

GLENCOE CORRELATION
PHYSICS: PRINCIPLES AND PROBLEMS
MARYLAND
Science Content Standards
Grade Twelve

CONTENT STANDARDS	PAGE REFERENCES
1.0 Skills and Processes - Students will demonstrate the thinking and acting inherent in the practice of science.	
Scientific Inquiry	
By the end of grade 12 , students know and are able to do everything required at earlier grades and:	
1.12.1 access and process information from readings, investigations, and/or oral communications. (SFS 3.2) (SFS 4.1)	
The student will read a technical selection and interpret it appropriately. (CLG 1.5.6)	SE: 4-10, 811-816, 841-853, 861-869 <i>Physics & Society</i> 70, 266, 587 <i>Physics & Technology</i> 178, 378, 519
<i>The student will learn the use of new instruments and equipment by following instructions in a manual or from oral direction. (CLG 1.3.4)</i>	SE: 24-29, 679-682 <i>How It Works</i> 473, 618 <i>Physics Lab</i> 281, 362, 446, 545, 562, 595
The student will use relationships discovered in the lab to explain phenomena observed outside the laboratory. (CLG 1.2.7)	SE: 4-10, 24-29 <i>Physics Lab</i> 69, 213, 281, 308, 377, 446, 545, 727
The student will create and/or interpret graphics (scale drawings, photographs, digital images, etc.). (CLG 1.5.4)	SE: 30-34, 90-92, 743 <i>Physics Lab</i> 179, 377, 612, 700 <i>Problem Solving Strategies</i> 397, 516
1.12.2 formulate questions that lead to a testable hypothesis , which demonstrates the logical connections between the scientific concepts and the design of an investigation .	
The student will identify meaningful, answerable scientific questions. (CLG 1.2.1)	SE: 4-10, 90-92 <i>How It Works</i> 405, 565, 709 <i>Physics & Society</i> 70, 334, 486, 683
<i>The student will pose meaningful, answerable, scientific questions. (CLG 1.2.2)</i>	SE: 4-10, 90-92 <i>How It Works</i> 405, 565, 709 <i>Physics & Society</i> 70, 334, 486, 683
1.12.3 use observations, research, and select appropriate scientific information to form predictions and hypotheses .	
The student will formulate a working hypothesis. (CLG 1.2.3)	SE: <i>Physics Lab</i> 32, 162, 232, 257, 545, 562, 595 TWE: CT 474, 812
1.12.4 design experimental approaches, which answer scientific questions.	
The student will select appropriate instruments and materials to conduct an investigation. (CLG 1.2.5)	SE: <i>Physics Lab</i> 12, 58, 100, 162, 213, 330, 545, 562, 612, 684
The student will identify appropriate methods for conducting an investigation and affirm the need for proper controls in an experiment. (CLG 1.2.6)	SE: <i>Physics Lab</i> 32, 58, 100, 162, 232, 257, 330, 545, 562, 700
1.12.5 <i>demonstrate safety when conducting an investigation.</i>	
The student will recognize safe laboratory procedures. (CLG 1.3.2)	SE: 877 <i>Physics Lab</i> 281, 518, 545 <i>Pocket Lab</i> 522, 539, 547, 675 TWE: DE 538-539

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<i>The student will demonstrate safe handling of the chemicals and materials of science. (CLG 1.3.3)</i>	SE: 877 <i>Physics Lab</i> 281, 518, 545 <i>Pocket Lab</i> 522, 539, 547, 675 TWE: DE 538-539
1.12.6 use mathematical processes (measuring, calculating, etc.) when conducting investigations, analyzing information, and/or displaying information.	
