the speed of the train between the 20-second and 30-second interval.
 - B Measure the speed of the train between the zero and 10-second interval.
 - C Measure the speed of the train between the 30-second and 40-second interval.
 - D Measure the speed of the train between the 10-second and 20-second interval.



Standards Practice: *(continued)*

SCSh1



Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

- c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.**
1. An experiment called the Laser Interferometer Gravitational Observatory (LIGO) is trying to find evidence for gravitational waves. These are waves predicted by Albert Einstein's General Theory of Relativity. If they exist, these gravitational waves change the shape of space by tiny amounts. Which statement is **NOT** true of this research?
 - A If gravitational waves are found, Einstein's theory will be proven correct.
 - B If gravitational waves are found, scientists will have more confidence in Einstein's theory.
 - C If gravitational waves are not found, scientists will doubt Einstein's theory.
 - D If gravitational waves are found, we will gain a deeper understanding of the universe.
 2. Which statement is **NOT** true?
 - A If two scientific theories make exactly the same predictions, there is no way for an experiment to distinguish between the two theories.
 - B If two scientific theories both explain the same set of data, scientists will often prefer the simpler of the two theories.
 - C If two scientific theories make different predictions for an experiment, then one of the theories will be right and the other will be wrong.
 - D If two scientific theories each explain data under different conditions, then the two theories might be combined into a third theory.
3. Why must experiment or observation be used to choose between competing scientific theories?
 - A Scientific theories can only explain unknown phenomena.
 - B Scientific theories are reinforced or weakened depending on how well they explain new data.
 - C Experiments and observations help scientists state the problem to be solved.
 - D Experiments and observations help scientists form their initial hypotheses.
 4. Further understanding of scientific problems often relies on new _____, which may reinforce or weaken opposing explanations.
 - A laboratory procedures
 - B technology
 - C safety equipment
 - D experiments



Standards Practice:

SCSh2



Students will use standard safety practices for all classroom laboratory and field investigations.

- a. Follow correct procedures for use of scientific apparatus.**
1. What is the correct procedure for using a test tube?
 - A** Always hold the test tube firmly with two hands while heating or adding chemicals.
 - B** Hold test tube directly in the flame of a Bunsen burner.
 - C** Never heat a test tube.
 - D** Hold test tubes a short distance above a Bunsen burner.
 2. If your teacher instructs you to smell a chemical during a classroom laboratory investigation, what method should be used?
 - A** Hold the container a short distance away and fan the vapors toward your nose.
 - B** Close your nose tightly to prevent chemicals from entering your nostrils.
 - C** Breathe into the chemical before sniffing.
 - D** Have a lab partner blow across the chemical to push the vapors toward your nose.
 3. Under what circumstances should you substitute other chemicals or substances from those listed in the materials?
 - A** This should never be done.
 - B** only if instructed by the teacher
 - C** only if you've run out of material
 - D** only if you test with a small amount first
 4. Under what circumstances should materials or chemicals be taken outside of the laboratory?
 - A** only if you test with a small amount first
 - B** This should never be done.
 - C** only if instructed by the teacher
 - D** only if you've run out of material
 5. Which is a correct use of scientific apparatus in classroom laboratory investigations?
 - A** Goggles and a safety apron are sufficient safety equipment for all labs.
 - B** Always slant the mouth of a test tube you are heating away from yourself and others.
 - C** Before beginning a lab, all safety equipment should be tested, including the fire extinguisher, the safety shower, the fire blanket, the first-aid kit, and the fire alarm.
 - D** If you are on fire, immediately run as fast as possible to the safety shower.



Standards Practice: *(continued)*

SCSh2



Students will use standard safety practices for all classroom laboratory and field investigations.

b. Demonstrate appropriate techniques in all laboratory situations.

1. What is NOT part of proper laboratory cleanup procedure?
 - A Turn off all burners, water, and gas, and disconnect all electrical devices.
 - B Dispose of chemicals and other materials as directed by your teacher.
 - C Return any unused chemicals to their original containers.
 - D Wash your hands with soap and water thoroughly before removing your goggles.



2. Which is NOT proper emergency procedure?
 - A Clean up spills before reporting them.
 - B Report any fire, electrical shock, glassware breakage, spill, or injury.
 - C If your clothing should catch fire, stop, drop, and roll.
 - D If chemicals come into contact with your eyes or skin, notify your teacher immediately.
3. Which is NOT a good strategy for accident prevention?
 - A Wear goggles and a safety apron.
 - B Use all senses, including taste and feel, to determine if a material is safe.
 - C Do not use hair spray, mousse, or other flammable hair products.
 - D Remove jewelry on hands and wrists and any loose jewelry, such as chains or long necklaces.

4. Which is NOT a general safety rule for the laboratory?
 - A Obtain your teacher's permission to begin all investigations.
 - B Study the procedure before you begin and ask questions to be sure you understand.
 - C Notify your teacher of allergies or other health conditions that could affect your participation.
 - D When unsure how to use a piece of equipment, watch your fellow students and model their behavior.
5. Which is a correct safety procedure for classroom laboratory investigations?
 - A Be cautious when inhaling chemicals.
 - B Always obtain your instructor's permission to begin a lab.
 - C Report accidents or injury to your instructor if they are not minor.
 - D Spills should be cleaned up immediately after the lab is over.



Standards Practice: *(continued)*

SCSh2



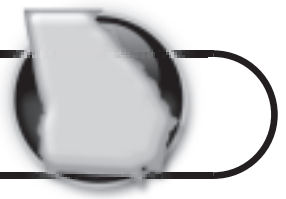
Students will use standard safety practices for all classroom laboratory and field investigations.

- c. Follow correct protocol for identifying and reporting safety problems and violations.**
- Which situations do NOT need to be reported immediately?
 - any fire or chemical spill
 - any broken equipment
 - any successfully performed laboratory procedure
 - any violation of laboratory rules
 - Under what circumstances should an electrical shock be reported to your teacher?
 - always, no matter how small the shock
 - only if a spark was visible
 - only if the person receiving the shock wishes to make a report
 - only if the teacher has instructed you ahead of time to report electrical shocks
 - Under what conditions should you obtain your teacher's permission to begin a laboratory investigation?
 - only if this is a new procedure for you
 - always, no matter what the investigation.
 - only if the teacher is in the room
 - only if there is sufficient time
 - Under what circumstances should you report a violation of laboratory rules?
 - only if you don't know the person you are reporting
 - only if you know that the violation creates a dangerous situation
 - only if you see the violation yourself
 - always, under all circumstances
- 5.** The correct safety procedure is to report any accidents or injury to your instructor _____.
- if they are clearly dangerous
 - no matter how minor or small they may be
 - using the proper written form
 - whether they happened or not



Standards Practice:

SCSh3



Students will identify and investigate problems scientifically.

- a. Suggest reasonable hypotheses for identified problems.**
- Which feature should NOT be included in the scientific process?
A hypothesis formation
B experimenter bias
C observation
D theory development
 - To determine the boiling point of an unknown liquid, a student heats 10 mL of the liquid in a test tube and records the temperature every minute for 20 min. In this example, time is the _____.
A control
B independent variable
C dependent variable
D hypothesis
 - Melissa heated a few blue crystals in a test tube. After a few minutes, she observed that the crystals had turned white and a film of water had formed on the inside of the test tube. Before Melissa conducted this experiment, she should most likely _____.
A develop a theory
B develop a hypothesis
C develop a bias
D develop a scientific law
 - The world's population has been increasing for most of recorded history. Which is the LEAST likely hypothesis to explain this fact?
A Better healthcare has allowed people to live longer.
B The number of children per family has been increasing.
C Population statistics have been recorded with increasing accuracy.
D The number of countries in the world has increased.
- In science, activities are performed that test the validity of theories. These activities are called _____.
A experiments
B hypotheses
C variables
D controls
 - Sometimes scientists misinterpret their data, causing them to draw the wrong conclusions. What is one common cause of scientific misinterpretation?
A unit conversion
B modeling
C researcher bias
D phenomena



Standards Practice: *(continued)*

SCSh3



Students will identify and investigate problems scientifically.

- b. Develop procedures for solving scientific problems.**
- Which is NOT usually one of the procedures used for solving scientific problems?
 - observation
 - experiment
 - bias
 - forming a hypothesis
 - A _____ shows the characteristics that two or more subjects have in common, as well as those that they do not have in common.
 - cycle map
 - Venn diagram
 - spider map
 - network tree
 - A(n) _____ models the order or sequence in a series of events, the steps in a procedure, or the stages in a process.
 - cycle map
 - events chain
 - Venn diagram
 - network tree
 - A(n) _____ shows how concepts are related. Words are written in ovals, while the description of the type of relationship is written across the connecting lines.
 - events chain
 - cycle map
 - Venn diagram
 - network tree
- 5.** Which is NOT a likely component of a physics experiment?
 - developing a mathematical description of the experiment
 - conducting a public opinion poll on the topic of the experiment
 - repeating the same procedure a large number of times
 - speculating about what the outcome of the experiment might be



Standards Practice: *(continued)*

SCSh3



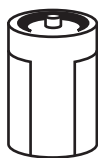
Students will identify and investigate problems scientifically.

- c. Collect, organize and record appropriate data.

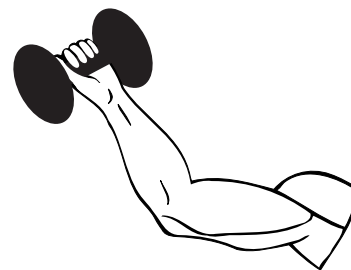
Golf Ball Falling from Height

Time	Distance
0 seconds	0
1 second	16
2 seconds	64
3 seconds	144
4 seconds	256
5 seconds	400
6 seconds	576

1. In the table shown, what is one major problem with the data that have been collected?
- A The data are incorrect.
 - B There are no units on the distance data.
 - C There are no units on the time data.
 - D The height at which the golf ball started to fall is not given.



2. You are investigating battery life for various brands of batteries. What information is probably not important to your investigation?
- A the voltage of each battery you test
 - B the amount of time each battery is used
 - C the shape of each battery in your investigation
 - D the type of equipment the battery powers in your investigation



3. In measuring the work done by a weight lifter, you record the weight being lifted and the number of repetitions. Which important piece of information have you left out?
- A the type of exercise being done
 - B the time of day the exercise is done
 - C which arm is used to lift the weight
 - D the distance through which the weights are lifted
4. In measuring the results of a chemical reaction, you record the grams of product at the end of the process. What other information will be most important?
- A the grams of reactant used at the beginning of the process
 - B the location at which the experiment is performed
 - C the time of day when the reaction occurs
 - D the shape of the container in which the reaction takes place

Standards Practice: *(continued)*

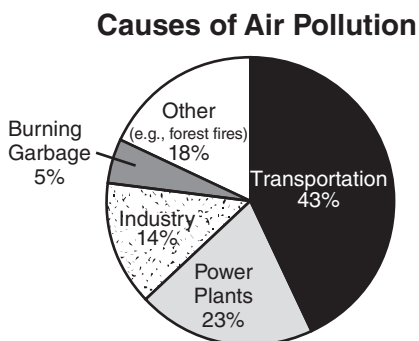
SCSh3



Students will identify and investigate problems scientifically.

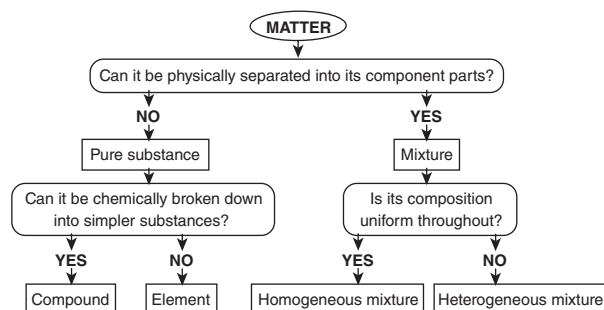
- d. Graphically compare and analyze data points and/or summary statistics.

Use the pie chart to answer questions 1 and 2.



- According to the pie chart, which would MOST improve the quality of air we breathe?
 - reducing the amount of electricity power plants produce
 - developing an electric-powered automobile
 - making more landfills so that garbage won't be burned
 - requiring industries to adopt less-polluting methods
- The answer to the previous question would change if _____.
 - industrial pollution increases by 10%
 - industry burns 50% of its trash instead of using a landfill
 - 90% of power plants are operated by industry
 - more than 20% of air pollution is caused by industrial transportation

Use the diagram to answer questions 3 and 4.

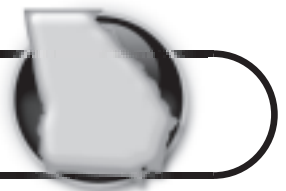


- According to the diagram, which is true?
 - Compounds cannot be broken down into simpler substances.
 - Elements can be broken down into simpler substances.
 - Heterogenous mixtures have a uniform composition throughout.
 - Homogenous mixtures have a uniform composition throughout.
- According to the diagram, a substance that cannot be physically separated but can be chemically broken down is a(n) _____.
 - compound
 - element
 - homogenous mixture
 - heterogenous mixture



Standards Practice: *(continued)*

SCSh3



Students will identify and investigate problems scientifically.

- e. Develop reasonable conclusions based on data collected.

Use the table to answer questions 1 and 2.

Information About Some Bulbs

	100-W Incandescent Bulb	23-W Compact Fluorescent Bulb
Life of bulb	750 hours	10,000 hours
Number of bulbs needed	about 6 over 3 years	1 over 6.8 years
Total cost of electricity (8 cents/kilowatt-hour)	\$33.04	\$8.06
Total cost of bulbs	\$6.50	\$11.06
Total cost over 3 years	\$39.54	\$19.12

- About how much does a consumer save over three years by using a fluorescent bulb in place of an incandescent bulb?
A \$10.50
B \$19.00
C \$20.50
D \$30.50
- If a consumer bought six incandescent bulbs on sale for half price, about how much more will they pay over three years compared to the fluorescent bulbs?
A \$5.25
B \$17.25
C \$25.25
D \$35.25

Use the chart to complete questions 3 and 4.

Element	Symbol	Flame Color	Description of element
Barium	Ba	yellow-green	silver-white metal
Lithium	Li	red	silver-white metal
Potassium	K	violet	silver-white metal
Strontium	Sr	red	silver-white metal
Copper	Cu	blue-green	pinkish red metal

- According to the chart, a substance that burns with a blue-green flame probably contains _____.
A barium
B lithium
C potassium
D copper
- What color will a silver-white metal most likely burn?
A red
B violet
C yellow-green
D not enough information to determine



Standards Practice: *(continued)*

SCSh3

Students will identify and investigate problems scientifically.

f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

1. In an investigation to determine average surface temperature in a temperate forest over the course of a year, temperature readings are taken in 540 locations every four hours for 365 days. What is a reasonable average temperature result for this investigation?

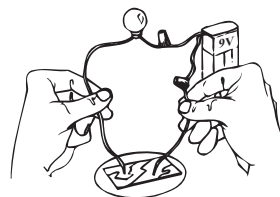
- A -10°C
- B 75°C
- C 10°C
- D 100°C

2. In an experiment to measure the relationship between the absolute temperature and the volume of a gas, theory says that if volume is halved, absolute temperature doubles, so long as pressure is held constant. Suppose the experiment shows that temperature increases by only 25%. Which is NOT a likely source of the discrepancy?

- A The pressure may have changed.
- B The volume measurement may be in error.
- C The temperature measurement may be in error.
- D The law relating temperature and pressure of a gas may be incorrect.

3. What is a reasonable result for a voltage measurement for a weak battery that ordinarily has a voltage of 9.0 V?

- A 9.0 V
- B 8.5 V
- C 0.0 V
- D 10.5 V



4. In a chemical reaction in which two reactants yield a single product, what is a reasonable beginning and ending mass for the reaction?

- A reactant 1 = 10 g, reactant 2 = 5.1 g, product = 15 g
- B reactant 1 = 5.0 g, reactant 2 = 5.0 g, product = 5.0 g
- C reactant 1 = 10.0 g, reactant 2 = 10.0 g, product = 10.0 g
- D reactant 1 = 7.9 g, reactant 2 = 10.0 g, product = 17 g

5. What is a reasonable result for a pH color change when using phenolphthalein?

- A pink
- B yellow
- C green
- D purple



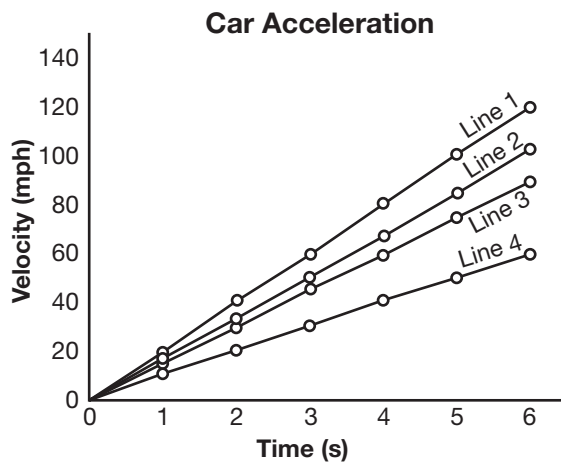
Standards Practice:

SCSh4



Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

- a. Develop and use systematic procedures for recording and organizing information.
- Which is NOT an important reason to use standardized units of measurement?
 - Standard units allow for easier communication among researchers.
 - Standard units will be the same over time and place.
 - Standard units can be converted using standard conversion factors.
 - Standard units are more natural than other units.



- Consider the graph shown here. What is one benefit of displaying scientific information with a graph?
 - A graph is more precise than a list or a table.
 - A graph is easier to produce than a list or a table.
 - A graph can quickly express relationships among variables.
 - A graph conveys extra information not found in lists or tables.

