



KANSAS
Science Standards, Grade 12
***Physics: Principles and Problems* © 2005**

OBJECTIVES	PAGE REFERENCES
STANDARD 1: SCIENCE AS INQUIRY	
As a result of their activities in grades 9-12, all students will develop the abilities necessary to do scientific inquiry and understandings about scientific inquiry.	
Benchmark 1: Students will demonstrate the fundamental abilities necessary to do scientific inquiry.	
Indicators: The students will:	
1. Develop a rich understanding and curiosity of the natural (material) world through experience.	SE: 33-37, 93-95, 131-135, 153-156, 266-273, 360-363, 549-553, 679-682, 761-765, 776-783
2. Develop questions and identify concepts that guide scientific investigations.	SE: <i>Launch Lab</i> 3, 87, 147, 171, 257, 431, 541, 591, 671, 775
3. Design and conduct scientific investigations.	SE: 8-10, 12-13, 15-19 <i>Physics Lab</i> 20-21, 160-161, 392-393, 532-533, 554-555, 660-661, 824-825
4. Use technology and mathematics to improve investigations and communications.	SE: 4-7, 11-19, 319-322 <i>Extreme Physics</i> 50 <i>How It Works</i> 740 <i>Physics Lab</i> 420-421, 580-581, 790-791 <i>Problem-Solving Strategies</i> 16, 728
5. Formulate and revise scientific explanations and models using logic and evidence.	SE: 38-47, 286-289, 752-756, 776-781 <i>MiniLab</i> 213, 270, 682 <i>Physics Lab</i> 108-109, 186-187, 738-739
6. Recognize and analyze alternative explanations and models.	SE: 172-176, 183-185, 726-729, 735-737, 748-756, 760-761, 787-789 TWE: C 445 RLP 329
7. Communicate and defend a scientific argument.	SE: <i>Future Technology</i> 162, 556, 826 <i>Physics Lab</i> 274-275, 606-607, 790-791 <i>Technology and Society</i> 220, 304, 450, 608
STANDARD 2B: PHYSICS	
Benchmark 1: The students will understand the relationship between motions and forces.	
Indicators: The students will understand:	
1. The motion of an object can be described in terms of its displacement (position), velocity, and acceleration.	SE: 32-33, 36-37, 43-47, 58-63, 65-68, 72-75 <i>Physics Lab</i> 48-49, 76-77 TWE: RLP 70 TPK 57
2. Objects change their motion only when a net force is applied.	SE: 88-91, 93-95, 100-101, 126-128, 153-155 <i>Physics Lab</i> 108-109, 136-137, 218-219 TWE: CT 214

OBJECTIVES	PAGE REFERENCES
3. Whenever a system applies force to an object, that object applies a related force to the system that is equal in magnitude and opposite in direction.	SE: 102-103, 105, 107 <i>How It Works</i> 110 <i>Physics Lab</i> 108-109 TWE: HSS 104
4. Gravitation is a relatively weak, attractive force that acts upon and between any two masses.	SE: 175-177, 179-185 <i>Extreme Physics</i> 188 <i>Physics Lab</i> 186-187 TWE: CU 178 TPK 546
5. Electric force is the attraction or repulsion that exists between two charged particles. Its magnitude is vastly greater than that due to gravity.	SE: 546-553 <i>Applying Physics</i> 802 <i>Launch Lab</i> 541, 563 <i>Physics Lab</i> 554-555 TWE: UA 564
6. Electricity and magnetism are two aspects of a single electromagnetic force.	SE: 648-649, 652-653, 655-656, 672, 675-677, 679-683 <i>Launch Lab</i> 671 <i>Physics Lab</i> 660-661, 686-687 TWE: PP 802
Benchmark 2: The students will understand the conservation of mass and energy, and that the overall disorder of the universe increases with time. Indicators: The students will understand:	
1. The energy of the universe is constant.	SE: 285-289, 293-295, 301, 734 <i>Physics Lab</i> 302-303 TWE: CB 298 RE 731
2. Energy may be classified as kinetic, potential, or energy within a field.	SE: 258, 287-291, 297-301, 314-315, 376-378, 563, 728-729 TWE: HSS 296
3. Heat is the transfer of energy from objects at higher temperature to objects at lower temperature.	Heat is the energy that is transferred. SE: 317, 319-320, 326-331 <i>Launch Lab</i> 313 <i>Physics Lab</i> 332-333 TWE: CB 318
4. The universe tends to become less organized and more disordered with every chemical and physical change.	SE: 328-330 TWE: EX 331
Benchmark 3: The students will understand the basic interactions of matter and energy. Indicators: The students will understand:	
1. Waves can transfer energy when they interact with matter.	SE: 381-382, 405, 705-712 <i>Technology and Society</i> 394 TWE: CB 409 CT 383
2. Electromagnetic waves result when a charged object is accelerated.	SE: 705-706, 709-711
3. Each kind of atom or molecule can gain or lose energy in unique, discrete amounts.	SE: 749-751, 756-759 <i>MiniLab</i> 755 TWE: DI 753 UM 726