The student will recognize mathematics as part of the scientific endeavor, comprehend the nature of mathematical thinking, and become familiar with key mathematical ideas and skills. (CLG 4.6.2)	SE: 16-21, 26-29, 33-34, 47-51, 64-68, 72-75, 737-747 <i>Problem Solving Strategies</i> 260, 474, 631
The student will recognize the important role that mathematics serves when solving problems in physics. (CLG 5.7.2)	SE: 47-51, 64-68, 72-75, 82-88, 90-102, 104-105, 176-192, 207-212, 396-398, 706-712
<i>The student will recognize mathematics as an integral part of the scientific process. (CLG 1.7.4)</i>	SE: 16-21, 26-29, 33-34, 47-51, 64-68, 72-75, 737-747 <i>Problem Solving Strategies</i> 260, 474, 631
The student will use ratio and proportion in appropriate situations to solve problems. (CLG 1.6.1)	SE: 64-68, 72-76, 87-89, 94-98, 119-121, 224-230, 542-544, 637-639, 739 <i>Problem Solving Strategies</i> 20, 420
<i>The student will use computers and/or graphing calculators to perform calculations for tables, graphs, or spreadsheets. (CLG 1.6.2)</i>	SE: <i>Physics Lab</i> 100, 162 <i>Pocket Lab</i> 93 TWE: A 34, 190 DE 90-91, 96-97, 378-379 TP 95
The student will express and/or compare small and large quantities using scientific notation and relative order of magnitude. (CLG 1.6.3)	SE: 19-20, 178, 180, 187, 203-204, 250, 287, 494-495, 500-501, 707
<i>The student will manipulate quantities and/or numerical values in algebraic equations. (CLG 1.6.4)</i>	SE: 33-34, 126-133, 150-153, 187, 380-381, 533-537, 740 <i>Problem Solving Strategies</i> 20, 127, 260
The student will judge the reasonableness of an answer. (CLG 1.6.5)	SE: <i>Physics Lab</i> 32, 162, 232, 362, 377, 496, 545, 700 <i>Problem Solving Strategies</i> 17-18, 474
1.12.7 collect, organize, and display data in multiple ways that fit the context using appropriate instruments to effectively convey the information (e.g., <i>calculators, spreadsheets, and databases and graphing programs</i>). (SFS 3.2) (SFS 4.1)	
<i>The student will test a working hypothesis. (CLG 1.2.4)</i>	SE: <i>Physics Lab</i> 32, 162, 232, 257, 545, 562, 595 TWE: CT 474, 812
<i>The student will develop and demonstrate skills in using lab and field equipment to perform investigative techniques. (CLG 1.3.1)</i>	SE: 24-29 <i>Physics & Technology</i> 178, 292, 663 <i>Physics Lab</i> 137, 213, 281, 446, 518, 545
The student will organize data appropriately using techniques such as tables, graphs, and webs (for graphs: axes labeled with appropriate quantities, appropriate units on axes, axes labeled with appropriate intervals, independent and dependent variables on correct axes, appropriate title). (CLG 1.4.1)	SE: 30-34, 82-88, 94-99, 104-105, 811-816, 833-839 <i>Physics Lab</i> 58, 100, 446, 700

CONTENT STANDARDS	PAGE REFERENCES
The student will use computers and/or graphing calculators to produce tables, graphs, and spreadsheet calculations. (CLG 1.5.5)	SE: <i>Physics Lab</i> 100, 162 <i>Pocket Lab</i> 93 TWE: A 34, 190 DE 90-91, 96-97, 378-379 TP 95
1.12.8 analyze appropriate data to identify trends to form conclusions and apply what has been learned to evaluate the hypothesis.	