Density of Various Metals at 20°C

Metal	Mass	Density	Temperature
Copper			
Steel			
Brass			
Bronze			
Aluminum			
Silver			
Tin			

- Which column of the incomplete data table is not necessary?
 - metal
 - mass
 - density
 - temperature
- What column should be added to this incomplete data table?
 - electrical conductivity
 - weight
 - volume
 - description



Ice melting

- In an investigation to find out how long it takes water to reach a temperature of 0°C when placed in a freezer, a group plans to rest a thermometer in water in an ice tray and then record the temperature every four hours. What is one potential flaw in this plan?
 - Water may reach 0°C between measurement times.
 - Water reaches a temperature of 0°C and then stays there.
 - Water can never get colder than 0°C.
 - Water freezes from the top down.

Go on

Standards Practice: *(continued)*

SCSh4



Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

- b. Use technology to produce tables and graphs.

Use the table to answer question 1.

Element	Percentage
Oxygen	65%
Carbon	18%
Hydrogen	10%
Nitrogen	3%
Calcium	1.5%

1. A computer program can be used to generate several different types of graphs. Given the data in the table, what is the type of graph to create?
- A line graph
 - B distance-time graph
 - C bar chart
 - D pie chart

Use the table to answer question 2.

Distance traveled by a projectile

Time	Distance
0.0 seconds	0.0 meters
0.5 seconds	2.0 meters
1.0 seconds	4.0 meters
1.5 seconds	6.0 meters
2.0 seconds	8.0 meters

2. What will the generated line graph look like?
- A straight line tilted up
 - B curved line moving up
 - C straight flat line
 - D curved line moving down

Use the table to answer question 3.

Isotope	Atomic Number	Number of Neutrons
Uranium-234	234	142
Uranium-235	235	143
Uranium-238	238	146

3. The data shown in the table are to be turned into a graph with a computer program. Which type of graph should you choose for this information?
- A pie graph
 - B bar graph
 - C line graph
 - D circle graph
4. A computer program can produce several different types of graph. What type of data is best expressed with a line graph?
- A speed of an object falling through a vacuum
 - B spread of the number of chocolate chips per cookie in a box of cookies
 - C percentage of different salts in seawater
 - D percentage of a budget spent on food, rent, clothing, and other



Standards Practice: *(continued)*

SCSh4



Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

- c. Use technology to develop, test, and revise experimental or mathematical models.**

Use the table to answer questions 1 and 2.

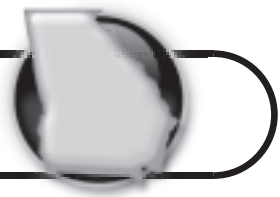
Year on Penny	Mass of Penny
1965	3.1 grams
1976	3.1 grams
1980	3.1 grams
1983	2.5 grams
1989	2.5 grams
1997	2.5 grams
2000	2.5 grams
2006	2.5 grams

1. You decide to use an electronic balance and a water displacement vessel to measure the density of pennies, but you run into a problem. Examine the table to discover the nature of the problem. How does this new information change your investigation?
 - A Because the mass of the penny changes over time, finding the density of the penny is not possible.
 - B Because the mass of the penny changes over time, the density you measure will depend on the age of your pennies.
 - C Because the mass of the penny changes over time, you cannot be certain that the volume is constant.
 - D Because the mass of the penny changes over time, you must throw out all your old data and start again.
2. If the data you collected in the table were intended to be used to predict the density of another penny of unknown age, what is the best way to process the data before calculating density?
 - A Use only the masses of the newest pennies.
 - B Throw out the highest and lowest masses.
 - C Round the masses of the pennies to the nearest whole number.
 - D Average the masses of the pennies.
3. What is one advantage of using a computer to test a mathematical model?
 - A Computers can perform a huge number of calculations quickly.
 - B Computers are always right.
 - C Computers are smarter than humans.
 - D Computers can automatically correct flaws in the mathematical models.
4. A particular computer model predicts that a certain chemical reaction will produce twice as much in products as it will consume as reactants. This violates the law of conservation of mass. What is NOT a likely source of the error?
 - A Incorrect data were input into the model.
 - B There is a mistake in the model.
 - C The computer made a calculating error.
 - D The model was entered into the computer incorrectly.



Standards Practice: *(continued)*

SCSh4



Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

5. What is one reason for high-speed automatic sensors to record data in an experiment with colliding bodies?
- A The collisions might happen too quickly for human eyes to record reliably.
 - B Automatic sensors are more expensive than human observers.
 - C Automatic sensors are better able than human observers to ignore unimportant events.
 - D Automatic sensors can make sense of what they see better than can human observers.



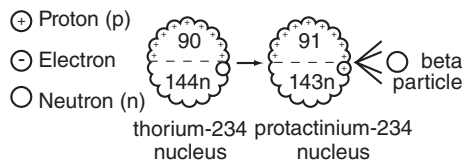
Standards Practice:

SCSh5



Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

- a. Trace the source on any large disparity between estimated and calculated answers to problems.



1. When scientists discovered a nuclear process called beta decay, they were dismayed to find that beta decay did not seem to obey the law of conservation of energy. In order to satisfy the conservation of energy law, scientists hypothesized that a particle called the neutrino existed. The neutrino, which could not be detected with the technology available at the time, would carry away the missing energy in beta decay. Many years later, the neutrino was actually detected and today is accepted as one type of fundamental particle that makes up the universe. What problem did the neutrino solve?
- A the cause of beta decay
 - B the problem of the missing energy
 - C the problem of the missing beta radiation
 - D why beta decay occurs
2. Group A measures the density of a block of metal to be 42 g/cm^3 . Group B measures the density of the same block to be 84 g/cm^3 . Your job is to discover the source of the discrepancy. Which factor is probably NOT the source of the discrepancy? (Density is mass/volume)
- A At least one group might have measured the mass incorrectly.
 - B At least one group might have measured the volume incorrectly.
 - C At least one group might have used the wrong formula for finding density.
 - D At least one group might have measured the density in a place where gravity has a different value.

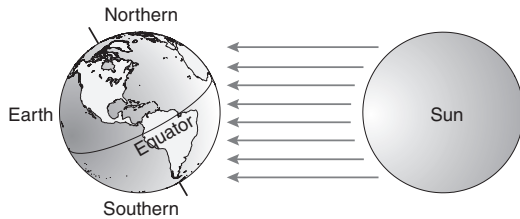


Standards Practice: *(continued)*

SCSh5



Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.



3. Once the properties of neutrinos were determined, some scientists started looking for neutrinos from the Sun. In the process of nuclear fusion, the Sun produces neutrinos, some of which travel to and through the Earth. When researchers measured the number of neutrinos from the Sun, they found the number was smaller than they expected by a factor of three. Recently, other researchers have discovered that neutrinos change from one form to another during their journey from the Sun, and early experiments were detecting only one of three possible types of neutrino. What discrepancy did the discovery of transforming neutrinos solve?
- A the problem of too few neutrinos from the Sun
 - B the problem of too many neutrinos from the Sun
 - C the problem of how neutrinos change from one to another
 - D the problem of how neutrinos can be detected

4. Perpetual motion machines are devices that can keep running forever without requiring outside energy sources; they can even produce more usable energy than they consume. Scientists today are confident that perpetual motion machines cannot be built because they would violate the law of conservation of energy. If someone suggests that he or she has built a perpetual motion machine, what is the most important question from a scientific standpoint?
- A Is there a patent for the machine?
 - B Are there any hidden power sources to the machine?
 - C Is the person trustworthy?
 - D Is the machine reliable?



Standards Practice: *(continued)*

SCSh5



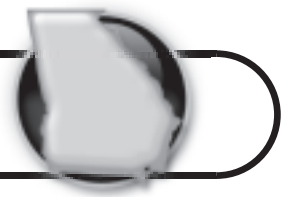
Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

- b. Consider possible effects of measurement errors on calculations.**
- If the uncertainty of measurement of the sides of a square is ± 3 meters, what is the uncertainty of the area of the square? The area of a square is given by the formula area equals length squared.
A $\pm 9 \text{ m}^2$
B $\pm 6 \text{ m}^2$
C $\pm 9 \text{ m}$
D $\pm 6 \text{ m}$
 - The period of a pendulum is proportional to the square root of the length of the string. If the pendulum bob rusts over a series of years, increasing its mass by 5%, what will be the effect on the period of the pendulum?
A The period of the pendulum will increase by 2.2%.
B The period of the pendulum will be unchanged.
C The period of the pendulum will increase by 2.2%.
D The period of the pendulum will increase by 5%.
- Density is mass divided by volume. In measuring the density of various metals, what will be the result of consistently measuring the volume too low?
A Density values will be unchanged.
B Density values will be too low.
C Density values will be too high.
D Density values will be random.
 - Tali uses a graduated cylinder to measure a sufficient amount of an acidic solution to neutralize a basic solution. If she reads the top of the meniscus instead of the bottom when she measures, what will the outcome of the experiment be?
A The final mixture will be basic.
B The final mixture will be acidic.
C The acid and base won't mix.
D The outcome will not be affected.



Standards Practice: *(continued)*

SCSh5



Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

c. Recognize the relationship between accuracy and precision.

- Josie and Sam drop pebbles onto a target. While Josie is the more accurate of the two, Sam is more precise. What statement explains this relationship?
 - Josie's pebbles are on average closer to the target, while Sam's pebbles are on average farther from one another.
 - Josie's pebbles are on average closer to one another, while Sam's pebbles are on average closer to the target.
 - Josie's pebbles are on average farther from one another, while Sam's pebbles are on average closer to the target.
 - Josie's pebbles are on average closer to the target, while Sam's pebbles are on average closer to one another.
- Accuracy measures how close a set of results are to _____, while precision measures how close a set of results are to _____.
 - the accepted value; each other
 - each other; the accepted value
 - the true value; the accepted value
 - the accepted value; the true value
- If you measured the length of a room several times using a meterstick, but you recorded your results in feet, your answer could be very _____ without being very _____.
 - accurate; precise
 - precise; accurate
 - reasonable; exact
 - accurate; reasonable

Use the tables to answer question 2.

Team A

Trial	Acceleration
Trial 1	9.7 m/s ²
Trial 2	9.6 m/s ²
Trial 3	9.9 m/s ²
Trial 4	10.0 m/s ²
Trial 5	10.0 m/s ²
Trial 6	9.7 m/s ²

Team B

Trial	Acceleration
Trial 1	9.2 m/s ²
Trial 2	9.2 m/s ²
Trial 3	9.2 m/s ²
Trial 4	9.1 m/s ²
Trial 5	9.2 m/s ²
Trial 6	9.1 m/s ²

- Two teams of researchers measure the acceleration due to gravity (g). The table gives the results for each team. Which statement describes their findings? The accepted value of g is 9.801 m/s^2 .
 - Team A's results are both more accurate and more precise.
 - Team B's results are both more accurate and more precise.
 - Team A's results are more accurate, but team B's results are more precise.
 - Team A's results are more precise, but team B's results are more accurate.



Standards Practice: *(continued)*

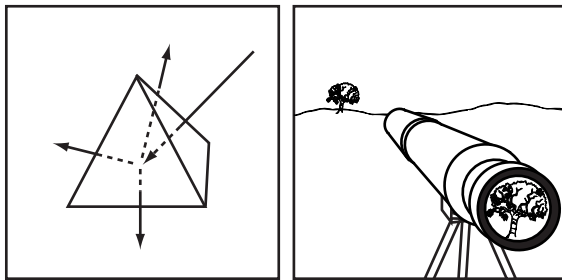
SCSh5



Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

d. Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.

1. Use the equation $\text{density} = \text{mass}/\text{volume}$ to calculate the density of silver given that the mass of a silver sample is 50.00 grams and the volume is 4.8 cm^3 . Be sure to use the correct number of significant figures.
A 10.4167 g/cm^3
B 10.0 g/cm^3
C 10.41 g/cm^3
D 10.417 g/cm^3



2. The speed of light is 299,792,458 m/s. Using three significant figures, how would you represent this number in scientific notation?
A $2.99 \times 10^8 \text{ m/s}$
B $2.998 \times 10^8 \text{ m/s}$
C $3.00 \times 10^8 \text{ m/s}$
D $3.000 \times 10^8 \text{ m/s}$

3. At sea level, the atmosphere exerts a force of $101,300 \text{ N}/\text{m}^2$ on all surfaces. What is atmospheric pressure in scientific notation?
A $101,300 \text{ N}/\text{m}^2$
B $101 \times 10^3 \text{ N}/\text{m}^2$
C $101,000 \text{ N}/\text{m}^2$
D $1.013 \times 10^5 \text{ N}/\text{m}^2$
4. The mass of an electron is about 0.000 000 000 000 000 000 000 000 000 910 938 26 kg. What is the mass of an electron, expressed in scientific notation?
A $9109382.6 \times 10^{-30} \text{ kg}$
B $9.1093826 \times 10^{-30} \text{ kg}$
C $9109382.6 \times 10^{-31} \text{ kg}$
D $9.1093826 \times 10^{-31} \text{ kg}$
5. A parsec is a unit that astronomers use to measure large distances in space. A parsec is equal to $30.857 \times 10^{12} \text{ km}$. How many meters is in a parsec?
A $30.857 \times 10^{15} \text{ m}$
B $30.857 \times 10^9 \text{ m}$
C $30.857 \times 10^{13} \text{ m}$
D $30.857 \times 10^{11} \text{ m}$



Standards Practice: *(continued)*

SCSh5



Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

- e. Solve scientific problems by substituting quantitative values, using dimensional analysis, and/or simple algebraic formulas as appropriate.

Use the table to answer questions 1 and 2.

Half-Life of Carbon-14

Half-life	Remaining Mass of C-14	Time
0	1 gram	0 years
1	$\frac{1}{2}$ gram	5,700 years
2	$\frac{1}{4}$ gram	11,400 years
3	$\frac{1}{8}$ gram	17,100 years
4	$\frac{1}{16}$ gram	22,800 years
5	$\frac{1}{32}$ gram	?

- According to these data, after how many years would the mass of a one-gram sample of carbon-14 decay to $\frac{1}{32}$ gram?
A 17,100 years
B 22,800 years
C 28,500 years
D 34,200 years
- If the sample were 2 grams to start with, what would the remaining mass of carbon-14 be after 17,100 years?
A $\frac{1}{4}$ gram
B $\frac{1}{8}$ gram
C $\frac{1}{16}$ gram
D $\frac{1}{32}$ gram

Use the table to answer questions 3 and 4.

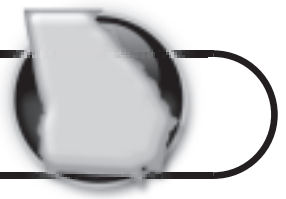
Pressure (kg/cm ²)	Volume (mL)
10	600
20	300
30	150
40	?
?	37.5

- Boyle's Law states that as the pressure exerted on a gas increases, the volume of the gas decreases proportionally. These data were collected after the pressure on 600 milliliters of gas in a sealed container was increased steadily. If everything remains the same, what will be the volume of gas at a pressure of 40 kg/cm²?
A 50 mL
B 75 mL
C 150 mL
D 200 mL
- If everything remains the same, what will be the pressure of gas at a volume of 37.5 mL?
A 20 kg/cm²
B 30 kg/cm²
C 40 kg/cm²
D 50 kg/cm²



Standards Practice:

SCSh6



Students will communicate scientific investigations and information clearly.

- a. Write clear, coherent laboratory reports related to scientific investigations.

Use the table to answer questions 1 and 2.

Time	Distance	Acceleration	Force	Power
0.0	0.0	0.0	0.0	0.0
1.0	10	1.0	5.0	20
2.0	15	1.5	10	15
3.0	20	1.3	15	12

- What is one problem with this portion of a lab report?
 - Significant digits are not used correctly.
 - The numbers should be written in scientific notation.
 - There are no units on any of the numbers.
 - The relationship among the data points is unclear.
- What is one problem with this portion of a lab report?
 - The table has no title.
 - There are too many variables.
 - The purpose of the experiment is not indicated.
 - There is no way to know what tools were used to measure.
- When should scientific notation be used in a laboratory report?
 - whenever numbers are written down
 - whenever numbers have three or more significant digits
 - whenever numbers are so big or so small that they become difficult to read or understand
 - whenever numbers have a great deal of uncertainty attached to them
- Which should NOT be included in a laboratory report?
 - procedures
 - data
 - sources of error
 - opinions
- Which should NOT be included in a laboratory report?
 - hand-drawn pictures
 - alternative interpretations
 - false data
 - investigators' intentions



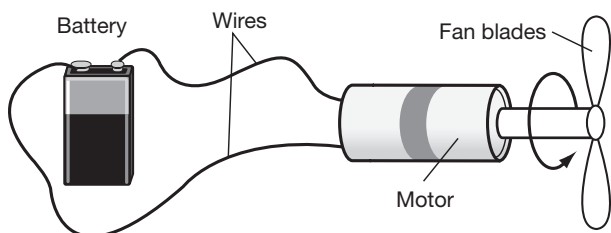
Standards Practice: *(continued)*

SCSh6

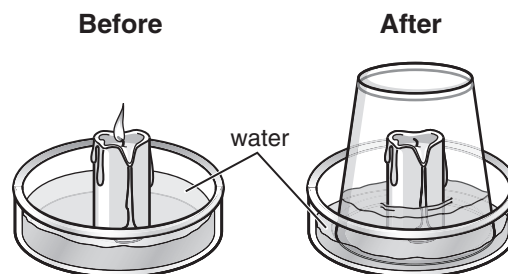


Students will communicate scientific investigations and information clearly.

- b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.



