

**GLENCOE CORRELATION**  
**CHEMISTRY: CONCEPTS AND APPLICATIONS**  
**MARYLAND**  
 Science Content Standards  
 Grade Twelve

CONTENT STANDARDS	PAGE REFERENCES
<b>1.0 Skills and Processes - Students will demonstrate the thinking and acting inherent in the practice of science.</b>	
<b>Scientific Inquiry</b>	
By the end of <b>grade 12</b> , 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: <i>Chemistry and Society</i> 146, 447, 537 <i>Chemistry and Technology</i> 176-178, 288-291, 354-355, 590-592, 754-755 <i>Literature Connection</i> 26, 96
<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: 20, 36-37, 788-790, 799-801 <i>ChemLab</i> 56-57, 136-137, 328-329, 362-363, 542-543, 606-607
The student will use relationships discovered in the lab to explain phenomena observed outside the laboratory. (CLG 1.2.7)	SE: <i>ChemLab</i> 328-329, 504-505, 650-652, 722-723 <i>MiniLab</i> 122, 388, 452, 503, 568, 712
The student will create and/or interpret graphics (scale drawings, photographs, digital images, etc.). (CLG 1.5.4)	SE: 311, 348-349, 352-353, 364-365, 383, 392, 426, 440, 804-808 <i>ChemLab</i> 362-363
1.12.2 formulate questions that lead to a testable <b>hypothesis</b> , which demonstrates the logical connections between the scientific concepts and the design of an <b>investigation</b> .	
The student will identify meaningful, answerable scientific questions. (CLG 1.2.1)	SE: 59, 85, 373-375 <i>Chemistry and Society</i> 537 <i>ChemLab</i> 38-39, 56-57, 100-101, 650-652 <i>Everyday Chemistry</i> 534, 657
<i>The student will pose meaningful, answerable, scientific questions. (CLG 1.2.2)</i>	SE: 59 <i>Chemistry and Society</i> 32, 146, 537, 659 <i>Chemistry and Technology</i> 108-109, 288-291, 728-729 <i>Everyday Chemistry</i> 160, 248-249
1.12.3 use observations, research, and select appropriate scientific information to form <b>predictions</b> and <b>hypotheses</b> .	
The student will formulate a working hypothesis. (CLG 1.2.3)	SE: 59 <i>Chemistry and Technology</i> 390, 424-425, 470-471, 484, 573 <i>ChemLab</i> 136-137 <i>Everyday Chemistry</i> 397, 534 <i>MiniLab</i> 89
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: 20, 36-37, 788-793 <i>ChemLab</i> 56-57, 100-101, 136-137, 206-207, 362-363, 384-385, 650-652

CONTENT STANDARDS	PAGE REFERENCES
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: 36-37, 59, 540-541, 599-605 <i>ChemLab</i> 136-137, 172-173, 236-237, 384-385, 422-423 <i>MiniLab</i> 312
1.12.5 <i>demonstrate safety when conducting an investigation.</i>	
The student will recognize safe laboratory procedures. (CLG 1.3.2)	SE: 839-840 <i>ChemLab</i> 56-57, 136-137, 384-385, 504-505, 542-543, 560-561, 722-723
<i>The student will demonstrate safe handling of the chemicals and materials of science. (CLG 1.3.3)</i>	SE: 641-645, 768-771, 774, 839-840 <i>Everyday Chemistry</i> 194, 466, 715, 777
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: 36-37, 198-199, 302-304, 408-409, 426-429, 601-613, 711-714, 719-721, 791-803 <i>ChemLab</i> 56-57
The student will recognize the important role that mathematics serves when solving problems in physics. (CLG 5.7.2)	SE: 36-37, 66-68, 74-75, 234-235, 348-353, 382-383, 391-395 TWE: IS 246 MIN 263
<i>The student will recognize mathematics as an integral part of the scientific process. (CLG 1.7.4)</i>	SE: 36-37, 198-199, 302-304, 408-409, 426-429, 601-613, 711-714, 719-721, 791-803 <i>ChemLab</i> 56-57
The student will use ratio and proportion in appropriate situations to solve problems. (CLG 1.6.1)	SE: 198-199, 350, 382-386, 391-398, 406-409, 414-419, 426-429, 539-541, 756-757 <i>ChemLab</i> 236-237
<i>The student will use computers and/or graphing calculators to perform calculations for tables, graphs, or spreadsheets. (CLG 1.6.2)</i>	SE: 799-800, 804-808 TWE: AS 385
The student will express and/or compare small and large quantities using scientific notation and relative order of magnitude. (CLG 1.6.3)	SE: 405-408, 416, 795-800 <i>Fact of the Matter</i> 360 TWE: EX 413
<i>The student will manipulate quantities and/or numerical values in algebraic equations. (CLG 1.6.4)</i>	SE: 195-199, 379-380, 392-393, 395, 416-421, 426-429, 801-803 TWE: MIN 263, 373, 383
The student will judge the reasonableness of an answer. (CLG 1.6.5)	SE: <i>ChemLab</i> 56-57, 206-207, 362-363 <i>History Connection</i> 271 <i>Literature Connection</i> 26 <i>MiniLab</i> 21, 30, 89
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>ChemLab</i> 136-137, 172-173, 328-329, 362-363, 384-385 <i>Everyday Chemistry</i> 397, 534 <i>MiniLab</i> 89, 775
<i>The student will develop and demonstrate skills in using lab and field equipment to perform investigative techniques. (CLG 1.3.1)</i>	SE: 20, 36-37, 788-790, 799-801 <i>ChemLab</i> 56-57, 136-137, 328-329, 362-363, 542-543, 606-607