OBJECTIVES	PAGE REFERENCES
4. Electrons flow easily in conductors (such as metals). Semiconducting materials have intermediate behavior. At low temperatures, some materials become superconductors and offer little or no resistance to the flow of electrons.	SE: 544-545, 576-577, 603, 777-780
STANDARD 5: SCIENCE AND TECHNOLOGY As a result of activities in grades 9-12, all students will develop understandings about science and technology and abilities of technological design.	
Benchmark 1: Students will develop understandings about science and technology.	
Indicators: The students will understand that:	
1. Creativity, imagination, and a broad knowledge base are all required in the work of science and engineering.	SE: <i>Future Technology</i> 22, 248, 476, 556, 826 <i>Technology and Society</i> 220, 394, 450, 608 TWE: HSS 8
2. Science and technology are pursued for different purposes.	SE: <i>Extreme Physics</i> 78, 188, 366, 422, 506 <i>Technology and Society</i> 220, 394, 608, 716
3. Scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations.	SE: 437-438, 500-501, 799-800 <i>Extreme Physics</i> 662, 792 TWE: RLC 68, 180, 319, 345, 777
4. Science advances new technologies. New technologies open new areas for scientific inquiry.	SE: <i>Extreme Physics</i> 50, 662, 792 <i>Future Technology</i> 22, 768, 826 <i>Technology and Society</i> 394, 450, 608, 716
5. Technological knowledge is often not made public because of the financial and military potential of the idea or invention. Scientific knowledge is made public through presentations at professional meetings and publications in scientific journals.	SE: 727, 733, 735-737, 759, 818 <i>Future Technology</i> 768, 826 TWE: CB 749, 761, 801
STANDARD 6: SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES As a result of their activities in grades 9-12, all students will develop an understanding of personal and community health, population growth, natural resources, environmental quality, natural and human-induced hazards, and science and technology in local, national, and global settings.	
Benchmark 1: Students will develop an understanding of the overall functioning of human systems and their interaction with the environment in order to understand specific mechanisms and processes related to health issues.	
Indicators: The students will understand that:	
1. Hazards and the potential for accidents exist for all human beings.	SE: <i>Future Technology</i> 556 <i>How It Works</i> 634 <i>Technology and Society</i> 220, 394 TWE: CT 326 EX 814
2. The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease-producing organism.	SE: <i>Applying Physics</i> 811
3. Informed personal choices concerning fitness and health involve an understanding of chemistry and biology.	SE: <i>Applying Physics</i> 231, 265, 501, 764 <i>Biology Connection</i> 273, 500 <i>Physics Lab</i> 274-275 <i>Technology and Society</i> 304

