

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
SCIENCE STANDARD 1	
Nature and Application of Science and Technology - Science is a human endeavor involving knowledge learned through inquiring about the natural world. Scientific claims are evaluated and knowledge changes as a result of using the abilities and understandings of inquiry. The pursuit of scientific knowledge is a continuous process involving diverse people throughout history. The practice of science and the development of technology are critical pursuits of our society.	
Strand - Understandings and Abilities of Scientific Inquiry	
- Enduring Understanding: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.	
- Essential Questions: What makes a question scientific? What constitutes evidence? When do you know you have enough evidence? Why is it necessary to justify and communicate an explanation?	
Grades 9-12	
1. Understand that: Scientists conduct investigations for a variety of reasons including to explore new phenomena, to replicate other's results, to test how well a theory predicts, to develop new products, and to compare theories.	SE/TE: 15-17, 27
- Be able to: Identify and form questions that generate a specific testable hypothesis that guide the design and breadth of the scientific investigation.	SE/TE: 17
2. Understand that: Science is distinguished from other ways of knowing by the use of empirical observations, experimental evidence, logical arguments and healthy skepticism.	SE/TE: 15-16, 19, 27-28
- Be able to: Design and conduct valid scientific investigations to control all but the testable variable in order to test a specific hypothesis.	SE/TE: 17, 39, 51, 92, 120, 142, 149, 184, 200, 207, 238, 254, 279, 295, 324, 328, 354, 374, 399, 404, 435, 437, 467, 475, 491, 508, 519, 545, 551, 571, 583, 600, 635, 662, 670, 699, 717, 750, 752, 818, 849, 887, 896
3. Understand that: Theories in science are well-established explanations of natural phenomena that are supported by many confirmed observations and verified hypotheses. The application of theories allows people to make reasonable predictions. Theories may be amended to become more complete with the introduction of new evidence.	SE/TE: 16, 19, 28, 31, 124

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
<p>- Be able to: Collect accurate and precise data through the selection and use of tools and technologies appropriate to the investigations. Display and organize data through the use of tables, diagrams, graphs, and other organizers that allow analysis and comparison with known information and allow for replication of results.</p>	<p>SE/TE: 51, 72, 92, 120, 142, 149, 180, 200, 207, 238, 254, 279, 295, 324, 328, 374, 399, 435, 467, 475, 508, 545, 571, 583, 635, 662, 670, 699, 717, 752, 849, 887, 896</p>
<p>4. Understand that: Investigating most real-world problems requires building upon previous scientific findings and cooperation among individuals with knowledge and expertise from a variety of scientific fields. The results of scientific studies are considered valid when subjected to critical review where contradictions are resolved and the explanation is confirmed.</p>	<p>SE/TE: 18-19, 27-28</p>
<p>- Be able to: Construct logical scientific explanations and present arguments which defend proposed explanations through the use of closely examined evidence.</p>	<p>SE/TE: 17, 39, 51, 92, 120, 142, 149, 180, 184, 200, 207, 238, 254, 279, 295, 324, 328, 354, 374, 399, 404, 435, 437, 467, 475, 491, 508, 519, 545, 583, 600, 635, 670, 699, 717, 752, 849, 887, 896</p>
<p>5. Understand that: In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. (American Association for the Advancement of Science, 2001)</p>	<p>SE/TE: 19</p>
<p>- Be able to: Communicate and defend the results of scientific investigations using logical arguments and connections with the known body of scientific information.</p>	<p>SE/TE: 17, 39, 51, 92, 120, 142, 149, 180, 184, 200, 207, 238, 254, 279, 295, 324, 328, 354, 374, 399, 404, 435, 437, 467, 475, 491, 508, 519, 545, 583, 600, 635, 670, 699, 717, 752, 818, 849, 887, 896</p>
<p>6. Understand that: Knowledge and skill from sources other than science are essential to scientific inquiry. These include mathematics, reading, writing, and technology.</p>	<p>SE/TE: 11, 19, 23</p>
<p>- Be able to: Use mathematics, reading, writing and technology when conducting scientific inquiries.</p>	<p>SE/TE: 17, 39, 51, 72, 92, 109, 120, 142, 149, 180, 184, 200, 207, 238, 254, 279, 295, 324, 328, 354, 374, 399, 404, 435, 437, 467, 475, 491, 508, 519, 545, 571, 583, 600, 635, 662, 670, 699, 717, 750, 752, 778, 818, 828, 849, 856, 887, 896</p>

