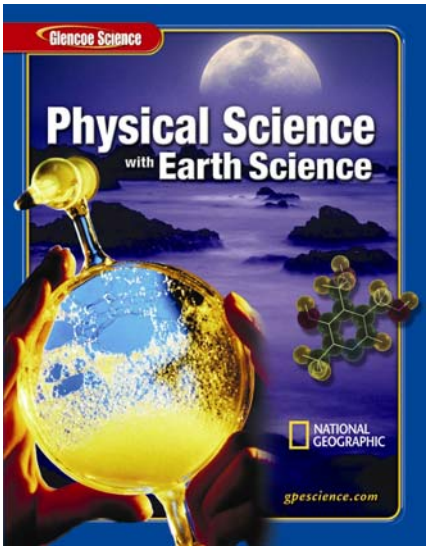
Glencoe

Grade Level Expectations (GLE) - Science
Grades 9/10

Washington



Physical Science
with Earth Science

STANDARDS	PAGE REFERENCES
EALR 1 — SYSTEMS: The student knows and applies scientific concepts and principles to understand the properties, structures, and changes in physical, earth/space, and living systems.	
Component 1.1 Properties: Understand how properties are used to identify, describe, and categorize substances, materials, and objects and how characteristics are used to categorize living things.	
Physical Systems	
1.1.1 Properties of Substances	

Codes used for Teacher Wraparound Edition pages are the initial caps of headings on that page.

STANDARDS	PAGE REFERENCES
Understand the atomic nature of matter, how it relates to physical and chemical properties and serves as the basis for the structure and use of the periodic table. W • (10) Identify an unknown substance using the substance's physical and chemical properties. • (10) Explain and predict the behavior of a substance based upon the substance's atomic structure, physical properties, and chemical properties. • (10) Describe the properties of electrons, protons, and neutrons (i.e., electrons have negative charge and very little mass, protons have positive charge and much mass, neutrons have neutral charge and the same mass as protons). • (10) Explain how changing the number of electrons, neutrons, and protons of an atom affects that atom, including atomic name, number, and placement on the periodic table. • (10) Explain the similar properties of elements in a vertical column (groups or families) of the periodic table. • (10) Predict the properties of an element based on the element's location (groups or families) on the periodic table.	**Student Edition:** 560-567, 578-583, 584-587, 588-596, 688-692, 694-702, 786-790 *MiniLAB* 581 *Lab* 693 **Teacher Wraparound Edition:** ACT 787; CFU 587; DI 593; IL 595; QD 585; SCB 576F
1.1.2 Motion of Objects	
Apply an understanding of direction, speed, and acceleration when describing the linear motion of objects. W • (9) Describe the linear motion (speed, direction, and acceleration) of an object over a given time interval relative to Earth or some other object (e.g., as a car accelerates onto a freeway the car speeds up from 30 km/hr to 90 km/hr in 10 sec.). • (9) Determine and explain the average speed of an object over a given time interval when the object is moving in a straight line.	**Student Edition:** 70-75, 76-80 *Launch Lab* 69 *MiniLAB* 71 *Applying Math* 72, 93 *Lab* 87 *Design Your Own Lab* 88-89 **Teacher Wraparound Edition:** A 75; DIS 77; IM 68F; LD 79; QD 73; SCB 68E; V 78