The student will analyze data to make predictions, decisions, or form conclusions. (CLG 1.4.2)	SE: <i>Physics & Society</i> 70, 334, 587 <i>Physics Lab</i> 12, 162, 518, 684 <i>Problem Solving Strategies</i> 17, 57, 474
The student will use experimental data from various investigators to validate results. (CLG 1.4.3)	SE: <i>Physics & Society</i> 8, 70, 683 <i>Physics Lab</i> 12, 69, 162, 232, 330, 656, 700
The student will determine the relationships between quantities and develop the mathematical model that describes these relationships. (CLG 1.4.4)	SE: <i>Physics Lab</i> 69, 100, 257, 362, 399, 496, 545, 612, 656, 700
The student will check graphs to determine that they do not misrepresent results. (CLG 1.4.5)	SE: 84-87, 90-91, 94-96, 104-105 <i>Physics Lab</i> 32 TWE: DE 34-35 PJ 31
The student will describe trends revealed by data. (CLG 1.4.6)	SE: 30-34, 90-92, 94-99, 120-121, 155-161, 182-183, 250 <i>Physics Lab</i> 69, 281, 612
The student will use analyzed data to confirm, modify, or reject an hypothesis. (CLG 1.4.9)	SE: <i>Physics Lab</i> 32, 162, 232, 257, 545, 562, 595 TWE: CT 474, 812
1.12.9 interpret and communicate findings through speaking, writing, and drawing in a form suited to the purpose and audience, using developmentally appropriate methods including technology tools and telecommunications. (SFS 3.1) (SFS 4.1)	
The student will demonstrate the ability to summarize data (measurements/observations). (CLG 1.5.1)	SE: 30-34 <i>Physics & Society</i> 70 <i>Physics Lab</i> 58, 69, 162, 257, 362, 518, 612, 700
The student will explain scientific concepts and processes through drawing, writing, and/or oral communication. (CLG 1.5.2)	SE: 33-34, 82-87, 90-96 <i>Physics Lab</i> 179, 213, 257 <i>Problem Solving Strategies</i> 31, 631
The student will use tables, charts, and graphs to display data in making arguments and claims in both oral and written presentations. (CLG 2.8.3), (CLG 5.6.4)	SE: 30-34, 82-88, 94-99, 104-105, 811-816, 833-839 <i>Physics Lab</i> 58, 100, 446, 700
<i>The student will use computers and/or graphing calculators to produce the visual materials (tables, graphs, and spreadsheets) that will be used for communicating results. (CLG 1.5.3)</i>	SE: <i>Physics Lab</i> 100, 162 <i>Pocket Lab</i> 93 TWE: A 34, 190 DE 90-91, 96-97, 378-379 TP 95
The student will communicate conclusions derived through a synthesis of ideas. (CLG 1.5.9)	SE: <i>Physics Lab</i> 32, 58, 100, 162, 232, 257, 330, 545, 562, 595

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Critical Thinking	
1.12.10 analyze similarities and differences of objects, materials, concepts, and actions.	
The student will describe similarities and differences when explaining concepts and/or principles. (CLG 1.5.8)	SE: 328-333, 350-361, 374-375, 508-509, 637-640 <i>Physics & Society</i> 266, 486, 587 <i>Physics Lab</i> 362, 612
1.12.11 construct various classification systems and infer degree of divergence and/or kinship of various objects, materials, concepts, actions, and organisms.	
The student will use, explain, and/or construct various classification systems. (CLG 1.5.7)	SE: 190, 233-236, 248-256, 533-540, 705-708 <i>How It Works</i> 618 <i>Physics Lab</i> 446, 543
1.12.12 critique scientific information in order to detect bias and analyze the source of the bias. (SFS 2.2)	
The student will critique arguments that are based on faulty, misleading data or on the incomplete use of numbers. (CLG 1.1.3)	SE: <i>Physics & Society</i> 587 TWE: PJ 31
The student will recognize data that are biased. (CLG 1.1.4), (CLG 2.8.2), (CLG 5.6.2)	SE: 24-29 <i>Physics & Society</i> 587 TWE: PJ 31
The student will explain the factors that produce biased data. (CLG 1.1.5)	SE: 24-29 <i>History Connection</i> 18 <i>Physics & Society</i> 587 TWE: PJ 31
1.12.13 analyze the adequacy of the supporting evidence used to form conclusions, devise a plan, or solve a practical problem. (SFS 2.2)	
The student will determine the sources of error that limits the accuracy or precision of experimental results. (CLG 1.4.7)	SE: 24-29, 737-739 <i>History Connection</i> 18 TWE: AP 448
1.12.14 provide supporting evidence when forming conclusions, devising a plan or solving a practical problem. (SFS 2.2)	
The student will defend the need for verifiable data. (CLG 1.2.8)	SE: 6-10, 289-294, 375-376, 404-409, 626-632, 639-640, 729-731 <i>Physics & Society</i> 70, 334, 683
1.12.15 analyze and extend patterns.	