Chemistry (Wilbraham) © 2012
Correlated to:
Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
Strand - Science, Technology, and Society	
- Enduring Understanding: The development of technology and advancement in science influence and drive each other forward.	
- Essential Question: How do science and technology influence each other?	
Grades 9-12	
1. The pursuit of science can generate the need for advanced technology. Advanced technology, in turn, can provide the opportunity to pursue new scientific knowledge.	SE/TE: 8-10, 29, 104
2. The social, economic, and political forces of a society have a significant influence on what science and technology programs are pursued, funded, and implemented.	SE/TE: 7, 10, 218
Strand - History and Context of Science	
- Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge.	
- Essential Question: How have past scientific contributions influenced current scientific understanding of the world? What do we mean in science when we say that we stand on the shoulders of giants?	
Grades 9-12	
1. New disciplines of science emerge as older disciplines interface into an integrated study of the natural world. As the body of scientific knowledge grows, the boundaries between individual disciplines diminish.	SE/TE: 2-3

Chemistry (Wilbraham) © 2012
Correlated to:
Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
SCIENCE STANDARD 2	
Materials and Their Properties - Materials exist throughout our physical world. The structures of materials influence their physical properties, chemical reactivity and use.	
Strand - Properties and Structure of Materials	
- Enduring Understanding: The structures of materials determine their properties.	
- Essential Question: How do the properties and structures of materials determine their uses?	
Grades 9-12	
1. All matter is composed of minute particles called atoms. Most of the mass of an atom is concentrated in the nucleus. In the nucleus, there are neutrons with no electrical charge and positively charged protons. Negatively charged electrons surround the nucleus and overall, the atom is electrically neutral.	SE/TE: 102-109, 121-123, 302, 590
2. Elements and compounds are pure substances. Elements cannot be decomposed into simpler materials by chemical reactions. Elements can react to form compounds. Elements and/or compounds may also be physically combined to form mixtures.	SE/TE: 42-45, 47, 54-56, 58-59, 156
3. Isotopes of a given element differ in the number of neutrons in the nucleus. Their chemical properties remain essentially the same.	SE/TE: 114-115, 119, 121-123, 125, 156, 190, 218, 260, 342, 380, 416, 904
4. The periodic table arranges the elements in order of atomic number (the number of protons). The elements are grouped according to similar chemical and physical properties. Properties vary in a regular pattern across the rows (periods) and down the columns (families or groups). As a result, an element's chemical and physical properties can be predicted knowing only its position on the periodic table.	SE/TE: 46-47, 56, 162, 164, 166, 168-175, 177-182, 184-189, 191, 218, 260, 302, 342, 416, 446
5. An atom's electron structure determines its physical and chemical properties. Metals have valence electrons that can be modeled as a sea of electrons where the valence electrons move freely and are not associated with individual atoms. These freely moving electrons explain the metallic properties such as conductivity, malleability, and ductility.	SE/TE: 194-195, 209-210, 212-213, 215-216