STANDARDS	PAGE REFERENCES
1.1.3 Wave Behavior	
Analyze sound waves, water waves, and light waves using wave properties, including frequency and energy. Understand wave interference. W • (10) Describe the relationship between the wave properties of amplitude and frequency and the energy of a wave (e.g., loud vs. soft sound, high vs. low pitch sound, bright vs. dim light, blue light vs. red light). • (10) Explain the relationship between a wave's speed and the properties of the substance through which the wave travels (e.g., all sound regardless of loudness and pitch travels at the same speed in the same air; a wave changes speed only when traveling from one substance to another). • (10) Predict and explain what happens to the pitch of sound and color of light as the wave frequency increases or decreases. • (10) Compare the properties of light waves, sound waves, and water waves. • (10) Describe the effects of wave interference (constructive and destructive).	**Student Edition:** 288-293, 294-299, 301-309, 320-326, 327-330 *Launch Lab* 287 *National Geographic* 292 *MiniLAB* 295 *Lab* 300, 310-311 **Teacher Wraparound Edition:** ACT 328; DI 290; DIS 296; IM 286F; LD 289
1.1.4 Forms of Energy	
Analyze the forms of energy in a system, subsystems, or parts of a system. W • (10) Explain the forms of energy present in a system (i.e., thermal energy, sound energy, light energy, electrical energy, kinetic energy, potential energy, chemical energy, and nuclear energy). • (10) Compare the potential and/or kinetic energy of parts of systems at various locations or times (i.e., kinetic energy is an object's energy of motion; potential energy is an object's energy of position). • (10) Measure and describe the thermal energy of a system, subsystem, and/or parts of a system in terms of molecular motion (temperature) and energy from a phase change (e.g., observe, measure, and record temperature changes over time while heating ice to boiling water).	**Student Edition:** 128-133, 135-143, 254-259, 260-265, 266-270, 272-277 *Launch Lab* 127 *Applying Math* 130, 258 *MiniLAB* 131 *Lab* 134 *Design Your Own Lab* 144-145 **Teacher Wraparound Edition:** CFU 133; IL 141; QD 130

STANDARDS	PAGE REFERENCES
Earth and Space Systems	
1.1.5 Nature and Properties of Earth Materials	
Understand and analyze how the chemical composition of Earth materials (rocks, soils, water, and air) is related to their physical properties. W • (9) Correlate the chemical composition of Earth materials (i.e., rocks, soils, water, and gases of the atmosphere) with their physical properties (e.g., limestone reaction to acid, the conductivity of copper, ice floats on water).	**Student Edition:** 518-522, 608-615, 617-623, 624-629, 630-635, 650-652 *National Geographic* 487 *MiniLAB* 612, 628 *Lab* 616, 636-637, 653 **Teacher Wraparound Edition:** ACT 610; QD 650; UAA 619
Component 1.2 Structures: Understand how components, structures, organizations, and interconnections describe systems.	
Systems Structure	
1.2.1 Structure of Physical Earth/Space and Living Systems	
Analyze how systems function, including the inputs, outputs, transfers, transformations, and feedback of a system and its subsystems. W • (9) Describe the function of a system's parts or subsystems. • (9) Explain inputs, outputs, transfers, transformations, and feedback of matter, energy, and information in a system. • (10) Explain the interconnections between a system's parts or subsystems.	**Student Edition:** 154-159, 160-165, 166-174, 272-277, 431-437, 438-444, 494-500, 501-506 *Lab* 175 *Model and Invent Lab* 176-177 **Teacher Wraparound Edition:** A 444; IL 170, 274; MM 169; QD 273

STANDARDS	PAGE REFERENCES
Physical Systems	
1.2.2 Energy Transfer and Transformation	
Analyze energy transfers and transformations within a system, including energy conservation. W • (9) Describe and determine the energy inputted to an object as work (i.e., work on an object is the product of the force acting on the object and the distance the object moves as the force acts). • (9) Describe how a machine transfers work and transforms force and distance through a force-distance tradeoff (e.g., a small force acting over a long distance can be transformed to a large force acting over a short distance). • (9) Examine and explain how energy is transferred within and among systems. • (10) Distinguish conditions likely to result in transfers or transformations of energy from one part of a system to another (e.g., a temperature difference may result in the flow of thermal energy from a hot area to a cold area). • (10) Describe what happens in terms of energy conservation to a system's total energy as energy is transferred or transformed (e.g., energy is never "lost," the sum of kinetic and potential energy remains somewhat constant). • (10) Explain the relationship between the motion of particles in a substance and the transfer or transformation of thermal and electrical energy (e.g., conduction of thermal and electrical energy as particles collide or interact, convection of thermal energy as groups of particles move from one place to another, and light waves transforming into thermal energy). • (10) Explain how or whether a phase change, a chemical reaction, or a nuclear reaction absorbs or releases energy in a system (e.g., water vapor forming rain or snow releases energy; water molecules speed up as they absorb energy until the molecules gain enough energy to become water vapor).	**Student Edition:** 128-133, 135-143, 154-159, 160-165, 254-259, 260-265, 266-270 *Launch Lab* 127, 253 *Integrate Environment* 139 *Design Your Own Lab* 144-145 *Lab* 271, 278-279 **Teacher Wraparound Edition:** LD 138; SJ 257