1. A team of students notes that over time a fan and a motor attached to a battery gets slower. They conclude that prolonged use of the fan causes it to spin more slowly. What is another possible interpretation of this experiment?
 - A The battery may be weakening over time.
 - B The wire may be getting longer, resulting in less light reaching the fan.
 - C The battery may be getting stronger over time.
 - D The battery may be getting stronger over time, causing the wire to get hotter and produce electricity.
2. It was once argued that heat was a fluid, able to flow from hot objects to cold ones. One argument in favor of heat as a fluid was that it seemed to flow from a hot metal bar into cold water, resulting in hotter water and colder metal. What is one possible argument against the heat fluid theory?
 - A The observation that hot objects cool down and cool objects heat up may be wrong.
 - B We can't see heat moving from one object to another, therefore it can't be happening.
 - C Heat can't be a fluid because hot air rises.
 - D Heat can be produced without the presence of a hot object—for instance, by rubbing your hands together.



3. The illustration shows a science demonstration in which a burning candle is surrounded by a puddle of water. When a glass is placed to cover the candle, the flame goes out and the water level inside the glass rises. What is a possible explanation for this?
 - A The water rises up because it is hot.
 - B The water rises up because of condensing water vapor in the glass, creating less pressure inside.
 - C The water rises up because a burning candle attracts water upward.
 - D The water rises up because it feels the pull of the Moon.



Standards Practice: *(continued)*

SCSh6



Students will communicate scientific investigations and information clearly.

- c. Use data as evidence to support scientific arguments and claims in written or oral presentations.**
1. Why is the use of data important in scientific arguments?
 - A** The use of data allows for verification by other researchers.
 - B** The use of data ensures that conclusions are correct.
 - C** The use of data avoids critical analysis by other researchers.
 - D** The use of data makes the argument look more scientific.

Use the table to complete question 2.

Time Period	Average Blood Lead Levels (micrograms per deciliter)
1976–1980	12.8
1988–1991	2.8

2. Leaded gasoline was phased out in the United States in the 1970s. What argument could be made by combining that fact with the data on blood lead levels among people in the US?
 - A** Lead is harmful to your health.
 - B** Leaded gasoline causes lower lead levels in blood.
 - C** The use of leaded gasoline is correlated with higher lead levels in blood.
 - D** Lead is no longer a problem.

Use the table to complete question 3.

Year	Atmospheric CFC Level (parts per trillion)
1977	139
1979	155
1981	170
1983	188
1985	208
1987	230
1989	250
1991	268
1993	272
1995	274

3. CFCs are chemicals that can damage the ozone layer of Earth. In the late 1980s, the production of CFCs began to be phased out all over the world. With this information and the data in the table, what scientific argument could you make?
 - A** Phasing out CFCs led to a reduced rate of increase of CFCs in the atmosphere.
 - B** Phasing out CFCs led to reduced amounts of CFCs in the atmosphere.
 - C** Phasing out CFCs had no effect on the level of CFCs in the atmosphere.
 - D** Phasing out CFCs led to increased amounts of ozone in the atmosphere.



Standards Practice: *(continued)*

SCSh6



Students will communicate scientific investigations and information clearly.

- d. Participate in group discussions of scientific investigation and current scientific issues.**
1. In preparing for a classroom discussion on global warming, what resource would probably provide you with the least biased source of information?
 - A a pamphlet from an oil company
 - B a booklet from an environmental organization
 - C a United States Geological Survey Web site
 - D a Web site from an amateur meteorologist
 2. Your class is discussing the pros and cons of nuclear energy. What argument would be in favor of nuclear power?
 - A Nuclear waste is dangerous and long-lasting.
 - B Nuclear materials could be stolen and turned into weapons.
 - C Nuclear fuel is not an unlimited resource.
 - D Nuclear fission does not release greenhouse gases.
 3. In a debate on fossil fuels, which argument is support for increased drilling for oil?
 - A Oil is a nonrenewable resource.
 - B Oil is important to our modern economy.
 - C Burning oil releases greenhouse gases and polluting chemicals.
 - D Oil spills are harmful to wildlife.
 4. Which is the most important thing to keep in mind when debating a scientific subject?
 - A that you must only present the evidence that supports your point of view
 - B that your arguments must be more enthusiastic than those of others
 - C that the validity of your opinion depends on the strength of your scientific evidence
 - D how much experience each person in the debate has



Standards Practice:

SCSh7



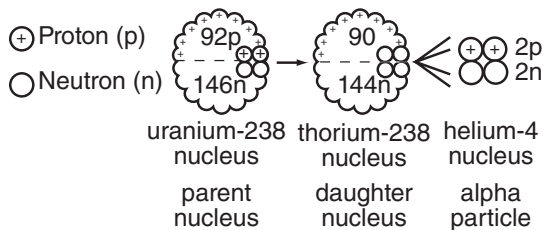
Students will analyze how scientific knowledge is developed.

Students will recognize that:

a. **The universe is a vast single system in which the basic principles are the same everywhere.**

1. Astronomers have discovered by analyzing sunlight and starlight, that the matter making up the Sun and the stars was no different than the matter making up Earth. What is one conclusion that can be drawn from this discovery?

- A The stars are very far away.
- B The Sun and stars are very old.
- C The laws of science seem to be universal.
- D Different scientific laws apply on the stars and on Earth.



2. Scientists have discovered evidence that a natural nuclear reactor once existed billions of years ago in Africa. Natural nuclear reactions can happen on Earth if the radioactive isotope uranium-235 is found in abundance. Because U-235 decays quickly, there was more naturally occurring U-235 in the past than there is today, so natural nuclear reactors are very unlikely to form today. What statement is consistent with these facts?

- A The laws of science today are different than they were in the past.
- B The laws of science today are the same as they were in the past.
- C Radioactive decay happens more quickly today than it did in the past.
- D Radioactive decay happens more slowly today than it did in the past.

3. One day, you might have the chance to visit the planet Mars. It would make sense to keep all in mind while exploring another planet, EXCEPT:

- A The acceleration due to gravity might not be 9.8 m/s^2 .
- B The weight of a 10-kg mass might not be the same as on Earth.
- C Force might not equal mass times acceleration.
- D Martian microorganisms might be contaminated by Earth microorganisms.

4. One day scientists might discover life on other planets. What would be the LEAST likely difference between Earth life and extraterrestrial life?

- A the ratio of carbon to hydrogen
- B the sources of food
- C the types of sensory organs
- D the mass of oxygen atoms



Standards Practice: *(continued)*

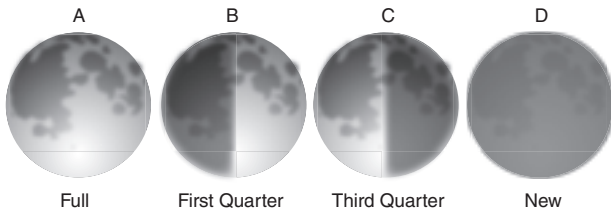
SCSh7



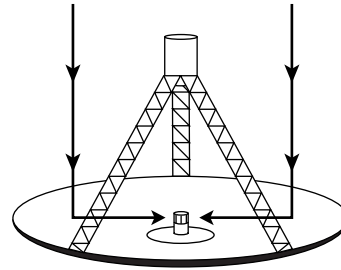
Students will analyze how scientific knowledge is developed.

Students will recognize that:

- b. Universal principles are discovered through observation and experimental verification.



1. Isaac Newton developed a theory of gravity that described the motion of all falling objects, including the Moon in orbit and objects falling on Earth. He found that the speed of the Moon in orbit around Earth matched the speed predicted by his theory. Which statement is accurate?
 - A Newton discovered that the Moon would not fall to Earth.
 - B Newton's observations supported his theory.
 - C Newton's calculations proved his theory.
 - D Newton discovered that the Moon has the same gravity as an apple.
2. Albert Einstein developed a new theory of gravity several centuries after Isaac Newton. Most scientists did not accept Einstein's theory until observations showed that light rays from stars were bent by the Sun's gravity, as Einstein predicted. What is the best reason scientists preferred Newton's theory?
 - A Newton's theory is the one they had learned about in school.
 - B Newton's theory was easier to use.
 - C There was no way to choose between the theories without observational evidence.
 - D Einstein would become more famous than Newton if his theory were shown to be true.



A radio telescope.

3. The big bang theory states that the universe began as a very dense, very hot fireball. This theory was highly controversial until evidence for the fireball, known as the cosmic microwave background radiation, was discovered by accident using a type of telescope known as a radio telescope. Why was this important for the acceptance of the big bang theory?
 - A All scientific theories must be supported by evidence from observation or experiment.
 - B Accidental discoveries are less likely to be affected by bias than intentional discoveries.
 - C It proved the existence of radio waves.
 - D It was thought that the cosmic microwave background radiation would be difficult to find.



Standards Practice: *(continued)*

SCSh7



Students will analyze how scientific knowledge is developed.

Students will recognize that:

- c. From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.**
1. Early philosophers believed that forces were necessary to keep an object moving. By analyzing data collected by himself and others, Isaac Newton realized that forces did not cause motion. Instead, forces cause changes in motion. Newton's three laws of motion explained how forces and motion are related. What made Newton's ideas more scientific than those of the early philosophers?
 - A Newton based his theory on data and early philosophers did not.
 - B Newton was smarter than early philosophers.
 - C Newton wrote his ideas down and early philosophers did not.
 - D Newton was more popular than early philosophers.
 2. In the late 1800s, the physicist Lord Kelvin made calculations to predict the age of Earth. He based his calculations on the idea that Earth was slowly cooling by losing heat into space and so must have been hotter in the past. By finding the rate of cooling, Kelvin determined a time in the past when Earth must have been so hot that its rocks were molten. Later, radioactivity was shown to be a source of heat inside Earth. What affect would this discovery have on Kelvin's calculations?
 - A It would mean that Earth is probably younger than Kelvin calculated.
 - B It would mean Earth is probably older than Kelvin calculated.
 - C It would mean that Earth has to be heating up.
 - D It would mean that Earth does not lose heat into space.
 3. When Albert Einstein developed his general theory of relativity, scientists recognized that Einstein's ideas about gravity completely changed the view, held since the time of Isaac Newton, that gravity was a force. Einstein's ideas were accepted because they fit the data better than Newton's theory of universal gravitation. And yet, when a spacecraft is sent to the Moon or to a distant planet, it is Newton's universal gravitation, and not Einstein's general relativity, that is used to predict the path of the spacecraft. What would explain this?
 - A Einstein's general relativity works only on the scale of galaxies.
 - B Einstein's general relativity is untested.
 - C Einstein's general relativity makes only tiny changes to Newton's universal gravitation.
 - D Einstein's general relativity makes poor predictions for the motions of spacecraft.

Go on 

Standards Practice: *(continued)*

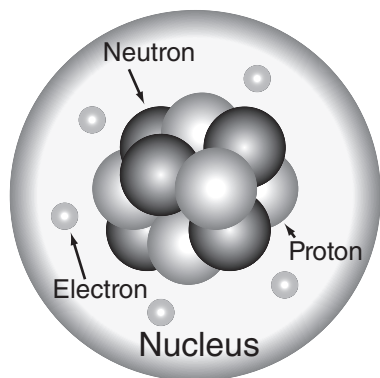
SCSh7



Students will analyze how scientific knowledge is developed.

Students will recognize that:

- d. Hypotheses often cause scientists to develop new experiments that produce additional data.



1. After discovering the atomic nucleus with his gold foil experiment, Ernest Rutherford soon learned that the nuclei of many atoms were roughly twice as massive as predicted. Rutherford guessed that there was an unseen particle in the nucleus—one that increased the mass of the nucleus without increasing its charge. Rutherford's student James Chadwick later did experiments to discover this new particle, called the neutron. What is the best word to describe Rutherford's guess about the neutron?
 - A conclusion
 - B observation
 - C hypothesis
 - D theory
2. Scientific hypotheses can be tested by _____ or by _____.
 - A making predictions; performing experiments
 - B making observations; performing experiments
 - C drawing conclusions; stating the problem
 - D making observations, drawing conclusions
3. James Clerk Maxwell, a Scottish physicist, developed a theory that showed the speed of light to be constant for all observers. Some scientists felt that light must move through something, and so hypothesized the idea of the "luminiferous ether," which would carry light rays through the vacuum of space. Experiments were derived to find the speed of Earth through the ether, but no evidence of the ether could be found. Which statement best describes the importance of the ether hypothesis?
 - A Incorrect hypotheses only interfere with scientific progress.
 - B Hypotheses often cause scientists to develop new experiments that produce additional data.
 - C Hypotheses do not lead to new experiments.
 - D Correct hypotheses do not need experimental evidence.



Standards Practice: *(continued)*

SCSh7



Students will analyze how scientific knowledge is developed.

Students will recognize that:

e. Testing, revising, and occasionally rejecting new and old theories never ends.

1. In 1900 Max Planck demonstrated that energy is quantized; in other words, energy comes in packets of certain set amount. Which statement about energy had to be abandoned as a result of Planck's work?
 - A Energy can neither be created nor destroyed.
 - B The quantity of energy in the universe is constant.
 - C Heat is a form of energy.
 - D There is no smallest amount of energy that can be transferred from one body to another.
2. It was once believed, based on experimental evidence, that matter could be neither created nor destroyed. Albert Einstein's famous equation $E = mc^2$ showed that matter could be both created and destroyed as it changed from or to energy. Which statement best expresses conditions before Einstein's discovery?
 - A Instruments before Einstein's time could not measure the tiny changes in mass involved in most reactions.
 - B Before Einstein's theory, these mass changes did not happen.
 - C The knowledge that mass could be both created and destroyed was suppressed by earlier scientists.
 - D The knowledge that mass could be both created and destroyed was known, but was considered unimportant.

3. Some researchers in a field known as string theory suggest that gravity might get weaker than expected at extremely small distances. What would be the result of reliable and repeatable experiments verifying this hypothesis?
 - A Gravity will stop working.
 - B The current theories of gravity will be slightly altered to take into account these new data.
 - C All theories of gravity will be thrown out, and researchers will start over.
 - D The data will be rejected because they go against established scientific law.



Standards Practice:

SCSh8



Students will understand important features of the process of scientific inquiry.

Students will apply the following to inquiry learning practices:

- a. Scientific investigators control the conditions of their experiments in order to produce valuable data.

Use the table to answer question 1.

Plant	Water	Fertilizer	Sunlight
Peanut tree 1	1 gallons	1 tablespoon	2 hours each day
Peanut tree 2	2 gallons	2 tablespoons	6 hours each day
Peanut tree 3	3 gallons	3 tablespoons	8 hours each day

1. Inigo plans to conduct an experiment using three peanut trees of the same variety and size. His hypothesis is that the plant receiving the most sunlight at the end of three months will show the most growth. In his plan below, he has listed how much water, fertilizer, and sunlight each plant will receive. Why is his experiment flawed?
 - A He has not recorded his observations.
 - B He has too many independent variables.
 - C None of the plants will get enough water.
 - D His control group will receive too much sunlight.



Standards Practice: *(continued)*

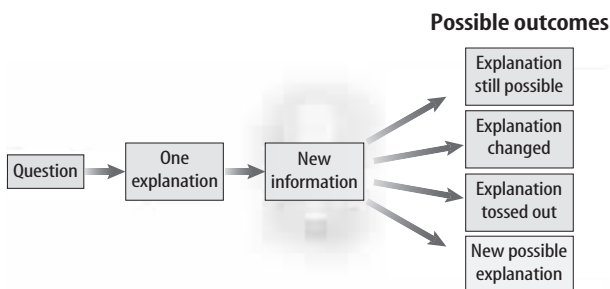
SCSh8



Students will understand important features of the process of scientific inquiry.

Students will apply the following to inquiry learning practices:

- b. Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations' hypotheses, observations, data analyses, and interpretations.



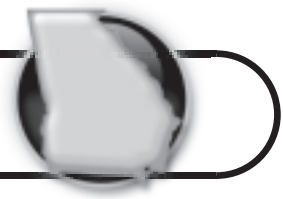
1. Wes hypothesizes that his pet hamster will lose weight if fed carrots rather than lettuce. He records the hamster's weight every day for a week before and after switching foods but finds that the hamster's weight increases. What is the responsibility of a scientist who discovers that the data do not support his hypothesis?
- A to change the data
 - B to change the hypothesis
 - C to redesign the experiment until the data come out right
 - D to abandon the research

2. Why must scientific researchers be aware of their own biases?
- A These biases must be hidden in the final research paper.
 - B These biases might prevent researchers from coming to the correct conclusions.
 - C It is important to find reviewers who share the same biases.
 - D Biases disqualify the researchers from the investigation.
3. A team of researchers record the progress of a chemical change by monitoring the color change of the products. What is one source of bias to guard against in such an investigation?
- A different researchers' interpretation of color
 - B changes in the lighting
 - C change in the amount of product made
 - D changes in the location of the experiment



Standards Practice: *(continued)*

SCSh8



Students will understand important features of the process of scientific inquiry.

