



Physical Science

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STANDARDS	PAGE REFERENCES
Physical Sciences	
<i>Nature of Matter</i>	
1. Recognize that all atoms of the same element contain the same number of protons, and elements with the same number of protons may or may not have the same mass. Those with different masses (different numbers of neutrons) are called isotopes.	Student Edition: 512-515, 518-519, 536, 539, 550, 556 Teacher Wraparound Edition: D 609; FYI 513; R 515, 540; VL 514
2. Illustrate that atoms with the same number of positively charged protons and negatively charged electrons are electrically neutral.	Student Edition: 507, 518-519, 608, 610 Teacher Wraparound Edition: D 513, 609; UA 522
3. Describe radioactive substances as unstable nuclei that undergo random spontaneous nuclear decay emitting particles and/or high energy wavelike radiation.	Student Edition: 538-540, 541-543, 546-550, 554-556 <i>Integrate Health</i> 554 <i>National Geographic</i> 555 Teacher Wraparound Edition: CU 540, 545; D 543; FYI 548; R 550

STANDARDS	PAGE REFERENCES
4. Show that when elements are listed in order according to the number of protons (called the atomic number), the repeating patterns of physical and chemical properties identify families of elements. Recognize that the periodic table was formed as a result of the repeating pattern of electron configurations.	Student Edition: 516-523, 572-576, 578-582, 584-589 Teacher Wraparound Edition: FYI 573; HS 594; QD 582; TPK 516
5. Describe how ions are formed when an atom or a group of atoms acquire an unbalanced charge by gaining or losing one or more electrons.	Student Edition: 608, 615-617, 620, 676-677 Teacher Wraparound Edition: D 610; FF 605
6. Explain that the electric force between the nucleus and the electrons hold an atom together. Relate that on a larger scale, electric forces hold solid and liquid materials together (e.g., salt crystals and water).	Student Edition: 192-194, 478, 482-483, 604, 606 <i>Lab</i> 496-497 Teacher Wraparound Edition: FYI 603; VL 161, 482
7. Show how atoms may be bonded together by losing, gaining or sharing electrons and that in a chemical reaction, the number, type of atoms and total mass must be the same before and after the reaction (e.g., writing correct chemical formulas and writing balanced chemical equations).	Student Edition: 463, 465, 602-606, 608-614, 615-618, 632-636, 638-640 <i>Applying Math</i> 617 <i>Lab</i> 607 <i>MiniLab</i> 612 <i>National Geographic</i> 613 Teacher Wraparound Edition: D 603; DI 612; QD 605
8. Demonstrate that the pH scale (0-14) is used to measure acidity and classify substances or solutions as acidic, basic, or neutral.	Student Edition: 704-705, 710-711 <i>Design Your Own Lab</i> 716-717 <i>Lab</i> 706 <i>Science and Society</i> 718 Teacher Wraparound Edition: IL 710; IM 704; R 705
9. Investigate the properties of pure substances and mixtures (e.g., density, conductivity, hardness, properties of alloys, superconductors and semiconductors).	Student Edition: 450-456, 758-763, 767-770 <i>Lab</i> 457 <i>MiniLab</i> 453, 759 Teacher Wraparound Edition: D 454; FYI 453; IM 761; VL 767

STANDARDS	PAGE REFERENCES
10. Compare the conductivity of different materials and explain the role of electrons in the ability to conduct electricity.	Student Edition: 195, 204, 242, 244, 759 <i>Lab 206</i> Teacher Wraparound Edition: D 194; DI 195; FYI 204
<i>Nature of Energy</i>	
11. Explain how thermal energy exists in the random motion and vibrations of atoms and molecules. Recognize that the higher the temperature, the greater the average atomic or molecular motion, and during changes of state the temperature remains constant.	Student Edition: 158-160, 162, 476-477 <i>Launch Lab 157</i> Teacher Wraparound Edition: VL 480
12. Explain how an object's kinetic energy depends on its mass and its speed ($KE = \frac{1}{2}mv^2$).	Student Edition: 102, 477 Teacher Wraparound Edition: QD 102
13. Demonstrate that near Earth's surface an object's gravitational potential energy depends upon its weight (mg where m is the object's mass and g is the acceleration due to gravity) and height (h) above a reference surface ($PE = mgh$).	Student Edition: 104-105 <i>Lab 106</i> Teacher Wraparound Edition: QD 104
14. Summarize how nuclear reactions convert a small amount of matter into a large amount of energy. (Fission involves the splitting of a large nucleus into smaller nuclei; fusion is the joining of two small nuclei into a larger nucleus at extremely high energies.)	Student Edition: 113, 265-266, 270, 551-553 <i>Lab 557</i> <i>MiniLab 552</i> <i>Science and History 560</i> Teacher Wraparound Edition: CU 115; FF 553; FYI 113, 265; VL 266
15. Trace the transformations of energy within a system (e.g., chemical to electrical to mechanical) and recognize that energy is conserved. Show that these transformations involve the release of some thermal energy.	Student Edition: 107-111, 114, 127, 646 <i>Design Your Own Lab 116-117</i> <i>Integrate Environment 111</i> <i>Integrate Health 115</i> <i>Lab 106</i> <i>MiniLab 112</i> <i>National Geographic 110</i> <i>Science and History 118</i> Teacher Wraparound Edition: QD 108; R 105; SJ 111; TPK 646

