



MINNESOTA
Academic Standards - Science Grades 9-12
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OBJECTIVES	PAGE REFERENCES
I. HISTORY AND NATURE OF SCIENCE	
A. Scientific World View The student will understand the nature of scientific ways of thinking and that scientific knowledge changes and accumulates over time.	
1. The student will be able to distinguish among hypothesis, theory and law as scientific terms and how they are used to answer a specific question.	SE: 8, 12, 76, 111, 174-175, 476-480, 791-792 <i>Design Your Own Lab</i> 116-117 <i>Science and History</i> 92 TWE: A 9
2. The student will be able to explain how scientific and technological innovations as well as new evidence can challenge portions of or entire accepted theories and models including but not limited to cell theory, atomic theory, theory of evolution, plate tectonic theory, germ theory of disease and big bang theory.	SE: 511, 516-517 <i>National Geographic</i> 2-3, 510 <i>Science and History</i> 92, 376, 528, 560
3. The student will recognize that in order to be valid, scientific knowledge must meet certain criteria including that it: be consistent with experimental, observational and inferential evidence about nature; follow rules of logic and reporting both methods and procedures; and be falsifiable and open to criticism.	SE: 7-10 <i>Science and History</i> 118, 376 <i>Science and Society</i> 150, 280, 718 <i>Science Skill Handbook</i> 788-796 TWE: DIN 23 IL 12
4. The student will explain how traditions of ethics, peer review, conflict and general consensus influence the conduct of science.	SE: 8-10 <i>Science and History</i> 118, 376, 560 <i>Science and Society</i> 280, 346, 718 TWE: DIN 23 IL 12 TPK 22
5. The student will recognize that some scientific ideas are incomplete, and opportunity exists in these areas for new advances.	SE: <i>Integrate Astronomy</i> 76 <i>Integrate Earth Science</i> 275 <i>Integrate Health</i> 115, 685 <i>Integrate Social Studies</i> 549 <i>Science and Society</i> 150, 280, 718 <i>Use the Internet Lab</i> 278-279, 652-653

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B. Scientific Inquiry The student will design and conduct a scientific investigation.	
1. The student will design and complete a scientific experiment using scientific methods by determining a testable question, making a hypothesis, designing a scientific investigation with appropriate controls, analyzing data, making conclusions based on evidence and comparing conclusions to the original hypothesis and prior knowledge.	SE: <i>Design Your Own Lab</i> 58-59, 116-117, 214-215, 246-247, 344-345, 406-407, 466-467, 592-593, 622-623, 716-717
2. The student will distinguish between qualitative and quantitative data.	SE: 492-495, 710 <i>Integrate Earth Science</i> 11 <i>Lab</i> 457, 466-467 <i>Math Skill Handbook</i> 827-831 <i>Science Skill Handbook</i> 792 TWE: DIN 10
3. The student will apply mathematics and models to analyze data and support conclusions.	SE: 8-11, 22-26, 509 <i>Applying Math</i> 69, 104, 211, 299, 487 <i>Math Skill Handbook</i> 827-831 <i>Model and Invent Lab</i> 438-439, 558-559
4. The student will identify possible sources of error and their effects on results.	TWE: AYD 29, 59, 215, 247, 345, 407, 467, 623, 717
5. The student will know that professional scientists and engineers have ethical codes.	SE: 10 <i>Science Skill Handbook</i> 788, 796 TWE: DIN 23
6. The student will give examples of how different domains of science use different bodies of scientific knowledge and employ different methods to investigate questions.	SE: 6 <i>Integrate History</i> 9 <i>National Geographic</i> 140, 258, 294, 430 <i>Science and History</i> 248 <i>Science and Society</i> 718 TWE: A 7
C. Scientific Enterprise The student will understand the relationship between science and technology and how both are used.	
1. The student will compare and contrast the purposes and career opportunities of engineering, technology and science.	SE: 13 <i>Integrate Career</i> 208, 240, 325, 370, 520, 576, 743
2. The student will provide an example of a need or problem identified by science and solved by engineering or technology.	SE: 13, 264-267 <i>Accidents in Science</i> 624, 654 <i>National Geographic</i> 2-3, 566-567, 660-661 TWE: FYI 12
3. The student will provide an example of how technology facilitates new discoveries and the development of scientific knowledge.	SE: 13 <i>Science and History</i> 248, 528, 594 <i>Science and Society</i> 150, 280, 780
4. The student will know that technological changes and scientific advances are often accompanied by social, political, environmental and economic changes.	SE: 13, 267-269 <i>Integrate Earth Science</i> 176 <i>Integrate Environment</i> 364, 772 <i>Integrate History</i> 713 <i>Integrate Social Studies</i> 266 <i>Science and Society</i> 280 TWE: IL 12