STANDARDS	PAGE REFERENCES
1.2.3 Structure of Matter	
Understand the structure of atoms, how atoms bond to form molecules, and that molecules form solutions. W • (10) Describe molecules forming a solution (e.g., salt added to water dissolves, forming a salt water solution, until saturation when no more salt will dissolve). • (10) Describe how to separate mixtures and/or solutions of several different kinds of substances (e.g., sand, sugar, iron filings). • (10) Describe the structure of atoms in terms of protons and neutrons forming the nucleus, which is surrounded by electrons (e.g., a helium atom usually has a nucleus formed by 2 protons and 2 neutrons, which is surrounded by 2 electrons). • (10) Describe how atoms bond to form molecules in terms of transferring and/or sharing electrons (e.g., sodium atoms transfer an electron to chlorine atoms to form salt).	**Student Edition:** 552-558, 560-561, 578-583, 688-692, 694-702, 786-790 *Lab* 559, 776-777 *Integrate Environment* 561 *MiniLAB* 562, 581, 789 *National Geographic* 582 **Teacher Wraparound Edition:** DIS 695; VL 556
Earth and Space Systems	
1.2.4 Components and Patterns of Earth Systems	
Analyze the patterns and arrangements of Earth systems and subsystems including the core, the mantle, tectonic plates, the hydrosphere, and layers of the atmosphere. W • (9) Identify and describe sources of Earth's internal and external thermal energy. • (9) Explain how plate tectonics is caused by Earth's internal energy (e.g., nuclear energy from radioactivity in the core transforms to thermal energy in the mantle that, through convection, causes the motion of tectonic plates). • (9) Correlate Earth's surface features to observable weather patterns (e.g., rain shadow, deserts, rain forest).	**Student Edition:** 354-361, 370-372, 518-522, 529-534, 663-668 *National Geographic* 531 **Teacher Wraparound Edition:** DIS 532; MM 530; QD 360, 533; R 522; RS 532; SCB 352E-F; TFYI 360; V 531

STANDARDS	PAGE REFERENCES
1.2.5 Components of the Solar System and Beyond (Universe)	
Understand that the Solar System is in a galaxy in a universe composed of an immense number of stars and other celestial bodies. W • (10) Describe how the Solar System is part of the Milky Way Galaxy. • (10) Compare how stars and other celestial bodies (at least 100 billion) are similar and different from each other (i.e., size, composition, distance from the Earth, temperature, age, source of light, and movement in space). • (10) Describe how other galaxies and other celestial bodies appear from Earth.	**Student Edition:** 218-222, 818-822, 823-829, 831-835 *Launch Lab* 817 *Science Online* 834 **Teacher Wraparound Edition:** ACT 826; CFU 835; IL 832; IM 816F; QD 221; R 835; RP 823; TFYI 220; VL 824
Component 1.3 Changes: Understand how interactions within and among systems cause changes in matter and energy.	
Physical Systems	
1.3.1 Nature of Force	
Analyze the forces acting on objects. W • (9) Describe how machines transform forces (e.g., a long lever allows a small downward input force to be transformed into a large upward output force). • (9) Describe the strength (in newtons [N]) and direction of forces acting on an object. • (9) Measure and describe the sum of all the forces acting on an object. • (9) Describe how forces between objects occur, both when the objects are touching and when the objects are apart. • (9) Explain that the strength of a gravitational force between two objects depends on the mass of the objects and the distance between the objects.	**Student Edition:** 104-111, 154-159, 160-165, 166-174, 187, 221, 392-394, 424-430 *Science and History* 120 *MiniLAB* 162 *Lab* 175 *Model and Invent Lab* 176-177 **Teacher Wraparound Edition:** IL 170; V 168