STANDARDS	PAGE REFERENCES
<p>16. Illustrate that chemical reactions are either endothermic or exothermic (e.g., cold packs, hot packs and the burning of fossil fuels).</p>	<p>Student Edition: 641, 648-649 <i>Use the Internet Lab</i> 652-653 Teacher Wraparound Edition: LD 648; R 650; TPK 646</p>
<p>17. Demonstrate that thermal energy can be transferred by conduction, convection or radiation (e.g., through materials by the collision of particles, moving air masses or across empty space by forms of electromagnetic radiation).</p>	<p>Student Edition: 164-167, 354-359, 362-363 <i>Lab</i> 171, 180-181 <i>MiniLab</i> 168, 169 <i>National Geographic</i> 166 Teacher Wraparound Edition: IM 167; LD 165; QD 173; R 359; TPK 164</p>
<p>18. Demonstrate that electromagnetic radiation is a form of energy. Recognize that light acts as a wave. Show that visible light is a part of the electromagnetic spectrum (e.g., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays).</p>	<p>Student Edition: 354, 356-359, 360-365, 367-373 <i>MiniLab</i> 356, 361 Teacher Wraparound Edition: CB 376; FF 363; FYI 358; QD 362</p>
<p>19. Show how the properties of a wave depend on the properties of the medium through which it travels. Recognize that electromagnetic waves can be propagated without a medium.</p>	<p>Student Edition: 291, 323-324, 354-359, 360-361, 367-368, 386-388 <i>Lab</i> 302, 312-313 <i>MiniLab</i> 323 <i>Science and History</i> 314 Teacher Wraparound Edition: BI 288; CB 314, 376; D 298, 323; DI 305; FYI 324, 386</p>
<p>20. Describe how waves can superimpose on one another when propagated in the same medium. Analyze conditions in which waves can bend around corners, reflect off surfaces, are absorbed by materials they enter, and change direction and speed when entering a different material.</p>	<p>Student Edition: 303-310, 339-342, 358-359, 384-388, 402-403 <i>Design Your Own Lab</i> 406-407 <i>Lab</i> 366, 405 <i>MiniLab</i> 387 Teacher Wraparound Edition: A 309; FYI 386; IL 305; QD 306; R 388</p>

STANDARDS	PAGE REFERENCES
<i>Forces and Motion</i>	
<p>21. Demonstrate that motion is a measurable quantity that depends on the observer's frame of reference and describe the object's motion in terms of position, velocity, acceleration and time.</p>	<p>Student Edition: 38-44, 47-51 <i>Integrate Astronomy</i> 39 <i>Integrate Earth Science</i> 45-46 <i>Integrate Physics</i> 60 <i>Launch Lab</i> 37 <i>National Geographic</i> 49 Teacher Wraparound Edition: D 48; FYI 45; IM 39; IP 60; R 46; SJ 44</p>
<p>22. Demonstrate that any object does not accelerate (remains at rest or maintains a constant speed and direction of motion) unless an unbalanced (net) force acts on it.</p>	<p>Student Edition: 54-56, 68 <i>Design Your Own Lab</i> 58-59 <i>Lab</i> 57 <i>Science and History</i> 92 Teacher Wraparound Edition: FF 55; IM 53; MM 54</p>
<p>23. Explain the change in motion (acceleration) of an object. Demonstrate that the acceleration is proportional to the net force acting on the object and inversely proportional to the mass of the object. ($F_{\text{net}} = ma$. Note that weight is the gravitational force on a mass.)</p>	<p>Student Edition: 54-56, 68-74, 77-79 <i>Design Your Own Lab</i> 58-59 <i>Lab</i> 57 <i>Science and History</i> 92 Teacher Wraparound Edition: D 74; FF 55; IM 53; MM 54; QD 76, 79; SJ 73</p>
<p>24. Demonstrate that whenever one object exerts a force on another, an equal amount of force is exerted back on the first object.</p>	<p>Student Edition: 83-84, 86-88 <i>Lab</i> 89, 90-91 <i>National Geographic</i> 85 <i>Science and History</i> 92 Teacher Wraparound Edition: CU 88; FF 85; SJ 84</p>
<p>25. Demonstrate the ways in which frictional forces constrain the motion of objects (e.g., a car traveling around a curve, a block on an inclined plane, a person running, an airplane in flight).</p>	<p>Student Edition: 70-72, 81, 112, 136-137, 144-145, 177 <i>Design Your Own Lab</i> 116-117 <i>MiniLab</i> 71 <i>National Geographic</i> 2-3 <i>Science and History</i> 118 Teacher Wraparound Edition: A 144; DI 72; FYI 195; LD 70</p>