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5. The student will recognize that science and technology are influenced by cultural backgrounds and beliefs and by social needs, attitudes, values and limitations.	SE: <i>Integrate Environment</i> 364, 772 <i>Integrate History</i> 713 <i>Science and History</i> 92, 248, 314, 560 <i>Science and Society</i> 280, 440, 718, 780
D. Historic Perspectives The student will recognize the historical and cultural context of scientific endeavors and how they influence each other.	
1. The student will be able to trace the development of a scientific advancement, invention or theory and its impact on society.	SE: 267-269 <i>Lab</i> 557 <i>Science and History</i> 560 <i>Science and Society</i> 280 <i>Use the Internet Lab</i> 278-279, 652-653
2. The student will provide examples of scientific advancements contributed by other civilizations and cultures.	SE: 231, 358 <i>Accidents in Science</i> 654 <i>National Geographic</i> 446-447 <i>Science and History</i> 92, 376, 560 TWE: DIN 359
3. The student will compare and contrast the differences between scientific theories and theories from other bodies of knowledge, and the importance of each in a science discussion.	SE: 12 <i>Science and History</i> 376
II. PHYSICAL SCIENCE	
A. Structure of Matter The student will understand the nature of matter including its forms, properties and interactions.	
1. The student will identify protons, neutrons and electrons as the major components of the atom, their mass relative to one another, their arrangement and their charge.	SE: 507, 511, 520-521, 536-538 <i>National Geographic</i> 510 TWE: IM 514
2. The student will be able to explain the relationship of an element's position on the periodic table to its atomic number and atomic mass.	SE: 512-513, 516-523, 572-576, 578-582, 584-589, 767 TWE: D 538
3. The student will compare and contrast the properties of an element and its isotopes, and describe how isotopes can be used in research, medicine and industry.	SE: 514-515, 542, 544-545, 551-552, 554-556 <i>Science and History</i> 528
4. The student will use the periodic table to identify regions, families, groups and periods.	SE: 516-523, 572-576, 578-582, 584-589, 767 <i>Use the Internet Lab</i> 526-527
5. The student will explain how neutral atoms become ions.	SE: 608-609, 676-677
6. The student will be able to explain how atoms form compounds through bonding.	SE: 579, 610-612, 615-617, 619-621 <i>National Geographic</i> 613 TWE: DI 614
7. The student will compare and contrast the states of matter in terms of interactions between particles.	SE: 476-480, 490 <i>Integrate History</i> 482 <i>Lab</i> 484 TWE: AS 483 TC 474