OBJECTIVES	PAGE REFERENCES
4. Selection of foods and eating patterns determine nutritional balance.	SE: <i>Biology Connection</i> 442
5. Sexuality is basic to healthy human development.	See Glencoe's <i>Biology: The Dynamics of Life</i> © 2004 SE: 995-1000, 1002-1004, 1005-1006 TWE: CA 1001
6. Intelligent use of chemical products relates directly to an understanding of chemistry.	SE: <i>Chemistry Connection</i> 442
Benchmark 2: Students will demonstrate an understanding of population growth. Indicators: The students will understand that:	
1. Rate of change in populations is determined by the combined effects of birth and death, and emigration and immigration.	See Glencoe's <i>Biology: The Dynamics of Life</i> © 2004 SE: 101-102 TWE: CA 101 EX 103
2. A variety of factors influence birth rates and fertility rates.	See Glencoe's <i>Biology: The Dynamics of Life</i> © 2004 SE: 96-99, 101, 103
3. Populations can reach limits to growth.	See Glencoe's <i>Biology: The Dynamics of Life</i> © 2004 SE: 91-93, 103 <i>Inside Story</i> 94 TWE: AS 103
Benchmark 3: Students will understand that human populations use natural resources and influence environmental quality. Indicators: The students will understand that:	
1. Natural resources from the lithosphere and ecosystems have been and will continue to be used to sustain human populations.	SE: 331
2. The earth does not have infinite resources.	SE: 331
3. Materials from human activities affect both physical and chemical cycles of the earth.	SE: 552-553
4. Humans use many natural systems as resources.	SE: 331
Benchmark 4: Students will understand the effect of natural and human-influenced hazards. Indicators: Students will understand that:	
1. Natural processes of earth may be hazardous for humans.	SE: <i>How It Works</i> 582 <i>Technology and Society</i> 394 TWE: CB 572 EX 814
2. There is a need to assess potential risk and danger from natural and human-induced hazards.	SE: 552-553 TWE: CB 564 EX 814

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Benchmark 5: Students will develop an understanding of the relationship between science, technology, and society.	
Indicators: The students will understand that:	
1. Science and technology are essential components of modern society. Science and technology indicate what can happen, not what should happen. The latter involves human decisions about the use of knowledge.	SE: 811-813 <i>Future Technology 22</i> <i>Technology and Society 220, 394</i> TWE: PP 213, 232
2. Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various challenges related to science and technology.	SE: 811-813 <i>Future Technology 22</i> <i>Technology and Society 608, 716</i>
3. Progress in science and technology can be affected by social issues and challenges.	SE: 811-813 TWE: RLP 295
STANDARD 7: HISTORY AND NATURE OF SCIENCE	
As a result of activities in grades 9-12, all students will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	
Benchmark 1: Students will develop an understanding that science is a human endeavor.	
Indicators: The students will:	
1. Demonstrate an understanding of science as both vocation and avocation.	SE: <i>Applying Physics 212, 231, 265, 435</i> <i>Technology and Society 304</i> TWE: RLC 180, 214, 241, 360 RLP 295
2. Explain how science uses peer review, replication of methods, and norms of honesty.	SE: 8-10, 11, 438, 731 TWE: CB 730, 801
3. Recognize the universality of basic science concepts and the influence of personal and cultural beliefs that embed science in society.	SE: 93-95, 175-177, 293-294, 737 TWE: CB 184 RLP 173
4. Recognize that society helps create the ways of thinking (mindsets) required for scientific advances, both toward training scientists and educating a populace to utilize benefits of science (e.g., standards of hygiene, attitudes toward forces of nature, etc.).	SE: <i>Applying Physics 180, 501, 764</i> <i>Extreme Physics 662</i> <i>Future Technology 22, 768</i> <i>Technology and Society 220, 304, 394, 716</i>
5. Recognize society's role in supporting topics of research and determining institutions where research is conducted.	SE: <i>Extreme Physics 188, 366, 506, 792</i> <i>Future Technology 22, 162, 248, 476, 768, 826</i>
Benchmark 2: Students will develop an understanding of the nature of scientific knowledge.	
Indicators: The students will:	
1. Demonstrate an understanding of the nature of scientific knowledge.	SE: 8-10, 96-101, 156, 293-295, 328-331, 437-438
Benchmark 3: Students will understand science from historical perspectives.	
Indicators: The students will:	
1. Demonstrate an understanding of the history of science.	SE: 93-94, 172-178, 344-346, 354-355, 357-358, 723-737, 747-761, 818-823 TWE: CB 7, 9, 184

Codes Used for TWE Pages

C	Challenge
CB	Content Background
CD	Concept Development
CT	Critical Thinking
CU	Check for Understanding
DI	Discussion
EX	Extension
HSS	Helping Struggling Students
PP	Physics Project
RE	Reinforcement
RLC	Real-Life Careers
RLP	Real-Life Physics
TPK	Tie to Prior Knowledge
UA	Using an Analogy
UM	Using Models