CONTENT STANDARDS	PAGE REFERENCES
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: 364-365, 391-392 <i>ChemLab</i> 16-17, 100-101, 172-173, 266-267, 362-363, 384-385, 456-457, 722-723
The student will use computers and/or graphing calculators to produce tables, graphs, and spreadsheet calculations. (CLG 1.5.5)	SE: 799-800, 804-808 TWE: AS 385
1.12.8 analyze appropriate data to identify <b>trends</b> to form <b>conclusions</b> 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>ChemLab</i> 56-57, 136-137, 422-423, 650-652 <i>MiniLab</i> 89, 262, 312, 375, 568, 726
The student will use experimental data from various investigators to validate results. (CLG 1.4.3)	SE: <i>ChemLab</i> 8-9, 38-39, 100-101, 236-237, 328-329, 384-385, 504-505, 542-543, 606-607, 722-723
The student will determine the relationships between quantities and develop the mathematical model that describes these relationships. (CLG 1.4.4)	SE: 391-398, 406-409, 414-419, 426-428, 719-721 <i>ChemLab</i> 362-363, 384-385, 542-543, 722-723, 752-753
The student will check graphs to determine that they do not misrepresent results. (CLG 1.4.5)	SE: 382-383, 392, 540, 711-714, 805-808 TWE: VL 364
The student will describe trends revealed by data. (CLG 1.4.6)	SE: 88-91, 243-247, 364-365, 391-396, 482-483 <i>ChemLab</i> 384-385, 504-505 <i>MiniLab</i> 375 TWE: DE 386-387
The student will use analyzed data to confirm, modify, or reject an hypothesis. (CLG 1.4.9)	SE: <i>ChemLab</i> 136-137, 172-173, 328-329, 362-363, 384-385 <i>Everyday Chemistry</i> 397, 534 <i>MiniLab</i> 89, 775
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: <i>ChemLab</i> 16-17, 100-101, 172-173, 266-267, 362-363, 384-385, 456-457, 504-505, 722-723
The student will explain scientific concepts and processes through drawing, writing, and/or oral communication. (CLG 1.5.2)	SE: 311, 348-349, 352-353, 364-365, 383, 392, 426, 440, 804-808 <i>ChemLab</i> 362-363
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: 364-365, 391-392 <i>ChemLab</i> 16-17, 100-101, 172-173, 266-267, 362-363, 384-385, 456-457, 722-723
<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: 799-800, 804-808 TWE: AS 385