1.12.16 analyze conclusions and modify ideas based on new information from developmentally appropriate readings, data, and the ideas of others.	
The student will modify or affirm scientific ideas according to accumulated evidence. (CLG 1.1.2)	SE: 181-184, 191-192, 248-256, 289-294, 637-640, 705-712 <i>Physics & Society</i> 266, 334, 356, 587
1.12.17 describe to others how scientific information was used.	
Applications of Science	
1.12.18 apply scientific principles and/or concepts to understand a new situation.	
1.12.19 The student will apply skills, processes, and concepts of biology, chemistry, physics, and earth/space science to societal issues. (CLG 1.7.1)	SE: 6-9, 722-731 <i>Physics & Society</i> 70, 266, 334, 356, 587 <i>Physics & Technology</i> 178, 378, 428

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<i>The student will describe the role of science in the development of literature, art, and music. (CLG 1.7.3)</i>	SE: 364-367, 570 <i>Chemistry Connection</i> 384 <i>How It Works</i> 142 <i>Physics & Technology</i> 378 TWE: CD 379 TP 53 UM 383
<i>The student will apply chemistry to the concepts of biology, earth/space science, and environmental science. (CLG 4.6.1)</i>	SE: <i>Biology Connection</i> 723 <i>Chemistry Connection</i> 289, 312 <i>Physics & Technology</i> 316, 663
<i>The student will apply physics to the concepts of biology, earth/space science, and environmental science. (CLG 5.7.1)</i>	SE: 6-10, 185-190, 722-724 <i>Biology Connection</i> 620 <i>Earth Science Connection</i> 335, 566 <i>Physics & Technology</i> 178, 292, 428, 639, 732
<i>The student will investigate the role of chemistry in areas of human endeavor and achievement. (CLG 4.6.3)</i>	SE: <i>Biology Connection</i> 723 <i>Chemistry Connection</i> 289, 312 <i>Physics & Technology</i> 316, 663
<i>The student will investigate the role of physics in all areas of human endeavor and achievement. (CLG 5.7.3)</i>	SE: 185-190, 570-571, 586, 722-724, 855-860 <i>Physics & Society</i> 266, 356 <i>Physics & Technology</i> 178, 428, 732
1.12.20 defend a position on a scientific issue and take into account the different types of risks and benefits in formulating a plan of action. (SFS 2.3)	
<i>The student will investigate an issue such as climatic changes or electric power generation. (CLG 2.8.1)</i>	SE: 586-589, 692-696, 718-721, 725-731 <i>History Connection</i> 583 <i>Physics & Society</i> 266, 356, 587 <i>Physics Lab</i> 595 <i>Pocket Lab</i> 585
<i>The student will investigate a social issue related to physics such as alternate energy source, fiber optics in telecommunications, nuclear power, microwave technology, effect of power lines, etc. (CLG 5.6.1)</i>	SE: <i>Physics & Society</i> 266, 334, 356, 486, 587, 683 <i>Physics & Technology</i> 732 <i>Physics Lab</i> 727
1.12.21 The student will recognize that real problems have more than one solution and decisions to accept one solution over another are made on the basis of many issues. (CLG 1.1.1), (CLG 2.8.5), (CLG 5.6.3) (SFS 2.3)	
The student will explain why curiosity, honesty, openness, and skepticism are highly regarded in science. (CLG 2.8.4)	SE: 4-10, 24-29, 176-183, 191-192, 375-376, 382-383 <i>Physics & Society</i> 70, 266, 334, 587
Technology	
1.12.22 design, construct, and use models (e.g., math, computer, physical) to make predictions about actual events.	