STANDARDS	PAGE REFERENCES
1.3.2 Forces to Explain Motion	
Analyze the effects of balanced and unbalanced forces on the motion of an object. W • (9) Describe the balanced forces acting on an object moving at a constant speed along a straight line, 1st Law of Motion (e.g., a car traveling at a constant speed of 60 mph on a straight freeway has a force pushing it forward balanced by frictional forces acting in the opposite direction). • (9) Explain how unbalanced forces change the speed and/or direction of motion of different objects moving along a straight line, 2nd Law of Motion (e.g., a 2-kg object needs twice the unbalanced force to speed up the same amount as a 1-kg object). • (9) Investigate and describe that forces always come in pairs, 3rd Law of Motion (e.g., pull a spring scale against another spring scale, as water blasts out of a bottle rocket two forces act — a force on the water and an equal force on the rocket).	**Student Edition:** 98-103, 113-117 *Launch Lab* 97 *MiniLAB* 99 **Teacher Wraparound Edition:** A 103; CFU 103, 117; DI 100; DIS 101; LD 102; QD 102; R 103, 117; SJ 114
1.3.3 Conservation of Matter and Energy	
Analyze the factors that affect physical, chemical, and nuclear changes and understand that matter and energy are conserved. W • (9) Investigate and analyze the effect of different factors on the rate of a physical and chemical change (e.g., temperature, surface area, pressure, catalysts). • (9) Explain how chemical changes produce substances with different chemical properties and the same total mass. • (9) Describe the products of radioactive decay in terms of the conservation of matter and energy (e.g., a radioactive nucleus decays into a new nucleus and emits particles and rays). • (9) Recognize and explain that the rate of radioactive decay of a substance is constant, not affected by any factors (e.g., the half-life of a radioactive substance is constant over a long time and a wide range of conditions found on Earth).	**Student Edition:** 563-567, 648-649, 672-673, 720-725, 730-733, 734-740, 786-790, 791-795, 801-802 *Applying Math* 566 *MiniLAB* 647, 724 *Launch Lab* 719 *Lab* 742-743 **Teacher Wraparound Edition:** SCB 718E-F

STANDARDS	PAGE REFERENCES
Earth and Space Systems	
1.3.4 Processes and Interactions in the Earth System	
Analyze processes that have caused changes to the features of Earth's surface, including plate tectonics. W • (9) Describe the processes that cause the movement of material in Earth's systems (e.g., pressure differences that cause convection resulting in winds, mantle movement, and ocean currents; erosion and deposition). • (9) Describe the effects of glaciation and floods on the Pacific Northwest. • (9) Describe the causes and effects of volcanoes, hot spots, and earthquakes in Washington State and elsewhere (e.g., subduction of the Juan de Fuca plate causes earthquakes that may cause seismic sea waves; earthquakes along the Seattle fault cause P, S, and surface seismic waves). • (9) Explain how substances change as they move through Earth's systems (e.g., carbon cycle, nitrogen cycle, burning of wood and fossil fuels).	**Student Edition:** 354-361, 362-369, 373-378, 565-566, 646-649, 654-662, 681#19 *MiniLAB* 656 **Teacher Wraparound Edition:** DI 660; DIS 649; IL 659; IM 649; LD 659; SCB 644E
1.3.5 History and Evolution of the Earth	
Analyze a variety of evidence, including rock formations, fossils, and radioactive decay, to construct a sequence of geologic events. W • (9) Explain how decay rates of radioactive materials in rock layers are used to establish the age of fossil remains or the time of geologic events. • (9) Describe how rock formations can be used to determine the nature of past geologic events. • (9) Correlate evidence of geologic events to the relative and absolute dates of rock layers to construct a sequence of the history of Earth.	**Student Edition:** 669-675, 681#24, 794-795 *Lab* 676-677 *Applying Math* 681 **Teacher Wraparound Edition:** A 677; AIL 677; CC 794; IP 673; MM 674; QD 671; SCB 644F; VL 671, 674