CONTENT STANDARDS	PAGE REFERENCES
The student will communicate conclusions derived through a synthesis of ideas. (CLG 1.5.9)	SE: <i>ChemLab</i> 8-9, 206-207, 328-329, 384-385, 722-723 <i>Everyday Chemistry</i> 19, 160, 501, 683, 777
<b>Critical Thinking</b>	
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: 143-147, 198-199, 218-220, 342-345, 443-444, 713-714, 733-737 <i>Chemistry and Society</i> 32, 537 <i>Chemistry and Technology</i> 728-729
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: 86-94, 102-105, 143-147, 202-209, 302-314, 622-636 <i>Chemistry and Technology</i> 470-471 <i>ChemLab</i> 100-101 TWE: DE 88
1.12.12 critique scientific information in order to detect <b>bias</b> 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: 52-55, 87 <i>Chemistry and Society</i> 32 <i>History Connection</i> 58 <i>MiniLab</i> 25 TWE: CB 91 CJ 78 CM 104, 346 DI 90
The student will recognize data that are biased. (CLG 1.1.4), (CLG 2.8.2), (CLG 5.6.2)	SE: <i>ChemLab</i> 38-39, 56-57, 542-543, 722-723 TWE: CD 15 DE 6-7
The student will explain the factors that produce biased data. (CLG 1.1.5)	SE: <i>ChemLab</i> 38-39, 56-57, 542-543, 722-723 TWE: CD 15 CM 419 DE 6-7
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: <i>ChemLab</i> 38-39, 56-57, 542-543, 722-723 <i>How It Works</i> 569 TWE: CM 419
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: <i>Chemistry and Society</i> 32 <i>Chemistry and Technology</i> 573 <i>ChemLab</i> 542-543 <i>Everyday Chemistry</i> 466, 501, 777 <i>How It Works</i> 569 <i>People in Chemistry</i> 12-13

CONTENT STANDARDS	PAGE REFERENCES
<i>1.12.15 analyze and extend patterns.</i>	
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: 52-55, 61-79, 86-94, 230-242 <i>Chemistry and Society</i> 32, 146, 537 <i>MiniLab</i> 25, 375, 775
1.12.17 describe to others how scientific information was used.	
<b>Applications of Science</b>	
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: <i>Biology Connection</i> 487, 772 <i>Chemistry and Society</i> 60, 447, 495, 659 <i>History Connection</i> 271, 307 <i>How It Works</i> 468, 569
<i>The student will describe the role of science in the development of literature, art, and music. (CLG 1.7.3)</i>	SE: 98, 106 <i>Art Connection</i> 163, 346, 411, 759 <i>Everyday Chemistry</i> 594 <i>Literature Connection</i> 26, 96 TWE: AC 570
<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> 203, 280, 487, 632, 772 <i>Earth Science Connection</i> 524, 727 <i>Health Connection</i> 610, 693 <i>History Connection</i> 271
<i>The student will apply physics to the concepts of biology, earth/space science, and environmental science. (CLG 5.7.1)</i>	SE: <i>Chemistry and Technology</i> 240-241, 728-729, 754-755 <i>Physics Connection</i> 73, 232, 566
<i>The student will investigate the role of chemistry in areas of human endeavor and achievement. (CLG 4.6.3)</i>	SE: <i>Chemistry and Society</i> 32, 60, 146, 447, 495 <i>Chemistry and Technology</i> 216-217, 288-291, 590-592 <i>How It Works</i> 167, 710
<i>The student will investigate the role of physics in all areas of human endeavor and achievement. (CLG 5.7.3)</i>	SE: <i>Chemistry and Technology</i> 240-241, 728-729, 754-755 <i>How It Works</i> 410 <i>Physics Connection</i> 73, 232, 566
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: 637-639, 725-726, 730-732, 761-767, 778 <i>Chemistry and Technology</i> 728-729 <i>How It Works</i> 614
<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: 637-639, 725-726, 730-732, 761-767, 778 <i>Chemistry and Technology</i> 728-729 <i>How It Works</i> 614