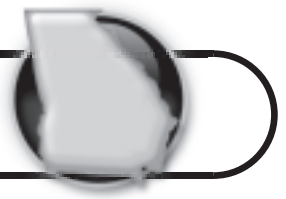
Students will apply the following to inquiry learning practices:

- c. Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.**
1. Which is NOT a goal of peer review in scientific publications?
 - A Peer review gives experts the opportunity to check for mistakes and procedural errors.
 - B Peer review helps ensure that the work that is produced is of high quality.
 - C Peer review provides researchers an opportunity to better explain points that may be unclear.
 - D Peer review prevents the publication of unpopular or controversial ideas.
 2. Why is publishing in peer-reviewed publications such an important part of science?
 - A It allows other researchers to analyze the work and repeat experiments.
 - B It guarantees that controversial ideas will be censored.
 - C It ensures that researchers will be paid for their work.
 - D It prevents the use of scientific discoveries for commercial gain.
 3. For scientists, what is the most important difference between publishing research in a peer-reviewed journal and posting research on an Internet Web page?
 - A Only scientists are allowed to read peer-reviewed journals.
 - B Peer-reviewed journals are checked for reliability by many scientists.
 - C Peer-reviewed journals contain only proven information.
 - D Web pages can be more interactive than the journal articles.
 4. Scientific publications usually publish letters in which scientists may comment on or criticize the articles written by other scientists. Why is it important that scientists be able to criticize each others' work?
 - A so that all scientists may take credit for developing the theory
 - B scientists must criticize each other so people can see how intelligent they are
 - C to keep inexperienced scientists from publishing their papers
 - D in order to improve a theory, its weaknesses must be pointed out



Standards Practice: *(continued)*

SCSh8



Students will understand important features of the process of scientific inquiry.

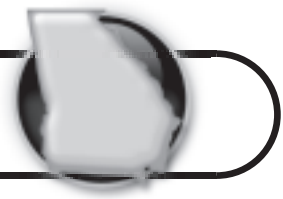
Students will apply the following to inquiry learning practices:

- d. The merit of a new theory is judged by how well scientific data are explained by the new theory.**
1. What is the most important attribute a scientific theory must possess?
 - A It must be developed by a famous scientist.
 - B It must be elegant.
 - C It must explain scientific data.
 - D It must be published in a scientific journal.
 2. New theories are often developed as a response to changes in _____.
 - A available scientific data
 - B cultural biases
 - C political beliefs
 - D the philosophy of science
3. One reason that science is always changing is that _____.
 - A past scientists made many mistakes
 - B new technologies enable new data to be obtained
 - C scientific theories depend on the dominant culture
 - D scientists change their minds about the importance of data



Standards Practice: *(continued)*

SCSh8



Students will understand important features of the process of scientific inquiry.

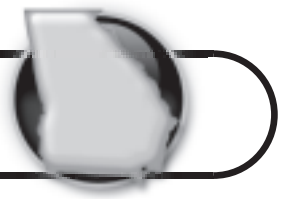
Students will apply the following to inquiry learning practices:

- e. The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.**
1. Science is our attempt to _____ the natural universe.
 - A understand
 - B control
 - C change
 - D regulate
 2. What is NOT true of bias?
 - A Biases are often based on experience.
 - B Biases can be incorrect because our experience is often limited.
 - C Biases are always incorrect.
 - D Biases can slow the progress of science.
 3. What best expresses the ultimate goal of science?
 - A The goal of science is to confirm those things we already believe.
 - B The goal of science is to disprove the beliefs of other cultures.
 - C The goal of science is to replace our past biases with the biases of today.
 - D The goal of science is to develop an understanding of the natural universe which is free of biases.
 4. Which is the best description of bias?
 - A Bias occurs when a scientist records her data incorrectly because she is tired.
 - B Bias occurs when a scientist records her data accurately no matter how she feels about the outcome of the experiment.
 - C Bias occurs when a scientist intentionally changes the data she collects.
 - D Bias occurs when a scientist's expectation changes how the results are viewed.



Standards Practice: *(continued)*

SCSh8



Students will understand important features of the process of scientific inquiry.

Students will apply the following to inquiry learning practices:

f. Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.

1. A researcher combines an acid and a base and analyzes the products of the reaction. This researcher is working in the field of _____.
A physics
B astronomy
C geology
D chemistry
2. What branch of the sciences is most often concerned with motion and forces?
A physics
B astronomy
C geology
D chemistry

3. What branch of the sciences is most often concerned with the interactions of various forms of matter?
A physics
B astronomy
C geology
D chemistry
4. Paleontologists study fossils. Anthropologists study humans. Given this information, determine which of these a paleoanthropologist studies:
A the way humans collect fossils
B fossils of humans
C paleontologists
D ancient anthropologists



Standards Practice:

SCSh9

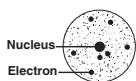


Students will enhance reading in all curriculum areas by:

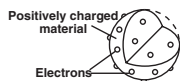
a. Reading in All Curriculum Areas

- Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
- Read both informational and fictional texts in a variety of genres and modes of discourse.
- Read technical texts related to various subject areas.

Rutherford's Model



Thomson's Model



1. After J.J. Thomson discovered the electron, he developed an atomic model known as the “plum-pudding” model. In this model, negatively charged electrons were embedded in a thin, positively charged cloud. The electrons were like the plums—small, concentrated regions of negative charge. Thomson’s student Ernest Rutherford tested this model by firing high-speed positively charged particles (called “alpha particles”) at a thin gold foil. If the plum-pudding model were correct, one would expect the alpha particles to fly through the gold foil with very little deflection. Instead, Rutherford and his assistants observed that occasionally an alpha particle would experience a large deflection, sometimes even bouncing almost straight back toward the alpha particle source. Rutherford compared this result to firing a cannonball at a piece of tissue paper and having it come back and hit you.

What was the purpose of Rutherford’s experiment?

- A** to test Thomson’s plum-pudding model of the atom
- B** to discover the thickness of gold foil
- C** to discover the speed of an alpha particle
- D** to test the positive charge on the alpha particle

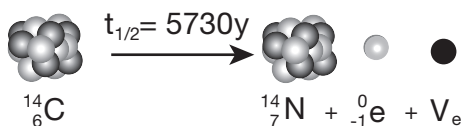
2. Albert Einstein’s realization that light can be described as a particle opened the door to the future discoveries to come. To explain a phenomenon called the photoelectric effect, Einstein said that light is absorbed by atoms as discrete, quantized bits. In Einstein’s theory, each particle of light has a certain amount of energy; that amount of energy depends on the frequency of the light. Strangely, frequency is a quantity associated not with particles, but with waves. In Einstein’s photoelectric theory we see the early hints of the wave-particle duality that would become a defining feature of quantum mechanics. Later, a physicist named Louis de Broglie speculated that if light can be both a wave and a particle, perhaps particles such as electrons could have wave properties. This strange idea proved a good one. It was eventually shown that electrons did have wave properties, including a frequency. One result of this discovery is the electron microscope, in which electrons are used to probe tiny structures. What was de Broglie’s key contribution?

- A** the idea that light is a particle
- B** the idea that light is a wave
- C** the idea that electrons have particle properties
- D** the idea that electrons have wave properties



Standards Practice: *(continued)*

SCSh9



3. Carbon-14 provides a convenient marker for measuring the age of certain organic materials. While they are alive, organisms are constantly taking in and releasing carbon. A certain percentage of that carbon is radioactive carbon-14. Over time, that carbon-14 naturally decays into nitrogen-14 by ejecting an electron and a mysterious particle known as an antineutrino. As long as the organism is alive, the amount of carbon-14 in the body remains relatively constant. But when the organism dies, and therefore stops taking in carbon, the percentage of carbon-14 in the body begins to drop. Measuring the percentage of carbon-14 and comparing it to the percentage of carbon-14 found in living organisms reveals the amount of time since the organism has died.

What happens to carbon-14 over time?

- A It decays into nitrogen-14 and an electron.
- B It decays into nitrogen-14, an antielectron, and a neutrino.
- C It decays into nitrogen-14, an electron, and an antineutrino.
- D It decays into nitrogen-14, an electron, and a neutrino.



Standards Practice: *(continued)*

SCSh9



Students will enhance reading in all curriculum areas by:

b. Discussing books

- Discuss messages and themes from books in all subject areas.
 - Respond to a variety of texts in multiple modes of discourse.
 - Relate messages and themes from one subject area to messages and themes in another area.
 - Evaluate the merit of texts in every subject discipline.
 - Examine author's purpose in writing.
 - Recognize the features of disciplinary texts.
1. Dante wanted to learn more about the laws of gravity, so he went to the library to find a book. In which section of the library would he most likely find a book on gravity?
 - A physics
 - B geology
 - C physiology
 - D astronomy
 2. Anita wanted to find out the pH of a vinegar solution, so she went to the library to look up the information in a book. In which section of the library should she look?
 - A biology
 - B physics
 - C chemistry
 - D cooking
 3. If you were reading a scientific paper about an experiment, which parts would it most likely have?
 - A introduction, methods, procedure, conclusions
 - B prologue, description, glossary, index
 - C history, goals, public opinions, statistics
 - D forward, plan, implementation, afterward
 4. The physicist Thomas Gold wrote a book about biology called *The Deep Hot Biosphere* in which he proposed theories that many biologists are skeptical of. To determine the validity of Gold's theories, what is the most important question to ask?
 - A Why would a physicist write a book about biology?
 - B What are the credentials of the biologists who object to Gold's theories?
 - C What is the evidence that Gold uses to support his theories?
 - D How easy is it to understand Gold's theories?



Standards Practice: *(continued)*

SCSh9



Students will enhance reading in all curriculum areas by:

- c. Building vocabulary knowledge**
- **Demonstrate an understanding of contextual vocabulary in various subjects.**
 - **Use content vocabulary in writing and speaking.**
 - **Explore understanding of new words found in subject area texts.**
1. If you were reading an article that discussed decay, you would most likely be reading about _____.
- A** chemistry or geology
 - B** anthropology or sociology
 - C** physics or biology
 - D** computer science or astronomy
2. If you were reading an article that discussed nuclei and fusion, you could most likely determine whether the subject you were reading about was biology or physics by all of the following EXCEPT _____.
- A** using the other information in the article
 - B** asking your teacher or other knowledgeable adult
 - C** looking at the pictures in the article
 - D** looking up the words *nucleus* and *fusion* in a dictionary
3. Information about alcohol and acids would most likely be found under which heading in a table of contents?
- A** The Funny Shapes of Fused Rings
 - B** The Uses of Substituted Hydrocarbons
 - C** The Underground Life of Petroleum
 - D** The Math of Saturation
4. The best place to find the scientific definition of the word “repulsion” is _____.
- A** the Internet
 - B** a college dictionary of the English language
 - C** a dictionary of physics terms
 - D** figuring it out from context



Standards Practice: *(continued)*

SCSh9



Students will enhance reading in all curriculum areas by:

d. Establishing context

- Explore life experiences related to subject area content.
 - Discuss in both writing and speaking how certain words are subject area related.
 - Determine strategies for finding content and contextual meaning for unknown words.
1. Scientists have discovered particles called quarks that have a property physicists call “color charge,” even though the particles have no color because they are too small to reflect visible light. What is the most likely reason physicist use the term “color charge” to describe these particles?
 - A If quarks were bigger, they would be different colors.
 - B Physicists think that small particles see colors different from visible light.
 - C There are three types of “color” charge, just as there are three primary colors.
 - D Physicists have equipment that allows them to see colors other people can’t see.
 2. Electrons are negatively charged particles. Scientists have also discovered particles called anti-electrons. Use your knowledge about electrons to determine which is most likely another name for and anti-electron.
 - A photon
 - B negatron
 - C neutrino
 - D positron
 3. Scientists often use common words in ways that are slightly different from their everyday meaning. Why?
 - A Scientists need to be able to keep non-scientists from understanding them.
 - B Scientists use very precise definitions of words in order to communicate with each other clearly.
 - C Most scientists don’t speak English.
 - D The everyday meanings of most words are wrong.
 4. Because science can be very complicated, it is best to _____.
 - A simplify everything as much as possible
 - B use the most complex vocabulary you can.
 - C wait until you are an adult to study science
 - D use vocabulary as clearly as possible



Standards Practice:

SPS1



Students will investigate our current understanding of the atom.

- a. Examine the structure of the atom in terms of
- proton, electron, and neutron locations.
 - atomic mass and atomic number.
 - atoms with different numbers of neutrons (isotopes).
 - explain the relationship of the proton number to the element's identity.
1. Why is the lithium atom electrically neutral?
- A The number of protons equals the number of electrons.
B The number of neutrons equals the number of electrons.
C The number of protons equals the number of neutrons.
D The sum of the protons and electrons is greater than the number of neutrons.
2. Scientists believe that magnetism is caused by the spin of certain atomic particles called _____.
- A electrons
B protons
C neutrons
D nuclei
3. Which particle is located in the cloud region of the atom?
- A electron
B neutron
C nucleus
D proton
4. The atoms in Group 1 of the Periodic Table are different from the atoms in Group 18 because only the atoms in Group 18 have _____.
- A their outer energy levels filled with electrons
B three energy levels of electrons
C electron arrangements typical of metals
D electron arrangements typical of nonmetals
5. Which is **NOT** a subatomic particle?
- A electron
B neutron
C nucleus
D proton
6. Which gives the best definition of *allotropes*?
- A Allotropes are compounds containing the element aluminum.
B Allotropes are elements that conduct electricity.
C Allotropes are different structural forms of the same element.
D Allotropes are two atoms of the same element with different atomic numbers.



Standards Practice: *(continued)*

SPS1



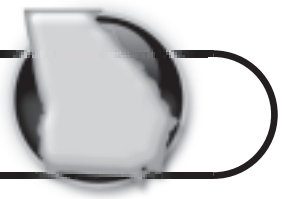
Students will investigate our current understanding of the atom.

- b. Compare and contrast ionic and covalent bonds in terms of electron movement.**
- Many ionic compounds contain charged, covalently bonded groups of atoms that act like a single atom. These groups are called _____.
 - hydrates
 - binary compounds
 - polar molecules
 - polyatomic ions
 - Ionic compounds are usually formed by ionic bonding between metals and nonmetals. Which is **NOT** an ionic compound?
 - NaBr
 - MgCl₂
 - HCl
 - KI
 - Which statement provides the best description of a covalent bond?
 - A covalent bond is the attraction between atoms when they share electrons.
 - A covalent bond is the attraction between opposite charges of ions in a compound.
 - A covalent bond usually forms between a metal and a nonmetal.
 - A covalent bond is usually stronger than an ionic bond.
- The noble gases rarely combine with other elements to form compounds because _____.
 - they are gases
 - their outer energy levels are full
 - their atoms are much too large
 - they are nonmetals
 - A covalent bond forms when two nonmetal atoms share electrons. According to this definition, which is an example of a covalent bond?
 - CO
 - NaCl
 - MgCl₂
 - LiI



Standards Practice:

SPS2



Students will explore the nature of matter, its classifications, and its system for naming types of matter.

- a. Calculate density when given a means to determine a substance's mass and volume.

Use the table to answer question 1.

Volume (mL)	Mass (g)
200	180
300	270
400	360

1. A liquid of unknown density is studied. Based on the data, what is the density of the liquid?
- A 1.1 g/mL
 - B 0.9 g/mL
 - C 1.1 mL/g
 - D 0.9 mL/g

Use the table to answer question 2.

Material	Density (g/cm ³)
Aluminum	2.7
Iron	7.9
Gold	19.3

2. Densities of some metals are shown. Find the density of an alloy that is 50% aluminum and 50% gold by weight.
- A 22 g/cm³
 - B 13.6 g/cm³
 - C 5.3 g/cm³
 - D 11 g/cm³

3. The density of iron is 7.9 g/cm³. What is the weight of a block of iron of volume 500 cm³?
- A 3.9 kg
 - B 7.9 kg
 - C 390 g
 - D 790 g
4. The density of gold is 19.3 g/cm³. What is the volume in cm³ of a gold crown of mass 193 grams?
- A 0.1 cm³
 - B 1.0 cm³
 - C 10 cm³
 - D 100 cm³



Standards Practice: *(continued)*

SPS2



Students will explore the nature of matter, its classifications, and its system for naming types of matter.

- b. Predict formulas for stable binary ionic compounds based on balance of charges.

Use the table to answer question 1.

Positive Ions	Charge	Negative Ions	Charge
Li	1+	Cl	1-
NH ₄	1+	O	2-
Be	2+	OH	1-
Sr	2+	ClO ₃	1-
Ba	2+	PO ₄	3-

1. Based on the table, what is the correct formula for the ionic compound containing NH₄ and Cl?
- A NH₄Cl₄
 - B NH₄Cl
 - C (NH₄)₄Cl₄
 - D NH₄Cl₂

Use the table to answer question 2.

Positive Ions	Charge	Negative Ions	Charge
Li	1+	Cl	1-
NH ₄	1+	O	2-
Be	2+	OH	1-
Sr	2+	ClO ₃	1-
Ba	2+	PO ₄	3-

2. Based on the table, what is the correct formula for the ionic compound containing Li and OH?
- A LiO
 - B LiH
 - C LiOH
 - D Li(OH)₂

Use the table to answer question 3.

Positive Ions	Charge	Negative Ions	Charge
Na	1+	F	1-
Ka	1+	I	1-
Ca	2+	NO ₃	1-
Mg	2+	SO ₄	2-
Al	3+	CO ₃	2-

3. Based on the table, what is the correct formula for the ionic compound containing sodium and sulfate?
- A Na₂SO₄
 - B NaSO₄
 - C Na(SO₄)₄
 - D Na(SO₄)₂

Use the table to answer question 4.

Positive Ions	Charge	Negative Ions	Charge
Na	1+	F	1-
K	1+	I	1-
Ca	2+	NO ₃	1-
Mg	2+	SO ₄	2-
Al	3+	CO ₃	2-

4. Based on the table, what is the correct formula for the ionic compound containing calcium and iodine?
- A CaI
 - B Ca₂I₂
 - C Ca₂I
 - D CaI₂



Standards Practice: *(continued)*

SPS2



Students will explore the nature of matter, its classifications, and its system for naming types of matter.