STANDARDS	PAGE REFERENCES
1.3.6 Hydrosphere and Atmosphere	
Analyze the factors that influence weather and climate. W • (9) Explain how energy transfers and transformations among the atmosphere, hydrosphere, and landforms affect climate and weather patterns. • (9) Explain how greenhouse gases in the atmosphere affect climate (e.g., global warming). • (9) Describe how catastrophic events (e.g., volcanic eruptions, forest fires, asteroid impacts) can cause climate and weather changes.	**Student Edition:** 520-522, 524-528, 529-534, 535-539 *Science and History* 382 *Launch Lab* 517 *Lab* 523 *MiniLAB* 525 *Design Your Own Lab* 540-541 **Teacher Wraparound Edition:** A 534; CFU 539; DIS 520; QD 520; SCB 516F; TFYI 519
1.3.7 Interactions in the Solar System and Beyond (Universe)	
Understand how stars, solar systems, galaxies, and the universe were formed and how these systems continue to evolve. W • (10) Explain phenomena caused by the regular and predictable motions of planets and moons in the Solar System. • (10) Describe how the Solar System formed. • (10) Describe that the Solar System is part of the Milky Way Galaxy and how the Milky Way and other galaxies appear from Earth. • (10) Describe the formation and life cycle of stars. • (10) Describe the properties of different stars (e.g., size, temperature, age, formation, energy production). • (10) Describe how the Big Bang theory explains the observed properties of the universe (e.g., expansion, evolution, structures, element generation by fusion).	**Student Edition:** 206-207, 218-222, 822, 823-829, 831-835, 836-839 *National Geographic* 826 *Lab* 830 **Teacher Wraparound Edition:** A 222; CFU 839; PR 222; R 222; SCB 216E, 816E; V 826

STANDARDS	PAGE REFERENCES
EALR 2 — INQUIRY: The student knows and applies the skills, processes, and nature of scientific inquiry.	
Component 2.1 Investigating Systems: Develop the knowledge and skills necessary to do scientific inquiry.	
Investigating Systems	
2.1.1 Questioning	
Understand how to generate and evaluate questions that can be answered through scientific investigations. W • (9, 10) Generate a new question that can be investigated with the same materials and/or data as a given investigation. • (9, 10) Generate questions, and critique whether questions can be answered through scientific investigations.	**Student Edition:** 6-13 **Teacher Wraparound Edition:** AIL 28, 88, 144, 242, 278, 310, 344, 414, 446, 508, 568; IL 434, 564, 697

STANDARDS	PAGE REFERENCES
2.1.2 Planning and Conducting Safe Investigations	

Understand how to plan and conduct systematic and complex scientific investigations. W
• (9, 10) Make a hypothesis about the results of an investigation that includes a prediction with a cause-effect reason.
• (9, 10) Generate a logical plan for, and conduct, a systematic and complex scientific controlled investigation with the following attributes:
  • hypothesis (prediction with cause-effect reason)
  • appropriate materials, tools, and available computer technology
  • controlled variables
  • one manipulated variable
  • responding (dependent) variable
  • gather, record, and organize data using appropriate units, charts, and/or graphs
  • multiple trials
  • experimental control condition when appropriate
  • additional validity measures
• (9, 10) Generate a logical plan for a simple field investigation with the following attributes:
  • Identify multiple variables
  • Select observable or measurable variables related to the investigative question
• (9, 10) Identify and explain safety requirements that would be needed in an investigation.
	Student Edition:
	6-13
	Design Your Own Lab 28-29, 88-89, 144-145, 242-243, 344-345, 414-415, 446-447, 540-541, 568-569
	Lab 51
	Teacher Wraparound Edition:
	A 13; FF 8; IL 12; QD 10

STANDARDS	PAGE REFERENCES
2.1.3 Explaining	
Synthesize a revised scientific explanation using evidence, data, and inferential logic. W • (9, 10) Generate a scientific conclusion, including supporting data from an investigation, using inferential logic. (e.g., The fertilizer did help the plants grow faster, but had little effect on the number of seeds that germinated. With the fertilizer, the plants matured 35 days sooner than plants without the fertilizer. Almost all of the 30 seeds used germinated, 13 seeds in the fertilized soil and 14 seeds in the soil without fertilizer.) • (9, 10) Describe a reason for a given conclusion using evidence from an investigation. • (9, 10) Generate a scientific explanation of an observed phenomenon using given data. • (9, 10) Predict and explain what logically might occur if an investigation lasted longer or changed. • (9, 10) Explain the difference between evidence (data) and conclusions. • (10) Revise a scientific explanation to better fit the evidence and defend the logic of the revised explanation. • (9, 10) Explain how scientific evidence supports or refutes claims or explanations of phenomena.	**Student Edition:** *Design Your Own Lab* 28-29, 88-89, 144-145, 242-243, 344-345, 414-415, 446-447, 540-541, 568-569 *Lab* 51, 87, 741, 742-743, 776-777
2.1.4 Modeling	
Analyze how physical, conceptual, and mathematical models represent and are used to investigate objects, events, systems, and processes. W • (9, 10) Compare how a model or different models represent the actual behavior of an object, event, system, or process. • (9, 10) Evaluate how well a model describes or predicts the behavior of an object, event, system, or process. • (9, 10) Create a physical, conceptual, and/or mathematical (computer simulation) model to investigate, predict, and explain the behavior of objects, events, systems, or processes (e.g., DNA replication).	**Student Edition:** 11, 581-583 *Model and Invent Lab* 58-59, 176-177, 710-711, 808-809 *Lab* 468 **Teacher Wraparound Edition:** ACT 11; AIL 208; DI 581; IL 306; MM 304, 691; UP 67; V 582