CONTENT STANDARDS	PAGE REFERENCES
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: 53-55, 63-65, 88-94, 238 <i>Chemistry and Society</i> 146 <i>ChemLab</i> 8-9 <i>History Connection</i> 58, 307 <i>People in Chemistry</i> 12-13 <i>Physics Connection</i> 232
<b>Technology</b>	
1.12.22 <i>design, construct, and use <b>models</b> (e.g., math, computer, physical) to make <b>predictions</b> about actual events.</i>	
<i>The student will use models and computer simulations to extend his/her understanding of scientific concepts. (CLG 1.4.8)</i>	SE: 10-11, 65, 230-242, 302-314, 318-325, 342-347 <i>MiniLab</i> 135, 262 TWE: DE 54-55, 198-199
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: <i>Everyday Chemistry</i> 194, 221, 320, 353, 455, 571, 715, 777 <i>How It Works</i> 410, 545, 614
1.12.24 <i>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: <i>Everyday Chemistry</i> 194, 221, 320, 353, 455, 571, 715, 777 <i>How It Works</i> 410, 569, 614
<b>History of Science</b>	
1.12.27 <i>describe how various cultures from ancient times to the present have made contributions that led to current scientific ideas and technological invention.</i>	
1.12.28 <i>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: <i>People in Chemistry</i> 12-13, 212-213, 316-317, 448-449, 490-491, 596-597, 634-635, 678-679

CONTENT STANDARDS	PAGE REFERENCES
<b>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.</b>	
<b>Structure of Matter</b>	
4.12.1 use observation of the properties of <b>matter</b> 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: 36-37, 785-794 <i>ChemLab</i> 38-39, 206-207, 362-363, 384-385, 560-561, 722-723 <i>How It Works</i> 410 <i>MiniLab</i> 21
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: 36-37, 426-427 <i>Chemistry and Technology</i> 176-178 <i>ChemLab</i> 38-39, 100-101, 172-173, 722-723 <i>Everyday Chemistry</i> 110, 248-249, 320
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: 143-147, 154-157, 170-171, 364-365 <i>Chemistry and Technology</i> 240-242 <i>ChemLab</i> 16-17, 38-39, 172-173, 362-363 <i>MiniLab</i> 712
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: 61-65, 69-70, 74-79, 98-99, 102-105, 131-132, 230-239, 243-251, 746-750, 762-767 TWE: MIN 72
<b>Physical or Chemical Changes</b>	
4.12.3 explain how the number and arrangement of <b>electrons</b> can be used to predict when an <b>atom</b> 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: 74-79, 95-99, 131-133, 231-235, 238-239, 243-247, 258-281, 292-295 <i>ChemLab</i> 100-101, 236-237
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: 98-99, 104-105, 111-113, 120-127, 131-135, 138-147, 154-166, 302-311, 318-325
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: 120-127, 138-147, 154-159, 170-171, 174-183, 305-311, 315-325, 330-333 <i>ChemLab</i> 172-173 <i>Everyday Chemistry</i> 466, 685

<b>CONTENT STANDARDS</b>	<b>PAGE REFERENCES</b>
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: 622-633, 640-645, 648-649, 654-661, 670-682, 686-691 <i>ChemLab</i> 650-652 <i>MiniLab</i> 646
<b>Classification of Matter</b>	
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: 24-33, 92-93, 138-147, 154-165, 174-183, 305-314, 406-409, 622-636, 654-658, 670-691
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: 190-195, 198-199, 203-209, 268-269, 276-277, 286, 516-520, 556-559 <i>Biology Connection</i> 280 <i>Everyday Chemistry</i> 275
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: 198-199, 414-419, 480-486, 488-489, 517-523, 556-559, 585, 602-603 <i>Chemistry and Technology</i> 424-425 TWE: DE 194-195
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: 203-205, 208-209, 734-735 <i>Chemistry and Technology</i> 216-217 <i>ChemLab</i> 136-137, 206-207, 674-675, 722-723 TWE: CJ 202
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: 198-199, 214-215, 404-409, 414-416, 421, 539-541 <i>ChemLab</i> 266-267 TWE: DE 410-411, 426-427, 532-533
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: 488-494, 497-503, 506-508, 516-530, 539-541 <i>ChemLab</i> 542-543 <i>MiniLab</i> 532 TWE: IS 536
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: 34-35, 86-94, 102-105, 143-147, 154-161, 170-183 <i>Chemistry and Society</i> 659 <i>Chemistry and Technology</i> 176-178 <i>ChemLab</i> 422, 456