- c. Use IUPAC nomenclature for transition between chemical names and chemical formulas of**
- **binary ionic compounds (containing representative elements).**
 - **binary covalent compounds (i.e. carbon dioxide, carbon tetrachloride).**
- 1.** What is the correct chemical name for BaSO_4 ?
- A** barium sulfur oxide
 - B** barium sulfate
 - C** barium sulfide
 - D** barium sulfoxide
- 2.** What is the correct chemical name for NaCl ?
- A** sodium chloride
 - B** sodium chlorate
 - C** sodium chlorine
 - D** sodium chloric
- 3.** What is the chemical formula for magnesium hydroxide?
- A** MgO
 - B** MgH
 - C** $\text{Mg}(\text{OH})_2$
 - D** $\text{Mg}_2(\text{OH})$
- 4.** What is the chemical formula for silicon dioxide (sand)?
- A** SiO
 - B** Si_2O
 - C** Si_2O_2
 - D** SiO_2



Standards Practice: *(continued)*

SPS2



Students will explore the nature of matter, its classifications, and its system for naming types of matter.

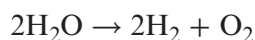
d. Demonstrate the Law of Conservation of Matter in a chemical reaction.

1. Antoine Lavoisier is credited with the discovery of the law of conservation of mass. This law states that in a chemical reaction, matter is not created or destroyed. Which equation obeys this law?

A $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
B $\text{H}_2 + \text{Cl}_2 \rightarrow \text{HCl}$
C $\text{H} + \text{Cl}_2 \rightarrow 2\text{HCl}$
D $2\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}_2$

2. The coefficient in the chemical equation $\text{H} + \text{Cl} \rightarrow 2\text{HCl}$ is _____.

A H
B Cl
C 2
D \rightarrow

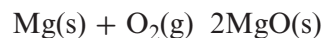


3. The law of conservation of mass states that in a chemical reaction the mass of the reactants equals the mass of the products. If approximately 20 g of water reacts in the equation above, producing about 15 g of oxygen, what mass of hydrogen (H_2) was produced in this reaction?

A 2 g
B 5 g
C 10 g
D 15 g

4. Jodi wants to test the law of conservation of mass by performing an experiment with charcoal. Which instrument should she use to weigh her materials?

A ammeter
B volumetric flask
C triple-beam balance
D Bunsen burner



Magnesium plus oxygen produces magnesium oxide.

5. The equation above is not balanced. In order to balance the equation, a coefficient of 2 needs to be placed directly _____.

A after the symbol for magnesium on the left side of the equation
B before the symbol for oxygen on the left side of the equation
C after the symbol for oxygen on the left side of the equation
D before the symbol for magnesium on the left side of the equation



Standards Practice: *(continued)*

SPS2



Students will explore the nature of matter, its classifications, and its system for naming types of matter.

- e. Apply the Law of Conservation of Matter by balancing the following types of chemical equations:**
- Synthesis
 - Decomposition
 - Single Replacement
 - Double Replacement
1. The process by which hydrogen and oxygen form water can be classified as _____.
- A decomposition reaction
 - B synthesis reaction
 - C precipitate reaction
 - D single-replacement reaction
2. A double-replacement reaction will occur if water, gas, or a precipitate (insoluble compound) forms when two ionic compounds in solution are combined. Which is the generalized formula for this type of reaction?
- A $AB + CD \rightarrow AD + CB$
 - B $A + BC \rightarrow AC + B$
 - C $D + BC \rightarrow BD + C$
 - D $A + B \rightarrow AB$
3. Knowing that a more active metal will replace a less active metal in a compound, which statement is true?
- A Gold would replace silver.
 - B Zinc would replace lead.
 - C Silver would replace copper.
 - D Copper would replace lead.
4. The process by which green plants convert carbon dioxide and water into glucose and oxygen can be classified as a _____.
- A decomposition reaction
 - B synthesis reaction
 - C precipitate reaction
 - D single-displacement reaction
5. Which is NOT a synthesis reaction?
- A $2NaOH + CaBr_2 \rightarrow Ca(OH)_2 + 2NaBr$
 - B $S + O_2 \rightarrow SO_2$
 - C $2H_2 + Cl_2 \rightarrow 2HCl_2$
 - D $2Na + Cl_2 \rightarrow 2NaCl$



Standards Practice:

SPS3



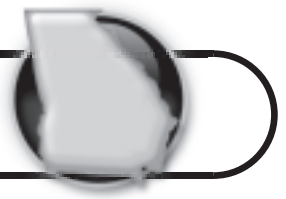
Students will distinguish the characteristics and components of radioactivity.

- a. Differentiate among alpha and beta particles and gamma radiation.**
1. An alpha particle is the same as a _____.
A helium nucleus
B hydrogen nucleus
C beta particle
D gamma particle
 2. Which is NOT a type of nuclear radiation?
A alpha particles
B beta particles
C gamma rays
D X rays
 3. Which would penetrate a car door made of aluminum?
A alpha particles
B beta particles
C gamma rays
D helium nuclei
4. A scientist was studying different radioactive samples using a cloud chamber. She looked at the path created by a sample. Which observation would mean that her sample probably contained beta-particle radiation?
A short, thin trails
B short, thick trails
C long, thin trails
D long, thick trails
 5. Which consists of electrons?
A alpha radiation
B beta radiation
C gamma radiation
D delta radiation



Standards Practice: *(continued)*

SPS3



Students will distinguish the characteristics and components of radioactivity.

b. Differentiate between fission and fusion.

1. Nuclear fusion produces energy when .
 - A two atomic nuclei combine
 - B an atomic nucleus splits
 - C a chemical reaction occurs
 - D helium transmutes into hydrogen
2. Nuclear fission produces energy when _____.
 - A two atomic nuclei combine
 - B an atomic nucleus splits
 - C a chemical reaction occurs
 - D helium transmutes into hydrogen
3. Nuclear fission converts _____.
 - A small atoms into molecules
 - B small atoms into larger atoms
 - C small amounts of energy into mass
 - D small amounts of mass into energy
4. Nuclear fusion converts
 - A large atoms into molecules
 - B large atoms into smaller atoms
 - C small amounts of energy into mass
 - D small amounts of mass into energy

5. Nuclear fission of uranium-235 can start a chain reaction by _____.
 - A releasing enough heat energy to start nuclear fission in neighboring atoms
 - B producing two smaller atoms that can then strike and split neighboring atoms
 - C producing neutrons that can then strike and split neighboring atoms
 - D combining two atoms with low mass to form one large atom
6. Nuclear fusion is most likely to be found _____.
 - A in the core of the Sun
 - B in the core of the Earth
 - C in nuclear power plants
 - D in microwaves



Standards Practice: *(continued)*

SPS3



Students will distinguish the characteristics and components of radioactivity.

- c. Explain the process half-life as related to radioactive decay.

Use the paragraph below to answer question 1.

Geologists make extensive use of radioactivity to establish the geologic history of Earth. One technique employs the ratio of U-235 atoms to Pb-207 atoms. U-235 atoms form Pb-207 atoms through a series of decays with essentially the half-life of U-235, which is 704 million years. That is, the amount of U-235 in a sample of rock decays to one-half its original amount in 704 million years.

- A sample of rock is found to contain $\frac{1}{4}$ of the U-235 atoms present when the rock was formed. What is the approximate age of the rock?
A 1.4 billion years
B 704 million years
C 352 million years
D 2.8 billion years
- Which statement provides the best description of transmutation?
A Transmutation is the change in genetic material due to radiation.
B Transmutation is the change of one element to another through nuclear decay.
C Nuclear reactors are the cause of all transmutations.
D Transmutation can be speeded up or slowed down by chemical intervention.

Use the table to answer question 3

Isotope	Half-Life
Rubidium-87	488×10^{10} years
Carbon-14	5730 years
Uranium-235	713 million years
Potassium-40	1.3 billion years

3. Which radioisotope in the table above would be most useful for determining the age of Earth?
A rubidium-87
B carbon-14
C uranium-235
D potassium-40

Use the table to answer question 4.

Half-Life of Carbon-14

Half-Life	Mass of C-14 Remaining (g)	Number of Years
0	1	0
1	$\frac{1}{2}$	5,700
2	$\frac{1}{4}$	11,400
3	$\frac{1}{8}$	17,100
4	$\frac{1}{16}$	22,800
5	$\frac{1}{32}$?

4. According to the above data, after how many years would the mass of carbon-14 remaining be $\frac{1}{32}$ g?
A 17,100 years
B 22,800 years
C 28,500 years
D 34,200 years



Standards Practice: *(continued)*

SPS3



Students will distinguish the characteristics and components of radioactivity.

- d. Describe nuclear energy, its practical application as an alternative energy source, and its potential problems.**
- Which is **NOT** a problem usually associated with nuclear energy?
 - disposal of radioactive waste
 - thermal pollution of rivers and streams
 - environmental damage from mining and extraction of uranium
 - emission of carbon dioxide into the atmosphere
 - Nuclear power plants can create high-level radioactive waste. Typical nuclear waste can remain hazardous for up to _____.
 - several hundred years
 - several thousand years
 - several million years
 - hundreds of billion years
- 3. Which is an advantage of nuclear energy?**
- It produces no air pollution.
 - It causes no heat pollution.
 - It has no chance for accidents.
 - It produces carbon dioxide.



Standards Practice:

SPS4



Students will investigate the arrangement of the Periodic Table.

- a. Determine the trends of the following:
- Number of valence electrons
 - Types of ions formed by representative elements
 - Location of metals, nonmetals, and metalloids
 - Phases at room temperature
1. Most metallic elements have all of these properties EXCEPT _____.
- A high melting point
 - B being a good conductor of electricity
 - C being easily crumbled into pieces
 - D a shiny luster
2. The atoms in the noble gas column are different from the atoms in halogen column because only the atoms in noble gas column have _____.
- A their outer energy levels filled with electrons
 - B three energy levels of electrons
 - C electron arrangements typical of metals
 - D electron arrangements typical of nonmetals
3. Which has the fewest valence electrons?
- A helium
 - B xenon
 - C oxygen
 - D nitrogen
4. Which is a liquid at room temperature?
- A sodium
 - B uranium
 - C argon
 - D mercury
5. Most elements are _____.
- A metals
 - B nonmetals
 - C metalloids
 - D noble gasses
6. Which statement best describes what happens to sodium and chlorine atoms when they combine to form sodium chloride?
- A The sodium atom becomes a positive sodium ion, and the chlorine atom becomes a negative chloride ion.
 - B The sodium atom becomes a negative sodium ion, and the chlorine atom becomes a positive chloride ion.
 - C The sodium atom becomes a positive chloride ion, and the chlorine atom becomes a negative sodium ion.
 - D The sodium atom becomes a negative chloride ion, and the chlorine atom becomes a positive sodium ion.



Standards Practice: *(continued)*

SPS4



Students will investigate the arrangement of the Periodic Table.

b. Use the Periodic Table to predict the properties for representative elements.

1. Vanadium has 23 protons. About what is its atomic weight?
A 23
B 32
C 50
D 75
2. Sulfur and oxygen are both in group 16 of the periodic table. Based on this, which is most likely a compound of sulfur?
A HeS_4
B H_2S
C SH_3
D $\text{Au}_{10}\text{S}_{12}\text{O}_6$

4. Which element is NOT in the same group as phosphorus (P)?

A antimony (Sb)
B arsenic (As)
C nitrogen (N)
D oxygen (O)

5. A group of elements are highly inactive and are used by chemists because of their chemical stability. Most are found in pure form. They are commonly used in lightbulbs, weather balloons, and in the prevention of oxidation in welding. In which group are these elements found?

A alkali metals
B alkaline earth metals
C halogens
D noble gases

Use the table to answer question 3.

Elements in the Same Group

Element	Valence
Fluorine	1
Chlorine	1
Bromine	1
Iodine	1
Astatine	1

3. The table above represents several elements that have the same valence. To which group do these elements belong?
A alkali metals
B alkaline earth metals
C halogens
D noble gases



Standards Practice:

SPS5



Students will compare and contrast the phases of matter as they relate to atomic and molecular motion.

a. Compare and contrast the atomic/molecular motion of solids, liquids, gases and plasmas.

- Which is not a property of liquids?
A They have a definite shape.
B They have a definite volume.
C They take the shape of their container.
D They have the ability to flow.
- Daphne placed a glass of water with a thermometer in it inside a freezer. She took temperature readings every 2 minutes for 30 minutes and found that the temperature remained constant during the time interval between the 12- and 22-minute marks. What is the most likely explanation for this?
A The ice was melting during that time.
B The water was freezing during that time.
C The water's kinetic energy was increasing.
D The water's kinetic energy was decreasing.
- Some liquids, such as motor oil, have a high viscosity. Why is this a useful property?
A It makes the oil easier to pour.
B It enables oil companies to retrieve crude oil from underground rock layers.
C It prevents the oil from spilling out of large tankers into waterways and onto land, thus preventing environmental damage.
D It enables the oil to coat the moving parts of the motor, preventing them from rubbing against each other.

Use this table to answer question 4.

Robert made the following table in science class.

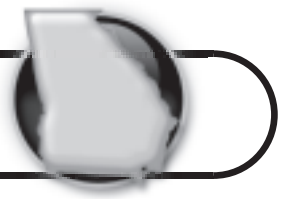
Breaking a piece of glass
Melting a piece of lead
Boiling a flask of liquid nitrogen
Freezing a beaker of water
Bending a piece of wire

- The purpose of Robert's list is to give _____.
A examples of chemical changes
B examples of physical changes
C examples of reactions that require the addition of heat energy
D examples of unsafe laboratory techniques
- Which is a property of gases?
A They have a definite shape.
B They have a definite volume.
C They take the shape of their container.
D They form crystal lattices.
- If solid sulfur is heated, its molecules move faster and eventually it will turn into a _____.
A liquid, then a gas, then a plasma
B liquid, then a solid, then a gas
C plasma, then a liquid, then a gas
D gas, then a liquid, then a plasma



Standards Practice: *(continued)*

SPS5



Students will compare and contrast the phases of matter as they relate to atomic and molecular motion.

b. Relate temperature, pressure, and volume of gases to the behavior of gases.

1. The pressure on five liters of compressed air at 303 kPa is reduced to 101 kPa. What is the new volume of the air?
A 1.6 liters
B 7.6 liters
C 15 liters
D 13.4 liters

Use the formula to answer question 2.

$$V_1/T_1 = V_2/T_2$$

Where V is volume and T is absolute temperature.

2. At constant pressure, the volume of a gas is reduced from 1.0 L to 0.9 L. If the beginning temperature is 298 K, what is the final temperature?
A 331 K
B 298 K
C 275 K
D 268 K

Use the table to answer question 3.

Pressure and Volume of Helium Gas at Constant Temperature

Pressure	Volume
101 kPa	3.0 L
152 kPa	2.0 L
202 kPa	1.5 L
253 kPa	?

3. Assuming conditions remain the same, what is the final volume of the helium gas?
A 1.0 L
B 1.1 L
C 1.2 L
D 0.9 L

Use the table to answer question 4.

Temperature and Volume of Air at Constant Pressure

Temperature	Volume
298 K	100 L
358 K	120 L
447 K	150 L
536 K	?

4. Assuming conditions remain the same, what is the final volume of the air?
A 170 L
B 180 L
C 200 L
D 220 L



Standards Practice:

SPS6



Students will investigate the properties of solutions.

- a. Describe solutions in terms of
 - solute/solvent
 - conductivity
 - concentration
1. Which is NOT a good example of a solute and a solvent in solution?
 - A a solution of a kilogram of water and a gram of salt
 - B a solution of a gram of silver and a milligram of copper
 - C a solution of a kilogram of cold water and a kilogram of hot water
 - D a solution of a kilogram of water and a milligram of sugar
2. Information about the amount of salt that will dissolve in a liter of water at 20°C would most likely be found in which kind of table?
 - A solubility
 - B polarity
 - C solvent properties
 - D temperature
3. Janelle added salt to a beaker of water, increasing the solute's concentration until she could still see salt crystals, even after stirring. What did Janelle make?
 - A an unsaturated solution
 - B a saturated solution
 - C a soluble solution
 - D a supersaturated solution
4. If a copper coin is placed into a beaker of nitric acid, the coin will dissolve. In this reaction, the coin's copper becomes the _____.
 - A solvent
 - B solution
 - C concentration
 - D solute
5. A solution of salt and water conducts electricity because _____.
 - A the sodium and chlorine form ions.
 - B the sodium and chlorine form a solvent
 - C the solution becomes a metal
 - D the saltwater creates electrons



Standards Practice: *(continued)*

SPS6



Students will investigate the properties of solutions.

- b. Observe factors affecting the rate a solute dissolves in a specific solvent.**
- Michelle wants to quickly dissolve powdered drink mix in a pitcher of water. Which is **NOT** a way she could increase the rate of dissolution?
 - heating the mixture
 - stirring the mixture
 - breaking up big pieces of the powdered drink mix
 - adding more powdered drink mix
 - Which does **NOT** affect the rate at which a solid dissolves in a liquid?
 - particle size
 - stirring
 - particle shape
 - temperature
 - Five grams of powdered sugar dissolves more quickly than a 5-g sugar cube because _____.
 - the powdered sugar has more surface area
 - the sugar cube has more surface area
 - the powdered sugar has less mass
 - the sugar cube has less mass
- Carbon dioxide dissolves in cold water more easily than it does in warm water. Given this information, what will happen to a carbonated beverage if it is heated up?
 - The carbon dioxide will come out of solution.
 - More carbon dioxide will go into solution.
 - The water will become the solute.
 - There will be no change.
 - If a piece of candy is dropped into a carbonated beverage, the beverage will fizz. Which statement best explains this phenomenon?
 - The sugar in the candy heats up the solution.
 - The dissolving sugar displaces the dissolved carbon dioxide.
 - The beverage is only able to dissolve one solute at a time.
 - The sugar in the candy becomes a gas.