STANDARDS	PAGE REFERENCES
2.1.5 Communicating	
Apply understanding of how to report complex scientific investigations and explanations of objects, events, systems, and processes and how to evaluate scientific reports. W • (9, 10) Report observations of scientific investigations without making inferences. • (9, 10) Summarize an investigation by describing: • reasons for selecting the investigative plan • materials used in the investigation • observations, data, results • explanations and conclusions in written, mathematical, oral, and information technology presentation formats • ramifications of investigations to concepts, principles, and theories • safety procedures used • (9, 10) Describe the difference between an objective summary of data and an inference made from data. • (9, 10) Compare the effectiveness of different graphics and tables to describe patterns, explanations, conclusions, and implications found in investigations. • (9, 10) Critique a scientific report for completeness, accuracy, and objectivity.	**Student Edition:** 22-26 *MiniLAB* 25 *Lab* 27, 51, 118-119, 278-279 *Design Your Own Lab* 28-29, 88-89, 144-145, 242-243, 344-345, 414-415, 446-447, 540-541 *Use the Internet Lab* 476-477

STANDARDS	PAGE REFERENCES
Component 2.2 Nature of Science: Understand the nature of scientific inquiry.	
Nature of Science	
2.2.1 Intellectual Honesty	
Analyze why curiosity, honesty, cooperation, openness, and skepticism are important to scientific explanations and investigations. W • (9, 10) Explain why honesty ensures the integrity of scientific investigations (e.g., explanations in the absence of credible evidence, questionable results, conclusions or explanations inconsistent with established theories). • (9, 10) Explain why a claim or a conclusion is flawed (e.g., limited data, lack of controls, weak logic). • (9, 10) Explain why scientists are expected to accurately and honestly record, report, and share observations and measurements without bias. • (9, 10) Explain why honest acknowledgement of the contributions of others and information sources are necessary (e.g., undocumented sources of information, plagiarism). • (9, 10) Explain why peer review is necessary in the scientific reporting process.	**Student Edition:** 10, 33#22, 50 *Science Online* 50 *Science Skill Handbook* 858 **Teacher Wraparound Edition:** CC 10; CFU 50; R 50
2.2.2 Limitations of Science and Technology	
Analyze scientific theories for logic, consistency, historical and current evidence, limitations, and capacity to be investigated and modified. W • (9, 10) Describe how a theory logically explains a set of facts, principles, concepts and/or knowledge. • (9, 10) Describe a theory that best explains and predicts phenomena and investigative results. • (9, 10) Explain how scientific theories are open to investigation and have the capacity to be modified.	**Student Edition:** 12, 206-207, 354-361, 836-839 *Science Online* 12 *Investigate* 120 *Science and History* 478 **Teacher Wraparound Edition:** CB 478; PR 222; SCB 216E; SJ 11