STANDARDS

PAGE REFERENCES

Historical Perspectives and Scientific Revolutions

<p>26. Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., atomic theory, quantum theory and Newtonian mechanics).</p>	<p>Student Edition: 242-244, 264-270, 358-359, 509-511, 632-634 <i>National Geographic</i> 446-447 <i>Science and History</i> 560 <i>Science and Society</i> 440, 780 <i>Use the Internet Lab</i> 652-653</p> <p>Teacher Wraparound Edition: CC 265, 633; CD 174, 210, 226; D 269; FYI 242, 358; IM 196, 201; SJ 552</p>
<p>27. Describe advances and issues in physical science that have important, long-lasting effects on science and society (e.g., atomic theory, quantum theory, Newtonian mechanics, nuclear energy, nanotechnology, plastics, ceramics and communication technology).</p>	<p>Student Edition: 54-55, 68-70, 75-88, 271-276, 358-359, 367-373, 396-399, 509-511, 551-552, 764-770, 771-776 <i>National Geographic</i> 769 <i>Science and History</i> 92, 376, 560 <i>Science and Society</i> 150</p> <p>Teacher Wraparound Edition: FF 357; FYI 274, 358; IM 398</p>

Science and Technology*Understanding Technology*

<p>1. Describe means of comparing the benefits with the risks of technology and how science can inform public policy.</p>	<p>Student Edition: 10, 13, 713 <i>Accidents in Science</i> 750 <i>Integrate Environment</i> 581, 772 <i>Integrate History</i> 713 <i>Science and History</i> 560 <i>Science and Society</i> 280, 346, 718 <i>Use the Internet Lab</i> 278-279, 652-653</p> <p>Teacher Wraparound Edition: AIL 652; CC 739; FF 699; IE 772; IH 713</p>
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STANDARDS	PAGE REFERENCES
<i>Abilities To Do Technological Design</i>	
<p>2. Identify a problem or need, propose designs and choose among alternative solutions for the problem.</p>	<p>Student Edition: 270, 271-276, 546-549 <i>Model and Invent Lab</i> 148-149 <i>National Geographic</i> 2-3, 446-447 <i>Science and History</i> 376, 560 <i>Science and Society</i> 346, 440, 718 <i>Science Skill Handbook</i> 788-796 <i>Use the Internet Lab</i> 278-279, 652-653 Teacher Wraparound Edition: D 275, 276, 549; FF 270; FYI 274; TPK 546</p>
<p>3. Explain why a design should be continually assessed and the ideas of the design should be tested, adapted and refined.</p>	<p>Student Edition: 267-268, 270, 271-276 <i>Use the Internet Lab</i> 278-279 Teacher Wraparound Edition: D 269; FYI 268</p>
Scientific Inquiry	
<i>Doing Scientific Inquiry</i>	
<p>1. Distinguish between observations and inferences given a scientific situation.</p>	<p>Student Edition: 7, 10, 508, 516-517 <i>Launch Lab</i> 505 <i>Science Skill Handbook</i> 796 Teacher Wraparound Edition: UA 508</p>
<p>2. Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g., OSHA, Material Safety Data Sheets [MSDS], eyewash, goggles and ventilation).</p>	<p>Student Edition: <i>Design Your Own Lab</i> 246-247, 716-717 <i>Lab</i> 466-467, 622-623 <i>Science Skill Handbook</i> 797, 798-799</p>
<p>3. Construct, interpret and apply physical and conceptual models that represent or explain systems, objects, events or concepts.</p>	<p>Student Edition: 11, 509-511 <i>Design Your Own Lab</i> 592-593 <i>Integrate Earth Science</i> 11 <i>Integrate Physics</i> 30 <i>MiniLab</i> 509 <i>Model and Invent Lab</i> 148-149, 558-559 <i>National Geographic</i> 2-3, 510 <i>Science Skill Handbook</i> 791 Teacher Wraparound Edition: D 11; DI 509</p>