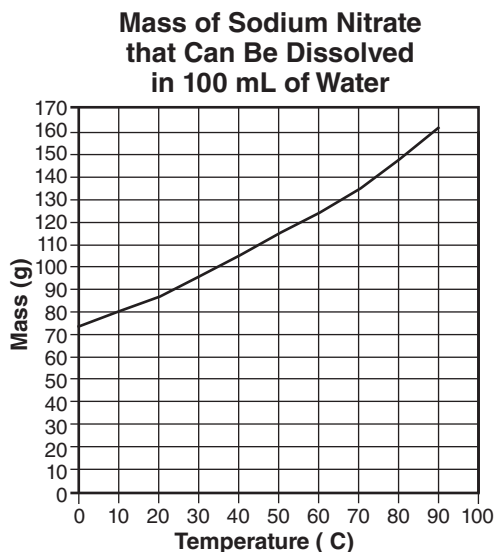
Standards Practice: *(continued)*

SPS6



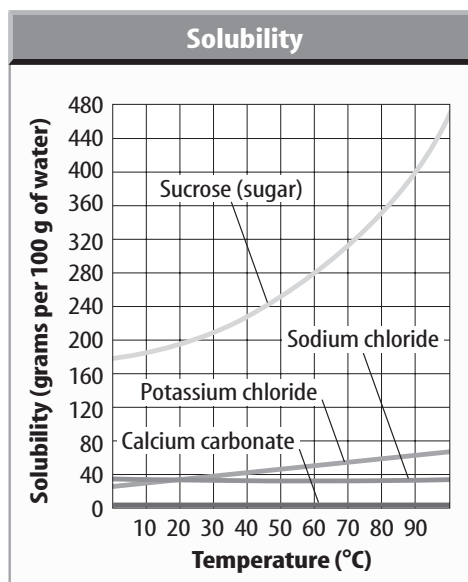
Students will investigate the properties of solutions.

- c. Demonstrate that solubility is related to temperature by constructing a solubility curve.



- Based on the solubility curve for sodium nitrate, what is the temperature required to dissolve 150 grams in 100 mL water?
A 23°C
B 89°C
C 66°C
D 80°C
- What happens to the carbon dioxide in two opened cans of soda pop if can A is left on the counter and can B is left in the refrigerator?
A Both cans lose carbon dioxide gas, but the can in the refrigerator loses gas faster.
B Both cans lose carbon dioxide gas, but the can in the refrigerator loses gas slower.
C The two cans lose carbon dioxide gas at the same rate.
D Only the can on the counter loses carbon dioxide gas.

Use the graph below to answer questions 3. and 4.



- How much more sugar than potassium chloride can be dissolved in 100 grams of water at 70°C?
A 260 g
B 280 g
C 320 g
D 360 g
- Which material's solubility is least affected by temperature?
A calcium carbonate
B sodium chloride
C potassium chloride
D sucrose



Standards Practice: *(continued)*

SPS6



Students will investigate the properties of solutions.

d. Compare and contrast the components and properties of acids and bases.

- Which instrument could tell you how acidic a sample of stream water is?
A anemometer
B oscilloscope
C pH meter
D voltmeter
- All are properties of an acid EXCEPT _____.
A producing hydrogen ions in solution
B burning a hole through metal
C tasting sour
D feeling slippery
- Which pH measurement is LEAST acidic?
A 7.0
B 9.5
C 5.5
D 1.2
- Fish-tank water must be kept at a particular pH level so the fish stay healthy. What is the best way to protect the water from becoming too acidic or too basic?
A Add a buffer to the water.
B Put pH paper on the tank.
C Add acid to the water.
D Fill the tank with colored water.

- An aqueous solution of which compound will change red litmus paper to blue?

A HCl
B H₂O
C NaCl
D NaOH

- When Maria adds a few drops of bromthymol blue to a beaker of water, the resulting solution has a blue color. Next, as she blows exhaled air into the solution through a straw, Maria observes a series of color changes—blue to blue-green, to green, to yellow-green, and finally to yellow. Which is the most likely cause of these color changes?

A The carbon dioxide in the exhaled air dissolves in water to form a weak acid.
B The carbon dioxide in the exhaled air dissolves in water to form a weak base.
C The oxygen in the exhaled air dissolves in water to form a weak acid.
D The oxygen in the exhaled air dissolves in water to form a weak base.



Standards Practice: *(continued)*

SPS6

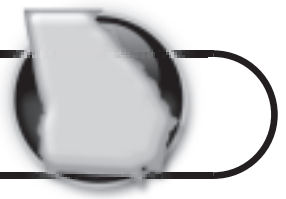


Students will compare and contrast the phases of matter as they relate to atomic and molecular motion.

- e. Determine whether common household substances are acidic, basic, or neutral.**
- What products commonly contain acids?
A cleaning products
B automotive fuels
C foods and beverages
D plastics
 - What products commonly contain bases?
A cleaning products
B automotive fuels
C foods and beverages
D plastics
 - Which substance will be located farthest toward the acidic end of the pH scale?
A hand soap
B detergent
C spaghetti sauce
D baking soda
 - When baking soda and vinegar are combined, the result is a salt called sodium acetate, bubbles of carbon dioxide gas, and water. What is the name for this change?
A phase change
B internal change
C physical change
D chemical change
- Antacids contain bases that react with the acid in your stomach to relieve indigestion. NaHCO_3 reacts with the strong hydrochloric acid, HCl , to form a salt, carbon dioxide, and water. This type of reaction is called _____.
A neutralization
B oxidation
C dehydration
D titration
 - Mr. Vasquez's chemistry class made a list of some solutions and their pH levels. The table above shows their results. Which sequence shows these solutions, in order of least acidic to most acidic?
A gastric juice, cola, acid rain, pure rain water
B cola, acid rain, gastric juice, pure rain water
C pure rain water, acid rain, cola, gastric juice
D acid rain, pure rain water, gastric juice, cola

Standards Practice:

SPS7



Students will relate transformations and flow of energy within a system.

- a. Identify energy transformations within a system (e.g. lighting of a match).**
1. What do a toaster, a hair dryer, and an iron have in common?
 - A They convert electrical energy to heat energy.
 - B They convert electrical energy to mechanical energy.
 - C They convert mechanical energy to electrical energy.
 - D They convert heat energy to electrical energy.
 2. A pendulum bob swings back and forth in an arc. Which describes the energy conversion process in one swing of the pendulum from left to right?
 - A kinetic energy to chemical energy to potential energy
 - B kinetic energy to potential energy back to kinetic energy
 - C potential energy to kinetic energy back to potential energy
 - D potential energy to kinetic energy to electromagnetic energy
3. Heterotrophs consume food to obtain energy for biological processes. During exercise, the chemical energy in food is transformed into what other forms of energy?
 - A potential and electrical energy
 - B electromagnetic and heat energy
 - C mechanical, kinetic, and heat energy
 - D potential, electromagnetic, and heat energy
 4. The temperature is higher inside a greenhouse than outside because of the conversion of _____.
 - A light energy into heat energy
 - B heat energy into light energy
 - C nuclear energy into heat energy
 - D electrical energy into heat energy



Standards Practice: *(continued)*

SPS7



Students will relate transformations and flow of energy within a system.

- b. Investigate molecular motion as it relates to thermal energy changes in terms of conduction, convection, and radiation.**
- Convection is the transfer of energy by the motion of the heated particles in a fluid. According to this information, which statement best describes an example of convection?
 - a shirt heated by an iron
 - a puddle of rainwater heated by sunlight
 - a dark-color car heated by sunlight
 - warm air rising in the atmosphere
 - Ms. Markas takes a thermos bottle filled with hot coffee to work each day. The thermos bottle keeps the coffee hot by _____.
 - using a battery-powered heating element
 - collecting solar heat energy
 - recirculating hot air inside
 - slowing heat transfer
 - Which is NOT a process by which heat energy is transferred from a warmer object to a cooler one?
 - conduction
 - convection
 - insulation
 - radiation
- Which of these statements is true?
 - Most of the energy produced by burning natural gas is wasted.
 - Oil-burning furnaces are the most energy-efficient method of heating.
 - Heating with electricity produced by a nuclear plant is the least energy-efficient method.
 - It would save money and the environment if everyone used wood-burning stoves.
 - Adam placed a heated aluminum cube in a beaker of water and then measured the change in the temperature of the water. The change in temperature he recorded was most likely measured in _____.
 - calories
 - degrees Celsius
 - grams per cubic centimeter
 - joules



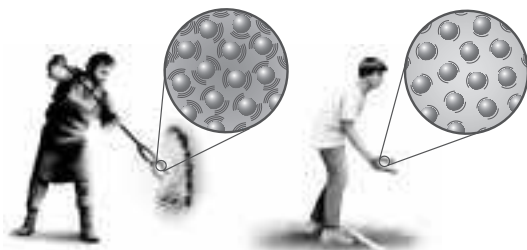
Standards Practice: *(continued)*

SPS7



Students will relate transformations and flow of energy within a system.

- c. Determine the heat capacity of a substance using mass, specific heat, and temperature.



1. When the temperature of an object increases, what else has increased?
- A density
 - B thermal energy
 - C specific heat
 - D melting point

Use the chart to answer question 2.

Substance	Specific Heat [J/(kg°C)]
Water	4,184
Wood	1,760
Carbon (graphite)	710
Glass	664
Iron	450

2. According to the chart, what material requires the most heat to raise its temperature 10°C?
- A glass
 - B iron
 - C water
 - D wood

Use the equation to answer question 3.

$$Q = m(T_f - T_i)C$$

Where Q is the change in thermal temperature, m is the mass of the object, T_f is the final temperature of the object, and T_i is the initial temperature of the object.

3. Suppose four pieces of metal, with masses of 10 g, 100 g, 500 g, and 1 kg, are heated. According to the equation above, which piece of metal requires the most heat to go from 10°C to 20°C?
- A 10-g piece
 - B 100-g piece
 - C 500-g piece
 - D 1-kg piece
4. In a calorimeter, the sample to be tested generally cools off. What material heats up?
- A air
 - B water
 - C alcohol
 - D mercury

Standards Practice: *(continued)*

SPS7

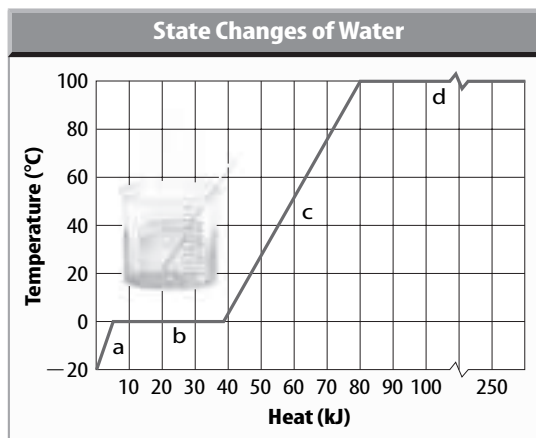


Students will investigate the properties of solutions.

d. Explain the flow of energy in phase changes through the use of a phase diagram.

1. While a block of ice is melting, the temperature of the ice _____.
A goes up
B goes down
C remains constant
D varies depending on conditions
2. When a pot of water reaches 100°C, its temperature remains constant even if heat is added to the pot. Where does this extra heat go?
A The extra heat overcomes the attractive forces between water molecules.
B The extra heat raises the temperature of the pot.
C The extra heat is radiated away into the air.
D The extra heat leaves the pot through convection currents.

Use the chart to answer questions 3 and 4.

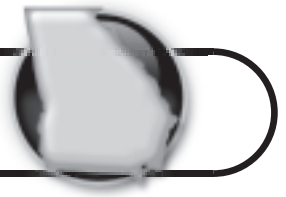


3. Examine the heating curve for water. What is happening along the diagonal line in this graph?
A Solid water is melting.
B Liquid water is boiling.
C Liquid water is freezing.
D Liquid water is changing temperature.
4. Examine the heating curve for water. Starting at 80°C, about how much heat does water have to lose to freeze?
A about 20 kJ
B about 30 kJ
C about 80 kJ
D about 10 kJ



Standards Practice:

SPS8



Students will determine relationships among force, mass, and motion.

a. Calculate velocity and acceleration.

1. If the same force is applied to objects with the following masses, which one will have the LEAST acceleration?
A $m = 1.0$ kg
B $m = 7.3$ kg
C $m = 0.75$ kg
D $m = 0.5$ kg

Use the table to answer question 2.

Time (s)	Distance (m)
0	0
1	4.9
2	19.6
3	44.1
4	78.4
5	122.5

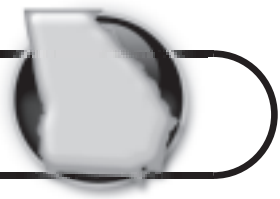
2. The table shows the total vertical distance a free-falling body travels for each second it falls. About how far does the free-falling body travel between 4 and 5 seconds?
A 44 m
B 54 m
C 144 m
D 154 m

3. Which is measured in meters per second per second (m/s^2)?
A speed
B velocity
C acceleration
D displacement
4. Sometimes, people mistakenly state that velocity and speed are the same thing. People might make such a mistake because they forget that velocity describes both speed and _____.
A volume
B force
C the time interval
D direction



Standards Practice: *(continued)*

SPS8



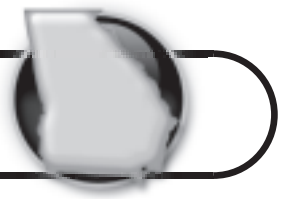
Students will determine relationships among force, mass, and motion.

- b. Apply Newton's three laws to everyday situations by explaining the following:**
- **Inertia**
 - **Relationship between force, mass and acceleration**
 - **Equal and opposite forces**
- 1.** A large box is being pushed in opposite directions by two men. The box will accelerate UNLESS _____.
- A** the opposing forces are balanced
 - B** the floor creates friction
 - C** the man on the left side applies more force than does the man on the right side
 - D** the man on the right side applies more force than does the man on the left side
- 2.** A group of students is playing tug-of-war. The students on both sides of the rope are pulling with equal force. This is an example of _____.
- A** unbalanced forces
 - B** displacement
 - C** acceleration
 - D** balanced forces
- 3.** According to Newton's second law of motion, force equals _____.
- A** mass times the speed of light squared
 - B** velocity times direction
 - C** distance times force
 - D** mass times acceleration
- 4.** According to Newton's first law of motion, why does a book stay on a desk without moving?
- A** The desk pushes up on the book with more force than the book pushes down on the desk.
 - B** The book pushes down on the desk with more force than the desk pushes up on the book.
 - C** The desk and the book push each other in opposite directions with equal force.
 - D** The desk and the book do not push on each other.



Standards Practice: *(continued)*

SPS8



Students will determine relationships among force, mass, and motion.

c. Relate falling objects to gravitational force.

1. What are the two forces experienced by a skydiver as she falls?
A gravity and wind
B friction and air resistance
C gravity and air resistance
D friction and wind
2. What is the relationship between the mass of an object and its rate of fall in a vacuum?
A Heavier objects fall faster than lighter objects.
B Lighter objects fall faster than heavier objects.
C Larger objects fall faster than smaller objects.
D All objects fall at the same rate.

Use the table to answer question 3.

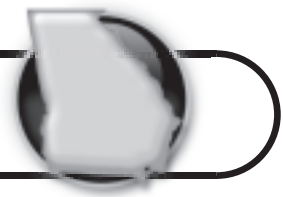
Ball	Horizontal Speed
A	10 m/s
B	20 m/s
C	2 m/s

3. Three identical tennis balls are fired from ball cannons at the same instant. The barrels of all three ball cannons are parallel to the ground. The table shows the horizontal speeds of the balls. What is true of their falling speeds?
A Ball A falls fastest.
B Ball B falls fastest.
C Ball C falls fastest.
D All three balls fall at the same rate.
4. No matter how far apart two objects are, the gravitational force between them _____.
A never completely goes to zero
B always increases over time
C increases as they move away from each other
D decreases as they move closer together



Standards Practice: *(continued)*

SPS8



Students will determine relationships among force, mass, and motion.

- d. Explain the difference in mass and weight.

Use the table to answer question 1.

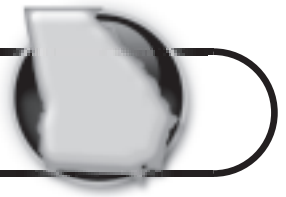
Weight on Venus	Weight on Moon	Weight on Earth	Weight on Mars	Weight on Jupiter	Weight on Saturn
90 N	17 N	100 N	38 N	254 N	116 N
450 N	84 N	500 N	190 N	1270 N	580 N
900 N	167 N	1000 N	380 N	2540 N	1060 N

- The table shows weight in newtons on the planets of the solar system. For a person with a mass of 50 kg, on which planet would her weight be the greatest?
 - Venus
 - Earth
 - Mars
 - Jupiter
- A satellite in free fall orbit around Earth experiences a force about 80% of the force of gravity at Earth's surface. If the satellite has a mass of 500 kg, what is its weight in free fall?
 - 0 N
 - 4900 N
 - 3920 N
 - 6130 N
- Describe the relationship between your weight and your mass on Earth and on the Moon.
 - Both are the same in each place.
 - Weight is the same in each place, but mass is different.
 - Mass is the same in each place, but weight is different.
 - Both weight and mass are different in each place.
- Weight is a _____ and mass is a measure of the amount of _____ an object contains.
 - speed; solid
 - distance; liquid
 - time; gas
 - force; matter



Standards Practice: *(continued)*

SPS8



Students will determine relationships among force, mass, and motion.