OBJECTIVES	PAGE REFERENCES
8. The student will differentiate between an atom and a molecule.	SE: 506-508, 512-515, 520-521, 611-612, 615-621, 682 <i>MiniLAB</i> 683 <i>National Geographic</i> 510, 613
9. The student will differentiate between an element and a compound.	SE: 450, 452, 539, 570-591, 602-606, 608-612, 615-621 <i>National Geographic</i> 451, 613
B. Chemical Reactions The student will describe chemical reactions and the factors that influence them.	
1. The student will describe chemical reactions using words and symbolic equations.	SE: 632, 635-637, 638-640, 641-645 TWE: TC 630
2. The student will explain the influence of temperature, surface area, agitation and catalysts on the rate of a reaction.	SE: 646-649 <i>Integrate History</i> 650 <i>Lab</i> 651
3. The student will distinguish between a chemical reaction and a nuclear reaction.	SE: 538-539, 541-545, 551-553, 632, 635-637, 638-640, 641-645 <i>Integrate History</i> 540 TWE: TC 534
4. The student will explain how the rearrangement of atoms and molecules in a chemical reaction illustrates conservation of mass.	SE: 465, 632-633, 638-640 <i>Applying Math</i> 463 <i>MiniLAB</i> 636
5. The student will describe how combining acids and bases produces a neutral solution.	SE: 707-708, 710-711 <i>Design Your Own Lab</i> 716-717 TWE: CB 718
C. Energy Transformations The student will understand energy forms, transformations and transfers.	
1. The student will know that potential energy is stored energy and is associated with gravitational or electrical force, mechanical position or chemical composition.	SE: 103, 105 <i>Applying Math</i> 104 <i>Design Your Own Lab</i> 116-117 <i>Lab</i> 106 TWE: USW 102
2. The student will differentiate between kinetic and potential energy and identify situations where kinetic energy is converted into potential energy and vice versa.	SE: 102-103, 105, 108-109 <i>Applying Math</i> 104 <i>Design Your Own Lab</i> 116-117 <i>Lab</i> 106 <i>National Geographic</i> 110
3. The student will differentiate between AC and DC current.	SE: 239, 242 TWE: DIN 241
4. The student will describe the production, storage and transmission of electricity.	SE: 238-240, 242-244, 260-263, 267, 271-275 <i>National Geographic</i> 241 <i>Science and Society</i> 280 <i>Use the Internet Lab</i> 278-279
5. The student will be able to describe physical and chemical changes in terms of the law of conservation of energy.	SE: 107-109, 111-113, 135, 174-175, 256-257 <i>Science and History</i> 118 TWE: LD 110
6. The student will compare and contrast the amount of energy released through chemical reactions and nuclear fission and fusion.	SE: 646-649 TWE: AS 640 FYI 265

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7. The student will describe the risks and benefits of fossil fuels, renewable sources and nuclear power as sources of usable energy.	SE: 256-257, 259-263, 264-269, 271-275, 648 <i>Lab 277</i> <i>Science and Society 280</i> <i>Use the Internet Lab 278-279, 652-653</i>
8. The student will describe applications of the different wavelengths of the electromagnetic spectrum.	SE: 360-365, 367-373, 394-399, 401, 404 <i>Use the Internet Lab 374-375</i> TWE: DI 359 TC 382
9. The student will describe energy, work and power both conceptually and quantitatively.	SE: 100-105, 126-131, 134-135, 175, 176-177, 210-213, 256-257, 260-263, 267
D. Motion The student will understand the nature of force and motion.	
1. The student will use Newton's three laws of motion to qualitatively and quantitatively describe the interaction of objects.	SE: 54-56, 69-70, 73-74, 83-88 <i>Design Your Own Lab 58-59</i> <i>Lab 57, 90-91</i>
2. The student will describe the effect of friction and gravity on the motion of an object.	SE: 70-72, 75-82, 104-105 <i>Lab 89, 106</i> <i>Launch Lab 67</i> <i>Science and History 118</i> TWE: DI 74 FF 73
E. Forces of Nature The student will understand the forces of nature and their application.	
1. The student will recognize the factors that affect the presence and magnitude of gravitational, electromagnetic, weak and strong nuclear forces.	SE: 75-82, 104-105, 193-194, 224, 537-538 <i>Launch Lab 67</i> TWE: FYI 537
2. The student will identify the dominant force or forces in a variety of interactions.	SE: 194, 537-538 <i>Lab 89</i> <i>MiniLAB 539</i> TWE: FYI 537

Codes Used for TWE Pages

A	Activity
AS	Assessment
AYD	Analyze Your Data
CB	Content Background
D	Discussion
DI	Daily Intervention
DIN	Differentiated Instruction
FF	Fun Fact
FYI	Teacher FYI
IL	Inquiry Lab
IM	Identifying Misconceptions
LD	Lab Demonstration
TC	Theme Connection
TPK	Tie to Prior Knowledge
USW	Using Science Words