STANDARDS	PAGE REFERENCES
4. Decide what degree of precision based on the data is adequate and round off the results of calculator operations to the proper number of significant figures to reasonably reflect those of the inputs.	Student Edition: <i>Extra Try at Home Lab</i> 800 <i>Lab</i> 27 <i>Math Skill Handbook</i> 823, 829 <i>Science Skill Handbook</i> 793
5. Develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology.	Student Edition: 22-26 <i>Math Skill Handbook</i> 829-831 <i>Science Skill Handbook</i> 796 <i>Technology Skill Handbook</i> 813, 815-816 Teacher Wraparound Edition: CYD 117, 215, 467; QD 24
6. Draw logical conclusions based on scientific knowledge and evidence from investigations.	Student Edition: 10 <i>Design Your Own Lab</i> 116-117, 214-215, 466-467, 622-623, 716-717 <i>Math Skill Handbook</i> 823 <i>MiniLab</i> 25 Teacher Wraparound Edition: AIL 116
Scientific Ways of Knowing	
<i>Nature of Science</i>	
1. Comprehend that many scientific investigations require the contributions of women and men from different disciplines in and out of science. These people study different topics, use different techniques and have different standards of evidence but share a common purpose – to better understand a portion of our universe.	Student Edition: 13 <i>Accidents in Science</i> 624, 654, 750 <i>Integrate Physics</i> 30 <i>National Geographic</i> 510, 769 <i>Science and History</i> 248, 314, 376, 528, 560, 594 <i>Science and Language Arts</i> 30 <i>Science and Society</i> 150, 440, 780 Teacher Wraparound Edition: A 45; IP 30
2. Illustrate that the methods and procedures used to obtain evidence must be clearly reported to enhance opportunities for further investigations.	Student Edition: 8-10, 17-21 <i>Design Your Own Lab</i> 28-29, 58-59, 116-117 <i>Lab</i> 312-313, 496-497, 778-779 <i>Model and Invent Lab</i> 148-149 Teacher Wraparound Edition: CYD 59, 117

STANDARDS	PAGE REFERENCES
<p>3. Demonstrate that reliable scientific evidence improves the ability of scientists to offer accurate predictions.</p>	<p>Student Edition: <i>Applying Science</i> 357, 644, <i>Design Your Own Lab</i> 28-29, 214-215 <i>Lab</i> 206, 277, 366, 496-497, 778-779 <i>Use the Internet Lab</i> 278-279, 652-653</p>
<i>Ethical Practices</i>	
<p>4. Explain how support of ethical practices in science (e.g., individual observations and confirmations, accurate reporting, peer review and publication) are required to reduce bias.</p>	<p>Student Edition: 10 <i>Science and History</i> 118, 376 <i>Science Skill Handbook</i> 788, 796 Teacher Wraparound Edition: AIL 28; DI 23; FF 10</p>
<i>Scientific Theories</i>	
<p>5. Justify that scientific theories are explanations of large bodies of information and/or observations that withstand repeated testing.</p>	<p>Student Edition: 12, 476-480 <i>Integrate Astronomy</i> 524 <i>Integrate Earth Science</i> 45 <i>Science and History</i> 560 Teacher Wraparound Edition: A 45; IL 12; R 560; SJ 482</p>
<p>6. Explain that inquiry fuels observation and experimentation that produce data that are the foundation of scientific disciplines. Theories are explanations of these data.</p>	<p>Student Edition: 6-12, 22-26, 46 <i>Applying Science</i> 228 <i>Design Your Own Lab</i> 116-117, 214-215, 406-407, 622-623 <i>Integrate Astronomy</i> 45 <i>Model and Invent Lab</i> 148-149 <i>Science Skill Handbook</i> 788-796 Teacher Wraparound Edition: A 45; FF 8; IL 12</p>
<p>7. Recognize that scientific knowledge and explanations have changed over time, almost always building on earlier knowledge.</p>	<p>Student Edition: 509-511, 516-523, 536-539, 541-545, 551-556 <i>Integrate History</i> 540 <i>National Geographic</i> 510 Teacher Wraparound Edition: FYI 553; IM 519; VL 509</p>

STANDARDS	PAGE REFERENCES
<i>Science and Society</i>	
<p>8. Illustrate that much can be learned about the internal workings of science and the nature of science from the study of scientists, their daily work and their efforts to advance scientific knowledge in their area of study.</p>	<p>Student Edition: <i>Accidents in Science</i> 624, 654, 750 <i>Integrate Astronomy</i> 76, 331 <i>Integrate Career</i> 370, 520, 743 <i>Integrate Health</i> 84 <i>Integrate History</i> 713 <i>Science and History</i> 376, 560 <i>Science and Society</i> 150, 780</p> <p>Teacher Wraparound Edition: A 45; CC 331; CD 370, 712, 760; FF 10; IC 520, 743; IH 713</p>
<p>9. Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.</p>	<p>Student Edition: 8-10 <i>Integrate Career</i> 208, 240, 325, 370, 520, 576, 743 <i>Integrate Earth Science</i> 11 <i>Integrate History</i> 9, 48, 713 <i>Integrate Life Science</i> 324, 427</p>