<i>The student will use models and computer simulations to extend his/her understanding of scientific concepts. (CLG 1.4.8)</i>	SE: 646-659, 710-712, 811-816 <i>Physics Lab</i> 12, 69, 137, 179, 496, 612, 634

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1.12.23 demonstrate and explain how using existing tools extend knowledge and identify the limitations, which drive the need for new technologies (i.e., create improvements in observing, estimating, measuring, computing, collecting, and communicating scientific data and information).	
The student will explain how development of scientific knowledge leads to the creation of new technology and how technological advances allow for additional scientific accomplishments. (CLG 1.7.6)	SE: 4-11, 185-192, 289-294, 567-571, 628-636, 722-731 <i>Physics & Society</i> 70, 266, 334, 683
<i>1.12.24 explain that when designing a device, process, or system (e.g., manufacturing, marketing, operating, maintaining, replacing, and disposing of) risk analysis and technology assessment determines how it will be employed.</i>	
1.12.26 explain that science and technology have strongly influenced the course of history and cite how human inventiveness has brought new risks as well as improvements to human existence.	
The student will identify and evaluate the impact of scientific ideas and/or advancements in technology on society. (CLG 1.7.2)	SE: 4-11, 570-571, 682-686 <i>Physics & Society</i> 70, 334, 587 <i>Physics & Technology</i> 178, 378, 519, 732
History of Science	
<i>1.12.27 describe how various cultures from ancient times to the present have made contributions that led to current scientific ideas and technological invention.</i>	
<i>1.12.28 explain that scientific careers differ from one another in what is studied, techniques used, where studied, and outcomes sought but they share a common purpose and philosophy and are part of the same scientific enterprise.</i>	
<i>The student will investigate career possibilities in the various areas of science. (CLG 1.7.5)</i>	SE: 6-10 <i>Help Wanted</i> 122, 165, 319, 332, 574, 629, 662, 694, 721
4.0 Chemistry - Students will use scientific skills and processes to explain the composition, structure, and interactions of matter in order to support the predictability of structure and energy transformations.	
Structure of Matter	
4.12.1 use observation of the properties of matter to predict its structure and changes to its structure.	
The student will select and use appropriate devices to measure directly or indirectly the length, mass, volume, or temperature of a substance (centigram balances, graduated cylinders & pipettes, metric rulers, thermometers & temperature probes). (CLG 4.1.1)	SE: 24-29, 275-277 <i>Physics Lab</i> 32, 58, 69, 137, 179, 281, 362 TWE: A 626
The student will gather and interpret data related to physical and chemical properties of matter such as density and percent composition (constructing data tables, graphing linear relationship, appropriate technology to analyze data). (CLG 4.1.2)	SE: 278-283, 285-288, 315-320, 351, 396-398, 647-650, 875 <i>Chemistry Connection</i> 312 TWE: CC 627
The student will distinguish among metallic, ionic, and covalent solids in terms of observable properties (solubility, melting point, boiling point, conductivity). (CLG 4.2.4)	SE: 279, 285-288 TWE: DE 282 DEV 670
The student will illustrate the structure of the atom and describe the characteristics of the particles found there (protons, neutrons, & electrons; nucleus). (CLG 4.2.1)	SE: 604-609, 646-655, 658-659, 692-696, 705-708, 710-712 <i>Physics Lab</i> 656 TWE: CC 469

CONTENT STANDARDS	PAGE REFERENCES
Physical or Chemical Changes	
4.12.3 explain how the number and arrangement of electrons can be used to predict when an atom will transfer or share electrons to form a bond and explain how the resulting materials are different from the original materials (i.e., organic, biochemical, and inorganic examples).	