CONTENT STANDARDS	PAGE REFERENCES
<b>Conservation of Matter and Energy</b>	
4.12.6 analyze the interrelationship of <b>mass</b> and energy associated with chemical, physical, and <b>nuclear changes</b> (i.e., endothermic, exothermic, kinetic molecular theory, rate of change, and <b>gas laws</b> ).	
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: 342-345, 348-351, 360-361, 364-365, 372-375, 386, 392 <i>ChemLab</i> 362-363
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: 42-43, 195, 360-361, 445, 708-714 <i>ChemLab</i> 362-363 <i>MiniLab</i> 196 TWE: DE 706-707, 716-717
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: 41-43, 198-199, 711-712, 719-720, 730-731 TWE: CB 708 CD 54 DE 36-37 DI 44 RM 339
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: 342-344, 351-352, 365, 372-375, 386, 392 TWE: CB 396 QD 391
<b>5.0 Physics - Students will use scientific skills and processes to explain the interactions of matter and energy and the energy transformations that occur.</b>	
<b>Mechanics</b>	
5.12.1 use algebra and geometry to apply the concepts of energy, <b>force</b> (i.e., <b>Newton's Law</b> , gravitation, friction), and momentum to explain the behavior of objects (i.e., linear and rotational <b>motion</b> , 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: 757, 785-803 <i>ChemLab</i> 752-753 <i>MiniLab</i> 234, 763 TWE: CB 776 DE 746-747, 774-775 IS 246
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)	Motion is qualitatively discussed on pages SE: 342 <i>MiniLab</i> 343 <i>Physics Connection</i> 566
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: <i>Physics Connection</i> 566 TWE: IS 246

CONTENT STANDARDS	PAGE REFERENCES
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: <i>Physics Connection</i> 566
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: 711-712, 719-720, 730-731 TWE: CB 708 CD 54
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.	
<b>Thermodynamics</b>	
5.12.7 analyze and apply the concepts of thermodynamics (i.e., laws, <b>heat energy</b> 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: 711-712, 716-718, 730-731 TWE: CB 708 CJ 714 CM 720
<b>Electricity &amp; Magnetism</b>	
5.12.10 analyze <b>electric fields</b> and their effect on charges and <b>electric circuits</b> (i.e., <b>series, parallel,</b> and complex), magnets and <b>magnetic fields</b> , and explain how electricity and <b>magnetism</b> 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: 62 TWE: MIN 263
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: 602-604 <i>Everyday Chemistry</i> 571
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: 111-112 <i>ChemLab</i> 100-101 <i>Everyday Chemistry</i> 571 TWE: CJ 595 DE 498-499
The student will explain the principle of electromagnetic induction and its applications (motors, generators). (CLG 5.2.4)	An application of electromagnets is on page SE: <i>How it Works</i> 410
<b>Wave Interactions</b>	
5.12.14 use <b>energy transformations</b> and physical effects to explain the interactions of waves and physical effects (i.e., <b>Doppler effect</b> and <b>interference patterns</b> ).	
The student will describe and demonstrate how waves can be used to transmit energy (physical, electromagnetic). (CLG 5.4.1)	SE: 70-72, 233
The student will compare the propagation of mechanical waves (longitudinal, transverse). (CLG 5.4.2)	SE: 70-71
The student will describe and mathematically calculate wave characteristics (wavelength, frequency/period, velocity, amplitude). (CLG 5.4.3)	SE: 70-72 TWE: MIN 75

CONTENT STANDARDS	PAGE REFERENCES
The student will describe and demonstrate the general behavior of waves (reflection, refraction, diffraction, superposition, interference, Doppler effect). (CLG 5.4.4)	SE: 74 TWE: QD 71
<b>Nuclear Energy</b>	
5.12.19 describe developments in modern physics (i.e., <b>nuclear fission, photoelectric effect, wave-particles duality, energy of light</b> ) and their applications (e.g., <i>nuclear power, MRI</i> ). (i.e., semiconductors).	
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: 233-235 TWE: CB 238 IS 246 MIN 75, 232
The student will explain the processes associated with atomic energy and its applications (atomic energy, radioactive decay, fission, fusion). (CLG 5.5.2)	SE: 762-766, 768-771, 774-776 <i>Biology Connection 772</i>

### Codes Used for TWE Pages

AC	Across the Curriculum
AS	Assessment
CB	Content Background
CD	Concept Development
CJ	Chemistry Journal
CM	Correcting Misconceptions
DE	Demonstration
DI	Discussion
EX	Extension
IS	Integrating the Sciences
MIN	Meeting Individual Needs
QD	Quick Demo
RM	Revealing Misconceptions
VL	Visual Learning