- e. Calculate amounts of work and mechanical advantage using simple machines.**
- Using a jack, Sonia is able to raise a 15,000-N car off the ground with a force of 500 N. What is the mechanical advantage, or the ratio of the resistance force to the effort force, of the jack?
 - 2 to 1
 - 10 to 1
 - 15 to 1
 - 30 to 1
 - The efficiency of a machine is a measure of how much of the work put into a machine is converted to useful output work by the machine. What causes the efficiency of a machine to be always less than 100 percent?
 - friction
 - poor design
 - limited strength of the user
 - elastic limit of the parts
- Which is measured in watts?
 - force
 - weight
 - power
 - work
 - On a bicycle, the wheels are wheels and axles, the hand brakes and gearshift are levers, and the chains are pulleys. Combinations of two or more simple machines are called _____.
 - third-class levers
 - block and tackles
 - complex devices
 - compound machines



Standards Practice:

SPS9



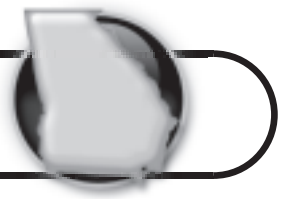
Students will investigate the properties of waves.

- a. Recognize that all waves transfer energy.**
1. A collision between which of the following does **NOT** result in constructive interference?
 - A two rarefactions
 - B a crest and a wave peak
 - C two compressions
 - D a crest and a trough
 2. Which statement best describes what happens when more waves pass a certain point per second?
 - A They accelerate.
 - B They transport less energy.
 - C They make a lower pitch.
 - D They increase in frequency
3. Which probably transfers the most energy?
 - A a running hair dryer
 - B a sound of 3 decibels
 - C an ultrasonic whistle
 - D the infrasonic rumble of an earthquake
 4. Why do doctors use ultrasound to crumble kidney stones?
 - A Hard objects absorb the energy in X rays.
 - B Hard objects absorb the energy in ultrasound waves.
 - C Ultrasonic frequencies are too low to be heard.
 - D Ultrasound can detect stones in a patient's lungs.



Standards Practice: *(continued)*

SPS9



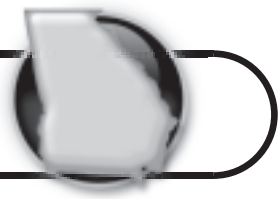
Students will investigate the properties of waves.

- b. Relate frequency and wavelength to the energy of different types of electromagnetic waves and mechanical waves.**
- In 1 second, four crests of a wave pass a certain point. What is the wave's frequency?
 - 2 Hz
 - 3 Hz
 - 4 Hz
 - 5 Hz
 - Which statement best explains frequency?
 - Frequency is the number of wavelengths that pass a point per second.
 - Frequency is the number of crests that pass a point in total.
 - Frequency is the number of wavelengths that pass a point in total.
 - Frequency is the amplitude per second.
- A student is learning how to play a woodwind instrument. Which would **LEAST** affect the frequency of the sound made by the woodwind?
 - the length of the air column
 - the vibration of the mouthpiece
 - the temperature of the air
 - the amplitude of the sound waves
 - Wave speed equals the wave frequency times its wavelength. According to this, what is the wave speed of a wave with a frequency of 170 Hz and a wavelength of 2.0 m?
 - 340 m/s
 - 85 m/s
 - 17 m/s
 - 1.7 m/s



Standards Practice: *(continued)*

SPS9



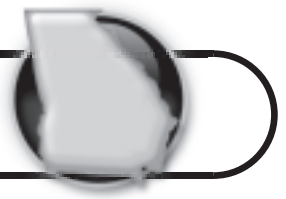
Students will investigate the properties of waves.

- c. Compare and contrast the characteristics of electromagnetic and mechanical (sound) waves.**
1. An electromagnetic wave is able to produce both an electric field and a magnetic field because _____.
 - A photons absorb magnetic energy
 - B they are always made at the same time
 - C the fields continually recreate each other
 - D they behave like matter instead of waves
 2. How can electromagnetic waves communicate information?
 - A moving sound energy
 - B by refraction
 - C gamma rays
 - D amplitude modulations
 3. How do sound waves transmit energy?
 - A moving electrical charges
 - B by reflection
 - C gamma rays
 - D compressions in the air
 4. What do electromagnetic waves and sound waves have in common?
 - A They both transmit energy.
 - B They both use compression waves in the air.
 - C They are both mechanical waves.
 - D They both transmit electrical energy.



Standards Practice: *(continued)*

SPS9



Students will investigate the properties of waves.

d. Investigate the phenomena of reflection, refraction, interference, and diffraction.

1. Which statement is true?
 - A Long wavelengths travel more slowly than short wavelengths.
 - B Long wavelengths have a greater frequency than short wavelengths.
 - C Long wavelengths diffract around large objects more easily than do short wavelengths.
 - D Long wavelengths are able to generate far more power than are short wavelengths.
2. Which statement best explains reverberation?
 - A A reverberation is an echo.
 - B A reverberation occurs when a room with good acoustics does not reflect sound.
 - C A reverberation occurs when echoes are used to locate the source of a sound.
 - D A reverberation occurs when there are many reflections of a sound.
3. Ramin heated some leftovers in a microwave oven. He noticed that some parts of the food got hot, while others did not. What is a possible explanation for this?
 - A The microwaves were interfering with each other.
 - B The microwaves reflected off each other.
 - C The wavelength of the microwaves was too short.
 - D The wavelength of the microwaves was too long.

4. A glass prism is able to bend light because _____.
 - A light is refracted as it enters a different medium
 - B the prism offers destructive interference
 - C energy is diffracted when it encounters an obstacle
 - D the glass and the light's wavelength create resonance
5. A collision between which of the following results in constructive interference?
 - A a wave and a barrier
 - B a rarefaction and a barrier
 - C two compressions
 - D a crest and a trough



Standards Practice: *(continued)*

SPS9



Students will investigate the properties of waves.

- e. Relate the speed of sound to different mediums.

$$c = \sqrt{C/\rho}$$

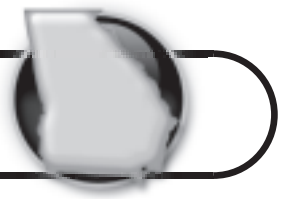
Where c represents the speed of sound, C represents the stiffness of the material, and ρ represents the density of the material.

- Steel gets more dense as its temperature drops. What will happen to sound in a piece of steel as the steel is cooled?
 - The sound's speed will decrease.
 - The sound's speed will increase.
 - The sound will cool down the steel.
 - The sound's speed will stay the same.
- Sonar is used to locate icebergs, submerged ships, schools of fish, and even the bottom of the ocean. A sound wave is sent out from an observation point and the amount of time for the sound to return is measured. A scientist can calculate how far the object is from the observation point if she knows _____.
 - the wavelength of the sound
 - the speed of sound in water
 - where the sonar is aimed
 - how far away the object is
- From slowest transmission to fastest, four media that transmit sound are _____.
 - lead, wood, air, water
 - air, wood, water, lead
 - water, air, wood, vacuum
 - wood, water, lead, air
- What is the speed of sound in a vacuum?
 - equal to the speed of light
 - faster than the speed of sound in air, but slower than the speed of sound in water
 - faster than the speed of sound in water, but slower than the speed of sound in air
 - A vacuum cannot transmit sound.



Standards Practice: *(continued)*

SPS9



Students will investigate the properties of waves.

f. Explain the Doppler Effect in terms of everyday interactions.

1. A student uses an electronic tuner to measure the frequency of a stationary car's horn. Then the student measures the car's horn frequency while the car drives away. The student is most likely trying to investigate _____.

A the Doppler effect
B vibrations in the inner ear
C noise pollution
D the location of the nearest resonator

2. Police officers use a special device to determine the speed of cars traveling on the highway. This device works by sending a wave toward the car, detecting its reflection, and the frequency change of the reflected wave. This device relies on _____.

A acoustics
B the Doppler effect
C beats
D a fundamental frequency

3. What evidence is there that the universe is expanding?

A New matter has been created as a result of other universal matter expanding outward.
B The results of the big bang explosion have expanded space and matter.
C The Hubble red shift shows that light waves traveling through space lengthen as space expands.
D The gravitational forces of dark matter have been reduced.

4. Which statement describes what happens when more waves pass a certain point per second?

A They accelerate negatively.
B They transport less energy.
C They make a lower pitch.
D They increase in frequency.



Standards Practice:

SPS10



Students will investigate the properties of electricity and magnetism.

- a. Investigate static electricity in terms of**
- **friction**
 - **induction**
 - **conduction**
- 1.** Electric forces have many everyday applications. One well-known example occurs when you walk across a carpet on a dry day. Your shoes might acquire excess charge from the carpet. This excess charge is an example of _____.
- A** static electricity
 - B** a static discharge
 - C** a static current
 - D** static friction
- 2.** If you have a build up of static charge and you touch another object, you may experience a small spark. This is an example of _____.
- A** an electrical storm
 - B** a static discharge
 - C** a static current
 - D** static friction
- 3.** Charge by conduction can occur more easily if _____.
- A** the electrons are tightly bound to the atoms that make up a material
 - B** the electrons are not tightly bound to the atoms that make up a material
 - C** the protons are not tightly bound to the atoms that make up a material
 - D** there are no electrons in the material
- 4.** A process that occurs when a charged object is brought near an uncharged object and electrons move toward the charged object or away from it, causing a separation of charge and the previously uncharged object becomes charged, is called charge by _____.
- A** friction
 - B** induction
 - C** static
 - D** conduction



Standards Practice: *(continued)*

SPS10

Students will investigate the properties of electricity and magnetism.

b. Explain the flow of electrons in terms of

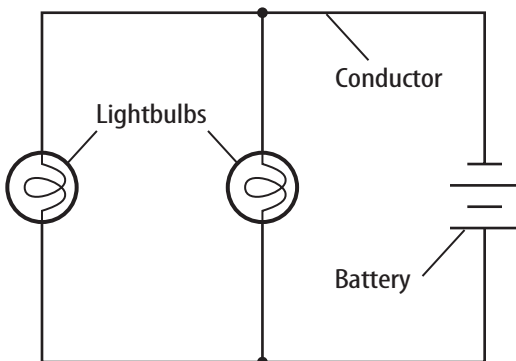
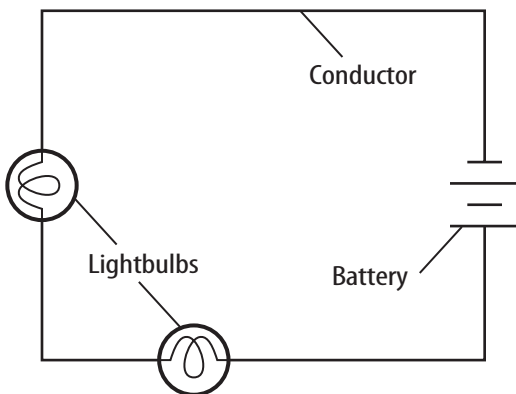
- alternating and direct current.
- the relationship among voltage, resistance and current.
- simple series and parallel circuits.

$$I = V/R$$

Where I is current, V is voltage, and R is resistance.

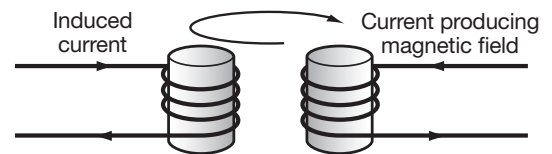
1. Ohm's Law is shown. For a current of 2 amperes and a voltage of 12 volts, what is the resistance in ohms?

- A** 24 ohms **C** 14 ohms
B 10 ohms **D** 6 ohms



2. A series and a parallel circuit are shown. Which statement is NOT true?

- A** Increasing the voltage in either circuit will increase the brightness of the bulbs in that circuit.
B If one of the bulbs in the parallel circuit is removed, the other bulb will go out.
C If one of the bulbs in the series circuit is removed, the other bulb will go out.
D If all the lightbulbs are identical, the parallel circuit draws more current from the battery than does the series circuit.



3. The diagram shows a transformer. What is true of transformers?

- A** Transformers require alternating current (AC) to work.
B Transformers require direct current (DC) to work.
C Transformers will work only at high voltages.
D Transformers will work only at low voltages.

4. In a circuit, how do electrons move?

- A** from positive to negative, through a conductor such as a wire
B from negative to positive, through an insulator such as plastic
C from positive to negative, through an insulator such as plastic
D from negative to positive, through a conductor such as a wire

Go on

Standards Practice: *(continued)*

SPS10



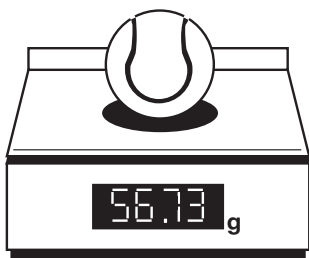
Students will investigate the properties of electricity and magnetism.

- c. Investigate applications of magnetism and/or its relationship to the movement of electrical charge as it relates to**
- electromagnets
 - simple motors
 - permanent magnets
- 1.** Which two areas of physical science are closely related to the development of electric motors and generators?
- A** sound and light
 - B** light and magnetism
 - C** electricity and sound
 - D** electricity and magnetism
- 2.** Geothermal power plants use renewable energy to produce electricity by making steam that spins turbines attached to electrical generators. The renewable energy ultimately comes from _____.
- A** the Sun
 - B** burning biomass
 - C** burning fossil fuels
 - D** hot molten rock beneath Earth's crust
- 3.** If you force an electrical motor to move when it is not plugged in, you may be able to use it as a _____.
- A** wheel.
 - B** magnet
 - C** generator
 - D** compass
- 4.** Many generators create electricity with _____.
- A** moving magnets and coils of wire.
 - B** energy stored in chemical bonds
 - C** motors.
 - D** nuclear isotopes



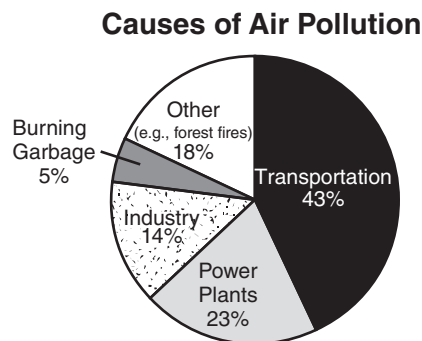
Self Assessment Test: *(continued)*

Post Test



7. Density is mass/volume. Group A measures the density of a ball to be 0.14 g/cm^3 . Group B measures the density of the same ball to be 0.35 g/cm^3 . Your job is to discover the source of the discrepancy. Which factor is the most likely source of the discrepancy?
- A One of the groups may have used the wrong unit system.
 - B The density of the ball may have changed.
 - C One of the groups may have been in an area of different gravity.
 - D The mass of the ball may have changed.
8. _____ can be tested by making observations or performing experiments.
- A Logic
 - B Scientific hypotheses
 - C Experiments
 - D Reason
9. No matter how far apart two objects are, the gravitational force between them _____.
- A is never zero
 - B always increases over time
 - C increases as they move away from each other
 - D decreases as they move closer together
10. All of these household substances usually contain acids EXCEPT _____.
- A fruit juice
 - B carbonated beverages
 - C cleaning products
 - D vegetable juice

Use the graph to answer question 11.



11. According to the circle graph, which of these would LEAST improve the quality of air we breathe?
- A reducing the amount of electricity power plants produce
 - B developing an electric-powered automobile
 - C making more landfills so that garbage won't be burned
 - D requiring industries to adopt less polluting methods

Use the table to answer question 12.

Constituents of a Rock Sample

Element	Mass (g)
Oxygen	65
Carbon	18
Hydrogen	10
Nitrogen	3
Calcium	1.5

12. A computer program can be used to generate several different types of graph. Given the data in the table, what is the best type of graph to create?
- A bar graph
 - B line graph
 - C acceleration graph
 - D circle graph



Self Assessment Test: *(continued)*

Post Test



13. What is a reasonable result for a pH reading using litmus paper?
- A black
 - B green
 - C blue
 - D yellow
14. What is the proper way to observe a chemical reaction?
- A from a distance, wearing goggles
 - B up close, wearing goggles
 - C from a distance, without goggles
 - D up close, without goggles
15. In 5 seconds, 10 wavelengths of a wave pass a certain point. What is the wave's frequency?
- A $\frac{5}{10}$ Hz
 - B 2 Hz
 - C 5 Hz
 - D 10 Hz
16. How do radio waves communicate information?
- A changing electromagnetic fields
 - B by reflection
 - C gamma rays
 - D compressions in the air

17. Heterotrophs consume food to obtain energy for biological processes. During exercise, the chemical energy in food is transformed into what other forms of energy?
- A kinetic energy and thermal energy
 - B light energy
 - C electrical energy
 - D nuclear energy

Use the table to answer question 18.

Solubility of Compounds (grams per 100 grams of water)

Compound	0°C	20°C	100°C
Sodium chloride	35.7	35.9	39.2
Sucrose (sugar)	179.2	203.9	487.2
Potassium chloride	28.0	34.0	56.3
Copper (II) sulfate	23.1	32.0	114.0

18. Based on the information in the table, how many grams of copper (II) sulfate is needed at 20°C to make a 300 g solution?
- A 32 g
 - B 69.3 g
 - C 96 g
 - D 102 g
19. Density is mass divided by volume. In measuring the density of various metals, what will be the result of consistently measuring the volume too high?
- A Density values will be unchanged.
 - B Density values will be too low.
 - C Density values will be too high.
 - D Density values will be random.



Self Assessment Test: *(continued)*

Post Test



Use the table to answer question 20.

Elements in the Same Group

Element	Valence
Hydrogen	1
Lithium	1
Sodium	1
Potassium	1
Rubidium	1

20. The table above represents several elements that have the same valence. To which groups do these elements belong?

- A alkali metals
- B alkaline earth metals
- C halogens
- D noble gases

21. Nuclear fission converts matter into _____.

- A mass
- B electrons
- C atoms
- D energy

Use the table to answer question 22.