The student will demonstrate that the arrangement and number of electrons determine the properties of an element and that these properties repeat in a periodic manner illustrated by their arrangement in the periodic table (atomic number, mass number, valence electrons, chemical properties/families). (CLG 4.2.2)	SE: 647-649 TWE: A 678 CU 677 RE 671 UM 672
The student will explain how atoms interact with other atoms through the transfer and sharing of electrons in the formation of chemical bonds (characteristics of a neutral atom, formation of ions, ionic bonding, covalent bonding). (CLG 4.2.3)	SE: (Some medical treatments with radioisotopes depend on chemical bond formation.) <i>Biology Connection 723</i> TWE: CC 469
The student will summarize that the properties of a molecule are determined by the number and types of atoms it contains and how these compounds are arranged (determine the types and numbers of atoms represented by a given formula, polar and nonpolar molecules). (CLG 4.2.5)	SE: <i>Chemistry Connection 312</i> TWE: CBI 490 CC 469, 627
The student will explain why organic compounds have such diverse properties and give examples of how they have had an impact on society (unique characteristics of carbon, fuels and plastics). (CLG 4.2.6)	SE: (Major impacts of organic compounds arise from uses as fossil fuels, and presence in living organisms.) <i>Earth Science Connection 263</i> TWE: CBI 490
Classification of Matter	
The student will illustrate that substances can be represented by formulas (know that symbols are used to represent elements; identify the atomic mass of the element; write formulas for compounds given the name of the compound; name binary compounds given the formula; calculate the molecular weight of a compound given the periodic table). (CLG 4.4.1)	SE: (Chemical formulas provide insight into chemical applications.) TWE: CC 511
The student will show that chemical reactions can be represented by symbolic or word equations that specify all reactants and products involved. (CLG 4.4.2)	SE: (Chemical reactions are the basis for many useful products and applications.) <i>Physics & Society 70</i> TWE: CC 262, 511
The student will use the law of conservation of mass and energy to balance simple equations (use appropriate coefficients to balance a given symbolic equation). (CLG 4.4.3)	SE: (Evaluation of any balanced system must consider energy and mass conservation.) 258 <i>Problem Solving Strategies 260</i> TWE: CC 262 CD 697

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The student will classify chemical reactions into general types based on the nature of the observed changes (synthesis and decomposition, combustion, single and double displacement). (CLG 4.4.4)	SE: (Reactions of all types are the basis for many material applications.) <i>Physics & Society</i> 70 TWE: CC 262, 511
The student will demonstrate that adjusting quantities of reactants will affect the amounts of products formed (use the coefficients of a balanced equation to predict amounts of reactants and products). (CLG 4.4.5)	SE: (Medical uses of radioisotopes often depend on changing quantities of substances in the body.) <i>Biology Connection</i> 723
The student will describe a neutralization reaction (properties of acids and bases, characteristics of weak and strong acids and bases, characteristics of salts, indicators, pH scale). (CLG 4.4.6)	SE: (Alkaline batteries use neutralization of by-products to ensure longer useful life.) TWE: CC 511
4.12.5 explain that all matter has structure and the structure serves as the basis for the properties of and the changes in matter.	
The student will demonstrate how matter may be identified and classified in various ways based upon common properties (states of matter; elements, compounds, mixtures, solutions; metals/nonmetals). (CLG 4.1.3)	SE: 285-287, 300-302, 314-315, 465-466, 670-676 TWE: CBI 490
Conservation of Matter and Energy	
4.12.6 analyze the interrelationship of mass and energy associated with chemical, physical, and nuclear changes (i.e., endothermic, exothermic, kinetic molecular theory, rate of change, and gas laws).	