STANDARDS	PAGE REFERENCES
2.2.3 Evaluating Inconsistent Results	
Evaluate inconsistent or unexpected results from scientific investigations using scientific explanations. W • (9, 10) Evaluate similar investigations with inconsistent or unexpected results. • (9, 10) Explain whether sufficient data has been obtained to make an explanation or conclusion (e.g., reference previous and current research; incorporate scientific concepts, principles, and theories). • (9, 10) Explain why results from a single investigation or demonstration are not conclusive about a phenomenon.	**Student Edition:** *Communicating Your Data* 29, 51, 89, 209, 279, 569, 777 *Design Your Own Lab* 242-243 **Teacher Wraparound Edition:** EA 345, 447
2.2.4 Evaluating Methods of Investigation	
Analyze scientific investigations for validity of method and reliability of results. W • (9, 10) Describe how the methods of an investigation ensured reliable results. • (9, 10) Explain how to increase the reliability of the results of an investigation (e.g., repeating an investigation exactly the same way increases the reliability of the results). • (9, 10) Describe how the methods of an investigation ensured validity (i.e., validity means that the investigation answered the investigative question with confidence; the manipulated variable caused the change in the responding or dependent variable). • (9, 10) Explain the purpose of the steps of an investigation in terms of the validity of the investigation. • (9, 10) Explain how to improve the validity of an investigation (e.g., control more variables, better measuring techniques, increased sample size, control for sample bias, include experimental control condition when appropriate, include a placebo group when appropriate). • (10) Explain an appropriate type of investigation to ensure reliability and validity for a given investigative question (e.g., descriptive, controlled, correlational, comparative, see Appendix D and Appendix E).	**Student Edition:** 6-13 *Model and Invent Lab* 58-59 *Lab* 208-209 *Communicating Your Data* 637, 677 *Science Skill Handbook* 850-858 **Teacher Wraparound Edition:** A 444; EA 89

STANDARDS	PAGE REFERENCES
2.2.5 Evolution of Scientific Ideas	
Understand how scientific knowledge evolves. W • (9) Explain how existing ideas were synthesized from a long, rich history of scientific explanations and how technological advancements changed scientific theories. • (9, 10) Explain how scientific inquiry results in new facts, evidence, unexpected findings, ideas, explanations, and revisions to current theories. • (9, 10) Explain how results of scientific inquiry may change our understanding of the systems of the natural and constructed world. • (9, 10) Explain how increased understanding of systems leads to new questions to be investigated. • (9, 10) Explain how new ideas need repeated inquiries before acceptance. • (9, 10) Use new tools to investigate a system to discover new facts about the system that lead to new ideas and questions.	**Student Edition:** 6-13, 38-45, 206-207, 218-222, 238-241, 354-361, 836-839 *Accidents In Science* 61, 210 *Science and History* 120, 312, 448, 478, 810 **Teacher Wraparound Edition:** USW 142

STANDARDS	PAGE REFERENCES
EALR 3 — APPLICATION: The student knows and applies science concepts and skills to develop solutions to human problems in societal contexts.	
Component 3.1 Designing Solutions: Apply knowledge and skills of science and technology to design solutions to human problems or meet challenges.	
Designing Solutions	
3.1.1 Identifying Problems	
Analyze local, regional, national, or global problems or challenges in which scientific design can be or has been used to design a solution. W • (9, 10) Explain how science and technology could be used to solve all or part of a human problem and vice versa (e.g., understanding the composition of an Earth material can be useful to humans, such as copper ore being used to make copper wire). • (9, 10) Explain the scientific concept, principle, or process used in a solution to a human problem (e.g., understanding the effect of seismic waves on structures can be used to design buildings to withstand an earthquake). • (9, 10) Explain how to scientifically gather information to develop a solution (e.g., perform a scientific investigation and collect data to establish the best materials to use in a solution to the problem). • (9, 10) Describe an appropriate question that could lead to a possible solution to a problem. • (9, 10) Describe a change that could improve a tool or a technology.	**Student Edition:** 13, 38-45 *National Geographic* 44 *Science and Society* 178 *Science and History* 312, 448, 600 *Accidents in Science* 712 **Teacher Wraparound Edition:** CB 178; SCB 36E; UP 251; V 44

STANDARDS	PAGE REFERENCES
3.1.2 Designing and Testing Solutions	

Evaluate the scientific design process used to develop and implement solutions to problems or challenges. W
• (9, 10) Research, propose, implement, and document the scientific design process used to solve a problem or challenge:
  • define the problem
  • scientifically gather information and collect empirical data
  • explore ideas
  • make a plan
  • list steps to do the plan
  • scientifically test solutions
  • document the scientific design process
• (9, 10) Evaluate possible solutions to the problem (e.g., describe how to clean up a polluted stream).
• (9, 10) Evaluate the reason(s) for the effectiveness of a solution to a problem or challenge.
	Student Edition:
	52-57
	Model and Invent Lab 58-59, 176-177
	Design Your Own Lab 344-345
	MiniLAB 489
	Teacher Wraparound Edition:
	A 51; CFU 277; IL 54, 85, 274, 322, 367, 434; MM 56; QD 55