Volume	Mass
200 mL	180 grams
300 mL	270 grams
400 mL	360 grams

22. A liquid of unknown density is studied. Based on the data, what is the density of the liquid?

- A 1.1 g/mL
- B 1.1 mL/g
- C 0.9 g/mL
- D 0.9 mL/g

23. Based on their name, what can you deduce about alkaline Earth metals?

- A Some of their compounds are likely to be basic.
- B Some of their compounds are likely to be acidic.
- C Some of their compounds are likely to be noble gasses.
- D Some of their compounds are likely to be halogens.

24. Which is NOT a goal of peer review in scientific publications?

- A Peer review gives experts the opportunity to check for mistakes and procedural errors.
- B Peer review helps ensure the quality of the work that is produced.
- C Peer review provides researchers an opportunity to better explain points that may be unclear.
- D Peer review helps to reduce the number of theories available for research.

25. A scientist uses a spectrometer to measure the wavelengths of light from two similar stars. One star appears more red than expected, while the other appears more blue than expected. What is the most likely conclusion?

- A The stars are moving in the same direction.
- B The stars are moving in opposite directions.
- C The stars are moving toward each other.
- D One of the stars is moving toward Earth while the other is moving away.



Self Assessment Test: *(continued)*

Post Test



26. In a circuit, how do electrons move?
- A from positive to negative, through a conductor such as a wire
 - B from negative to positive, through an insulator such as plastic
 - C from positive to negative, through an insulator such as plastic
 - D from negative to positive, through a conductor such as a wire

Use the table to answer question 27.

Weight on Venus	Weight on Earth	Weight on Mars	Weight on Jupiter	Weight on Saturn
90 N	100 N	38 N	254 N	116 N
450 N	500 N	190 N	1,270 N	580 N
900 N	1,000 N	380 N	2,540 N	1,060 N

27. The table shows the weight of three objects in newtons on different planets. For an object weighing 10 N on Earth, what would be its weight on Venus?
- A 90 N
 - B 10 N
 - C 9 N
 - D 100 N
28. Which pH measurement is LEAST basic?
- A 7.0
 - B 9.5
 - C 5.5
 - D 1.2
29. Daphne placed a pan of water with a thermometer in it on the stove. She took temperature readings every 2 minutes for 30 minutes and found that the temperature remained constant during the time interval between the 12- and 22-minute marks. What is the most likely explanation for this?
- A The water was boiling during that time.
 - B The water was condensing during that time.
 - C The water's kinetic energy was increasing.
 - D The water's kinetic energy was decreasing.
30. Which is NOT a decomposition reaction?
- A $\text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 - B $\text{SO}_2 \rightarrow \text{S} + \text{O}_2$
 - C $2\text{HCl}_2 \rightarrow 2\text{H}_2 + \text{Cl}_2$
 - D $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
31. What is another name for electrons emitted during the radioactive decay of atomic nuclei?
- A beta particles
 - B hydrogen nuclei
 - C alpha particles
 - D gamma particles



Self Assessment Test: *(continued)*

Post Test



Use the table to answer question 32.

Positive Ions	Charge	Negative Ions	Charge
Li	1+	Cl	1-
NH ₄	1+	O	2-
Be	2+	OH	1-
Sr	2+	ClO ₃	1-
Ba	2+	PO ₄	3-

32. Based on the table, what is the correct formula for the ionic compound containing Li and ClO₃?
- A Li₂ClO₃
 - B LiClO₃
 - C 2(Li)ClO₃
 - D LiClO₆
33. What is the correct name for SiO₂?
- A silicon oxydase
 - B silicon monoxide
 - C silicon oxide
 - D silicon dioxide
34. In the 1920s, a physicist named Louis de Broglie hypothesized that particles such as electrons could have wave properties. It was eventually shown that electrons behave as waves under certain circumstances. One result of this discovery is the electron microscope, in which electrons are used to probe tiny structures. What was de Broglie's key contribution?
- A the idea that light is a particle
 - B the idea that light is a wave
 - C the idea that electrons have wave properties
 - D the idea that electrons have particle properties
35. In the 19th century, scientists thought that energy can come in any amount, no matter how large or small. However, in 1900, Max Planck showed that energy comes in specific amounts which cannot be further divided. Which statement about energy had to be abandoned as a result of Planck's work?
- A Energy can neither be created nor destroyed.
 - B The quantity of energy in the universe is constant.
 - C Energy can be transferred in infinitely small amounts.
 - D Energy comes in packets of a certain set size.



Self Assessment Test: *(continued)*

Post Test



Use the table to answer question 36.

Half-Life of Carbon-14

Half-Life	Remaining Mass of C-14 (g)	Time (yrs)
0	1	0
1	$\frac{1}{2}$	5,700
2	$\frac{1}{4}$	11,400
3	?	17,100
4	$\frac{1}{16}$	22,800
5	$\frac{1}{32}$	28,500

36. According to these data, how much carbon-14 is left after 17,100 years?
- A $\frac{1}{2}$ g
B $\frac{1}{8}$ g
C $\frac{1}{4}$ g
D $\frac{1}{16}$ g
37. Which is NOT a general safety rule for the laboratory?
- A Obtain your teacher's permission to begin all investigations.
B Report any fire, electrical shock, glassware breakage, spill, or injury.
C Return any unused chemicals to their original containers.
D Remove jewelry on hands and wrists and any loose jewelry, such as chains or long necklaces.

Use the table to complete questions 38.

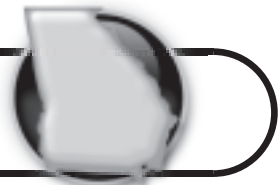
Element	Symbol	Flame Color	Description of Element
Barium	Ba	yellow-green	silver-white metal
Lithium	Li	red	silver-white metal
Potassium	K	violet	silver-white metal
Strontium	Sr	red	silver-white metal
Copper	Cu	blue-green	pinkish red metal

38. According to the table, a substance that burns with a red flame is likely to be _____.
- A potassium or barium
B copper or strontium
C lithium or strontium
D copper or barium
39. _____ measures how close a set of results are to the accepted value, while _____ measures how close a set of results are to each other.
- A Accuracy; precision
B Precision; accuracy
C Measurement; estimation
D Estimation; measurement
40. You are investigating battery life for various brands of batteries. What piece of data is probably MOST important to your investigation?
- A the voltage of each battery you test
B the shape of each battery you test
C the color of each battery you test
D the price of each battery you test



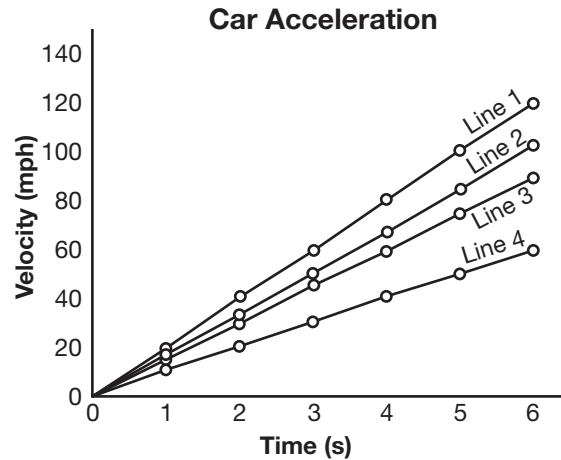
Self Assessment Test: *(continued)*

Post Test



41. An example of a static discharge is _____.
- A thunder
 - B lightning
 - C radio waves
 - D a balloon sticking to a wall
42. The temperature of a car's tires is higher after it has been driving because of the conversion of _____.
- A light energy into heat energy
 - B heat energy into light energy
 - C mechanical energy into heat energy
 - D electrical energy into heat energy
43. If you stirred salt into each of the following, which would be able to dissolve the most?
- A a cold glass of distilled water
 - B a warm glass of distilled water
 - C a cold glass of salt water
 - D a warm glass of salt water
44. An article that contains an introduction, description of methods and procedure, and conclusions is most likely a(n) _____.
- A scientific paper describing an experiment
 - B scientific paper describing a newly discovered animal
 - C magazine article explaining the concept of nuclear radiation
 - D magazine article explaining the difference between physics and chemistry
45. Further understanding of scientific problems often relies on new experiments, which may reinforce or weaken _____.
- A alternate theories
 - B researcher bias
 - C natural laws
 - D mathematical calculations

Use the graph to answer question 46.



46. Consider the graph shown here. What is one benefit of displaying scientific information with a graph?
- A A graph is more precise than a list or a table.
 - B A graph is easier to produce than a list or a table.
 - C A graph can more clearly express relationships among variables.
 - D A graph conveys extra information not found in lists or tables.
47. Which of these is measured in newtons?
- A mass
 - B weight
 - C acceleration
 - D gravity



Self Assessment Test: *(continued)*

Post Test



48. If a container of H_2O is changing temperature, then it may be all EXCEPT _____.

- A solid
- B gaining thermal energy
- C boiling
- D losing thermal energy

49. Adding salt to water can do all EXCEPT _____.

- A change its boiling point
- B change its magnetic field
- C change its conductivity
- D change its ability to dissolve salt

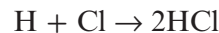
Use the table to answer question 50.

Half-life of Carbon-14

Half-Life	Mass of C-14 Remaining (g)	Time (y)
0	1	0
1	$\frac{1}{2}$?
2	$\frac{1}{4}$	11,400
3	$\frac{1}{8}$	17,100
4	$\frac{1}{16}$	22,800
5	$\frac{1}{32}$	28,500

50. According to the above data, after how many years would the mass of carbon-14 remaining be $\frac{1}{2}$ gram?

- A 5,700 yrs
- B 22,800 yrs
- C 28,500 yrs
- D 34,200 yrs



51. In the equation above, the number 2 is _____.

- A a factor
- B a superscript
- C a coefficient
- D a subscript

52. Which statement is true?

- A Water transmits sound better than air.
- B Air transmits sound better than water.
- C Air transmits sound, but water does not.
- D Air and water transmit sound in exactly the same way.

53. If they are the same diameter and the same force is applied to the following objects, which one will have the LEAST acceleration?

- A a lead ball
- B a plastic ball
- C a glass ball
- D a wooden ball

54. Which type of waste is most likely to be disposed of by burying underground?

- A waste water
- B radioactive waste
- C thermal pollution
- D hydrocarbon pollution

55. Ionic compounds are usually formed by ionic bonding between metals and nonmetals. Which is an ionic compound?

- A Cu_2S
- B H_2O
- C CH_4
- D SiO_2



Self Assessment Test: *(continued)*

Post Test



56. The best place to find a scientific definition of the word *product* is _____
- A the Internet
 - B a college dictionary of the English language
 - C a dictionary of chemistry terms
 - D figuring it out from context

Use the table to answer question 57.

Plant	Water (L)	Fertilizer (mL)	Sunlight (hrs/dy)
Peanut tree 1	3	50	2
Peanut tree 2	3	50	2
Peanut tree 3	3	50	2

57. Inigo plans to conduct an experiment using three plants. His hypothesis is that the plant receiving the most sunlight at the end of three months will show the most growth. In his plan above, he has listed the types of plants and how much water, fertilizer, and sunlight each plant will receive. What could Inigo do to improve his experiment?
- A Use a different amount of sunlight for each plant.
 - B Give the plants the different amounts of fertilizer.
 - C Give the plants the same amount of water.
 - D Use different kinds of plants.
58. Which statement best describes what happens when fewer waves pass a certain point per second?
- A They refract.
 - B They transport more energy.
 - C They make a higher pitch.
 - D They decrease in frequency
59. Which statement is true?
- A All of the energy produced by burning natural gas is turned into electricity by a power plant.
 - B All of the energy produced by burning gasoline is turned into thermal energy.
 - C None of the energy produced by burning coal in a stove is wasted.
 - D Most of the energy produced by burning wood in a fireplace is wasted.
60. Most metallic elements have all of these properties EXCEPT _____.
- A being highly ductile
 - B being a good electrical conductor
 - C being easily crumbled into pieces
 - D having a high density
61. The world's population has been increasing for most of recorded history. Which is the MOST likely hypothesis to explain this fact?
- A Population statistics have been recorded with increasing accuracy.
 - B The number of children per family has been decreasing.
 - C Better health care has allowed people to live longer.
 - D The number of countries in the world has increased
62. Tali is doing a laboratory procedure in which she has to measure a precise amount of an acidic solution. She will use a graduated cylinder to measure the solution. How should she read the graduated cylinder in order to measure the correct amount?
- A She should read the bottom of the meniscus below eye-level.
 - B She should read the top of the meniscus above eye-level.
 - C She should read the bottom of the meniscus at eye-level.
 - D She should read the top of the meniscus at eye-level.



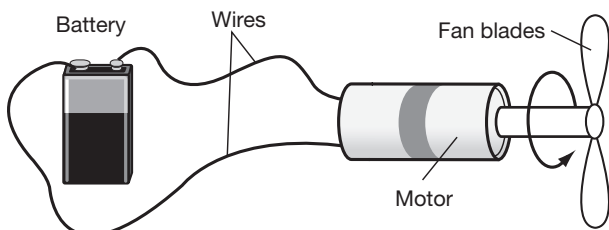
Self Assessment Test: *(continued)*

Post Test



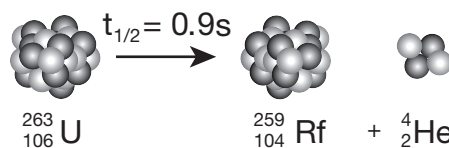
63. Which may be caused by constructive interference of sound waves?
- A quiet areas in a room with music playing
 - B louder areas in a room with music playing
 - C shaking walls in a room with music playing
 - D a breeze moving through a room with music playing

64. According to Newton's third law of motion, _____.
- A every action has an equal and opposite reaction
 - B an object in motion requires a force to keep it in motion
 - C an object at rest requires a force to keep it at rest.
 - D force equals mass times velocity



65. A student records the speed of a fan every day for a week and finds that on the third day of the week, the fan was going slower than on all of the other days. Which is the LEAST likely explanation?
- A The fan may have had a short circuit on the third day.
 - B The third day was the only correct measurement.
 - C Something may have gotten stuck in the motor on the third day.
 - D The student may have recorded incorrectly on the third day.

66. Early philosophers believed that forces were necessary to keep an object moving. By analyzing data collected by himself and others, Isaac Newton realized that forces did not cause motion. Instead, forces cause changes in motion. What made Newton's ideas more scientific than those of the early philosophers?
- A Newton was smarter than early philosophers.
 - B Newton wrote his ideas down and early philosophers did not.
 - C Newton based his theory on data and early philosophers did not.
 - D Newton was more popular than early philosophers.



67. Lise Meitner is famous for the discovery of nuclear fission. Experiments by her colleagues showed that they had changed uranium nuclei into barium nuclei. Many scientists rejected this because there was no known way to change one element into another. However, Meitner examined the problem and determined that one element can be changed into another. What scientific trait did Meitner possess?
- A curiosity
 - B openness
 - C honesty
 - D skepticism



Self Assessment Test: *(continued)*

Post Test



68. What branch of the sciences is most often concerned with energy transformations in natural systems?
- A astronomy
 - B geology
 - C physics
 - D chemistry
69. One day, you may have the chance to visit the planet Mars. It would make sense to keep all in mind while exploring another planet, EXCEPT that _____.
- A force might not equal mass times acceleration
 - B the acceleration due to gravity might not be 9.8 m/s^2
 - C the weight of a 10 kg mass might not be the same as on Earth
 - D the length of a Martian day is different than the length of an Earth day
70. Laboratory reports should be clear and _____.
- A coherent
 - B interesting
 - C short
 - D long
71. The mass of an isotope depends mostly on how many protons and _____ it has.
- A electrons
 - B photons
 - C nuclei
 - D neutrons
72. What is the correct procedure for using a test tube?
- A Always hold the test tube firmly with one hand while heating adding chemicals.
 - B Always slant test tubes away from yourself and others when heating or adding chemicals
 - C Always cap test tubes tightly while heating or adding chemicals.
 - D Never heat a test tube.
73. Which is the most important thing to keep in mind when reading about a scientific debate?
- A how simple the explanations are
 - B how interesting the different sides of the debate are
 - C how good the evidence supporting the different sides is
 - D how much experience the debators have
74. Albert Einstein developed a new theory of gravity several centuries after Isaac Newton. Most scientists did not accept Einstein's theory of gravity until observations were made, showing that light beams from distant stars were bent by the Sun's gravity, as predicted by Einstein's theory. What is the best reason scientists could have had to prefer Newton's theory?
- A Newton's theory is the one they had learned about it in school.
 - B Newton's theory was easier to use.
 - C There was no way to choose between the theories without observational evidence.
 - D Einstein would become more famous than Newton if his theory were shown to be true.



Self Assessment Test: *(continued)*

Post Test



75. _____ is our attempt to understand the natural universe.
- A Science
 - B Technology
 - C Chemistry
 - D Biology

Use the table to complete question 76.

Time Period	Average Blood Lead Levels ($\mu\text{g}/\text{dL}$)
1976–1980	12.8
1988–1991	2.8

76. Leaded gasoline was phased out in the United States in the 1970s. What argument could be made by combining that fact with the data on blood lead levels among people in the United States?
- A Lead is harmful to your health.
 - B Leaded gasoline leads to lower lead levels in blood.
 - C The use of leaded gasoline is correlated with higher lead levels in blood.
 - D Lead is no longer a problem.

77. What is the most important attribute a scientific theory must possess?
- A It must be developed by a trained scientist.
 - B It must be useful.
 - C It must explain scientific data.
 - D It must be published in a peer-reviewed journal.