The student will illustrate that heat energy in a material consists of the ordered and disordered motions of its colliding particles (phase changes). (CLG 4.3.1)	SE: 274-276, 285-287, 291-294, 314-315 <i>Physics Lab</i> 281 <i>Pocket Lab</i> 284 TWE: MIN 288
The student will explain why the interactions among particles involve a change in the energy system (exothermic change, endothermic change, specific heat). (CLG 4.3.2)	SE: 274-275, 278-280, 282-283, 286-287, 291-294, 314-318 <i>Physics Lab</i> 281
The student will conclude that the conservation of mass and energy holds true for all systems, and that the total amount of energy in any closed system remains constant (total amount of energy in any closed system remains constant). (CLG 4.3.3)	SE: 258-261, 282, 591, 628-629, 636 TWE: CD 697 FO 248 RT 525 UM 264
The student will describe the observed changes in pressure, in volume, or temperature of a sample of gas in terms of the behavior of particles (matter is made of small particles; particles are in constant motion; the collisions among particles are elastic collisions). (CLG 4.3.4)	SE: 274-275, 301, 841-851

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5.0 Physics - Students will use scientific skills and processes to explain the interactions of matter and energy and the energy transformations that occur.	
Mechanics	
5.12.1 use algebra and geometry to apply the concepts of energy, force (i.e., Newton's Law , gravitation, friction), and momentum to explain the behavior of objects (i.e., linear and rotational motion , projectiles, collisions).	
The student will use analytical techniques appropriate to the study of physics (symbolically representing vector quantities, using signs to represent directions, selecting and using appropriate equipment for measuring and investigating, using appropriate units and applying dimensional analysis, manipulating equations). (CLG 5.1.1)	SE: 24-29, 53-59, 64-68, 72-74, 817-824, 833-838 <i>Physics Lab</i> 137, 281, 446 <i>Problem Solving Strategies</i> 31
The student will use algebraic and geometric concepts to describe an object's motion (direction, position, distance/displacement, speed/velocity, motion with a constant acceleration, one and two dimensional motion, frames of reference). (CLG 5.1.2)	SE: 44-51, 53-59, 68, 82-88, 90-92, 94-99, 104-105, 150-161, 163-168 <i>Pocket Lab</i> 74
The student will analyze and explain how changes in an object's motion are described by Newton's Laws (balanced/unbalanced forces, inertia, acceleration, force, and mass, action/reaction). (CLG 5.1.3)	SE: 118-121, 126-130, 134-136, 150-152, 155-161, 163-168 <i>Physics Lab</i> 137, 162
The student will analyze the behavior of forces (recognize the four forces of nature, comparison of relative magnitude, inverse square nature of gravitational and electromagnetic forces, relation to work and energy). (CLG 5.1.4)	SE: 118-125, 130-134, 139-143, 150, 155-159, 163-168, 181-192, 567-569 <i>Physics Lab</i> 137 TWE: CR 138
The student will analyze systems with regard to the conservation laws of momentum and energy (conservation of momentum, conservation of energy). (CLG 5.1.5)	SE: 258-261, 282, 510, 591, 628-629, 636 TWE: CD 697 FO 248 RT 525 UM 264
5.12.2 explain the relationship between the universal law of gravitation and the force of gravity on an object at the surface of the Earth.	
Thermodynamics	
5.12.7 analyze and apply the concepts of thermodynamics (i.e., laws, heat energy transfer, equilibrium).	
The student will relate thermodynamics to the balance of energy in a system (heat transfer, thermal equilibrium, entropy). (CLG 5.3.1)	SE: 274-280, 282-283, 285-294 <i>Physics Lab</i> 281 <i>Pocket Lab</i> 284 TWE: CT 558

CONTENT STANDARDS	PAGE REFERENCES
Electricity & Magnetism	
5.12.10 analyze electric fields and their effect on charges and electric circuits (i.e., series, parallel, and complex), magnets and magnetic fields , and explain how electricity and magnetism affect one another (i.e., motors and generators).	