3.1.3 Evaluating Potential Solutions	
Evaluate consequences, constraints, and applications of solutions to a problem or challenge. W • (9, 10) Explain the criteria to evaluate the solution(s) to a problem or challenge. • (9, 10) Explain the effectiveness of the solution to the problem or challenge using scientific principles and concepts. • (9, 10) Explain the consequences of the solution(s) to the problem or challenge (e.g., doubling the fertilizer will probably not double the plant growth and could cause harm to the ecosystem). • (9, 10) Explain how to change a system to solve a problem or improve a solution to a problem. • (9, 10) Compare and evaluate the effectiveness of different solutions to a problem or challenge based on criteria, using scientific concepts and principles.	**Student Edition:** 52-57 *Model and Invent Lab* 58-59, 176-177 *Science and History* 146 *Design Your Own Lab* 344-345 *MiniLAB* 489 **Teacher Wraparound Edition:** MM 56; SJ 273

STANDARDS	PAGE REFERENCES
Component 3.2 Science, Technology, and Society: Analyze how science and technology are human endeavors, interrelated to each other, society, the workplace, and the environment.	
Science, Technology, and Society	
3.2.1 All Peoples Contribute to Science and Technology	
Analyze how scientific knowledge and technological advances discovered and developed by individuals and communities in all cultures of the world contribute to changes in societies. • (9) Explain how life has changed throughout history because of scientific knowledge and technological advances from a variety of peoples. • (10) Compare the impacts of diverse cultures and individuals on science and technology.	**Student Edition:** 38-45, 581-583 *Accidents in Science* 60 *Science and History* 120, 478 *Integrate History* 167, 273 **Teacher Wraparound Edition:** CD 115, 132, 167, 187, 410, 472; DI 460; VL 41
3.2.2 Relationship of Science and Technology	
Analyze how the scientific enterprise and technological advances influence and are influenced by human activity. W • (9, 10) Describe how science and/or technology have led to a given social or economic development. • (10) Explain risks associated with investigations involving living things (e.g., drug trials on animals, testing of genetically engineered plants, release of African snails into the environment after experimentation). • (10) Identify the limits of scientific research in solving a given social, environmental, and/or economic problem. • (10) Compare advantages and/or disadvantages of using new technology or science in terms of ethics, politics, and environmental considerations. • (10) Explain the concept of proprietary discovery (e.g., patents on genes).	**Student Edition:** 46-50, 469-475 *Science Online* 45, 473 *MiniLAB* 47 *Applying Science* 49 *Accidents in Science* 744 *Science and History* 811 **Teacher Wraparound Edition:** A 45; ACT 48; DI 7, 44; PR 50; SCB 36E-F

STANDARDS	PAGE REFERENCES
3.2.3 Careers and Occupations Using Science , Mathematics, and Technology	
Analyze the scientific, mathematical, and technological knowledge, training, and experience needed for occupational/career areas of interest. • (9, 10) Research and report on educational requirements associated with an occupation(s)/career(s) of interest. • (9, 10) Examine the scientific, mathematical, and technological knowledge, training, and experience needed for occupational/career areas of interest.	**Student Edition:** 804-806 *Integrate Career* 56, 335, 408, 440, 472, 592 **Teacher Wraparound Edition:** IC 753; RP 56; UP 67, 549, 685
3.2.4 Environmental and Resource Issues	
Analyze the effects human activities have on Earth's capacity to sustain biological diversity. W • (9, 10) Explain how the use of renewable and nonrenewable natural resources affects the sustainability of an ecosystem. • (9, 10) Explain how human activities affect Earth's capacity to sustain biological diversity (e.g., global warming, ozone depletion).	**Student Edition:** 466, 486-493, 494-500, 501-506, 536-539 *Lab* 51 *Applying Science* 499 *Use the Internet Lab* 508-509 *Science and Society* 510, 778 *Integrate Environment* 667 **Teacher Wraparound Edition:** LD 537; R 493; SCB 516F; TFYI 519