The student will describe the types of electric charges and the forces that exist between them (magnitude, sign, Coulomb's Law). (CLG 5.2.1)	SE: 462-464, 468-472, 497-498 <i>Physics Lab</i> 467 <i>Problem Solving Strategies</i> 474 TWE: A 466
The student will describe the sources and effects of electric and magnetic fields (static charge, moving charges, simple circuits, permanent magnets). (CLG 5.2.2)	SE: 482-485, 488-491, 497-501 <i>Biology Connection</i> 493 TWE: A 487 CUL 492
The student will describe how different kinds of materials respond to electric and magnetic fields (conductors, insulators, semiconductors, magnetic materials). (CLG 5.2.3)	SE: 493, 498-500, 559-563, 567-573 <i>Earth Science Connection</i> 566 <i>How It Works</i> 565 <i>Pocket Lab</i> 564 TWE: CBI 490 TP 494 UM 557
The student will explain the principle of electromagnetic induction and its applications (motors, generators). (CLG 5.2.4)	SE: 570-571, 582-584, 586-588, 590-594, 613-619 <i>Physics Lab</i> 595 <i>Pocket Lab</i> 585 TWE: CCR 596 CU 589
Wave Interactions	
5.12.14 use energy transformations and physical effects to explain the interactions of waves and physical effects (i.e., Doppler effect and interference patterns).	
The student will describe and demonstrate how waves can be used to transmit energy (physical, electromagnetic). (CLG 5.4.1)	SE: 328-332, 350-354, 363, 659-664, 855-860 <i>Earth Science Connection</i> 335 <i>FYI</i> 365 <i>Physics & Society</i> 334
The student will compare the propagation of mechanical waves (longitudinal, transverse). (CLG 5.4.2)	SE: 328-329, 336-343, 350-355, 363 <i>Earth Science Connection</i> 335 <i>Physics & Society</i> 334 <i>Physics Lab</i> 330 TWE: DE 332-333
The student will describe and mathematically calculate wave characteristics (wavelength, frequency/period, velocity, amplitude). (CLG 5.4.3)	SE: 331-333, 350-354, 358-361, 447-450 <i>Physics Lab</i> 330, 362, 446
The student will describe and demonstrate the general behavior of waves (reflection, refraction, diffraction, superposition, interference, Doppler effect). (CLG 5.4.4)	SE: 336-343, 350-355, 358-366, 382-388, 394-398, 400-401, 403-409, 449-455, 659-664 <i>Physics Lab</i> 399

CONTENT STANDARDS	PAGE REFERENCES
Nuclear Energy	
5.12.19 describe developments in modern physics (i.e., nuclear fission, photoelectric effect, wave-particles duality, energy of light) and their applications (e.g., <i>nuclear power, MRI</i>). (i.e., <i>semiconductors</i>).	
The student will cite evidence of the quantum nature of matter and its applications (energy of light waves, photoelectric effect, wave/particle duality, applications). (CLG 5.5.1)	SE: 626-630, 635-640, 650-655, 658-664 FYI 632 <i>Problem Solving Strategies</i> 631
The student will explain the processes associated with atomic energy and its applications (atomic energy, radioactive decay, fission, fusion). (CLG 5.5.2)	SE: 692-696, 701-708, 710-712, 722-731 FYI 718 <i>How It Works</i> 709 <i>Physics & Technology</i> 732 <i>Physics Lab</i> 700 TWE: CC 698 MIN 697

Codes Used for TWE Pages

A	Activity
AP	Applying Physics
CBI	Connections to Biology
CC	Connections to Chemistry
CCR	Connections to Criminology
CD	Concept Development
CR	Content Refresher
CT	Critical Thinking
CU	Checking for Understanding
CUL	Cultural Diversity
DE	Demonstration
DEV	Discrepant Event
FO	Focus
MIN	Meeting Individual Needs
PJ	Physics Journal
RE	Reinforcement
RT	Reteach
TP	Tech Prep
UM	Uncovering Misconceptions