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
6. Ionic compounds form when atoms transfer electrons. Covalent compounds form when atoms share electrons. Both types of interactions generally involve valence electrons and produce chemical bonds that determine the chemical property of the compound.	SE/TE: 201-202, 204, 206-207, 213-214, 216, 223, 225-234, 255-256, 261, 302
7. A change in physical properties does not change the chemical composition of the substance. The physical properties of elements and compounds (such as melting and boiling points) reflect the nature of the interactions among their atoms, ions, or molecules and the electrical forces that exist between.	SE/TE: 35, 37, 43
8. A change of phase may occur when there is a change in the potential energy of the atoms or molecules of a substance.	<i>Opportunities to address this standard can be found on the following pages:</i> SE/TE: 426, 430, 436-439
9. Temperature, pressure, and volume are important properties of a gas. A change in two of these properties results in predictable changes in the third.	SE/TE: 462, 478-479, 481
Building upon the K-8 expectations, all students in Grade 9 will be able to:	
- Explain that matter is composed of tiny particles called atoms that are unique to each element, and that atoms are composed of subatomic particles called protons, neutrons, and electrons.	SE/TE: 102-103, 105, 107, 109, 121-124, 590
- Describe the relative charge, approximate mass, and location of protons, neutrons, and electrons in an atom.	SE/TE: 105-109, 121-124, 590
- Classify matter as mixtures (which are either homogeneous or heterogeneous) or pure substances (which are either compounds or elements.)	SE/TE: 38-39, 41-42, 44-45, 47, 54-56, 59, 124, 156, 380
- Explain that elements are pure substances that cannot be separated by chemical or physical means. Recognize that compounds are pure substances that can be separated by chemical means into elements.	SE/TE: 42-43, 54-55
- Classify various common materials as an element, compound or mixture.	SE/TE: 38, 42, 44-45, 47, 55-56, 59, 124, 380

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
- Describe isotopes of elements in terms of protons, neutrons, electrons, and average atomic masses. Recognize that isotopes of the same element have essentially the same chemical properties that are determined by the proton and electron number.	SE/TE: 114-115, 119, 121-123, 125, 156, 190, 218, 260, 342, 380, 416, 904
- Use the Periodic Table to identify an element's atomic number, valence electron number, atomic mass, group/family and be able to classify the element as a metal, non-metal or metalloid.	SE/TE: 162, 164-173, 186, 191, 260, 302, 484
- Determine the physical and chemical properties of an element based on its location on the Periodic Table.	SE/TE: 166, 174-175, 177-189, 191, 302, 342
- Investigate differences between the properties of various elements in order to predict the element's location on the Periodic Table.	SE/TE: 187
- Use the Periodic Table to predict the types of chemical bonds (e.g., ionic or covalent) in a variety of compounds.	SE/TE: 256, 260, 302, 904
- Use models or drawings to illustrate how molecules are formed when two or more atoms are held together in covalent bonds by "sharing" electrons. Use models or drawings to illustrate how ionic compounds are formed when two or more atoms "transfer" electrons and are held together in ionic bonds.	SE/TE: 203, 226-236, 256-259, 261, 302
- Explain how an atom's electron arrangement influences its ability to transfer or share electrons and is related its position on the periodic table. Recognize that an atom in which the positive and negative charges do not balance is an ion.	SE/TE: 170-173, 176, 182, 185-189, 191
- Recognize that metals have the physical properties of conductivity, malleability, luster, and ductility.	SE/TE: 165, 209-210, 212, 215-216
- Explore the extent to which a variety of solid materials conduct electricity in order to rank the materials from good conductors to poor conductors. Based on the conductivity data, determine patterns of location on the Periodic Table for the good conductors versus the poor conductors.	SE/TE: 206-207, 209, 214-216

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
- Recognize that physical changes alter some physical properties of a substance but do not alter the chemical composition of the substance.	SE/TE: 37
- Conduct investigations to determine the effect of heat energy on the change of state (change of phase) of water. Sketch and interpret graphs representing the melting, freezing, evaporation and condensation of water.	SE/TE: 438-439
- Recognize that molecular and ionic compounds are electrically neutral.	SE/TE: 201-202, 207, 213-214
- Apply the kinetic molecular theory to explain that a change in the energy of the particles may result in a temperature change or a change of phase (change in state).	SE/TE: 423-424, 426, 430, 442-445, 447
- Use a model or a diagram to explain water's properties (e.g., density, polarity, hydrogen bonding, boiling point, cohesion, and adhesion) in the three states of matter. Cite specific examples of how water's properties are important (i.e., water as the "universal").	SE/TE: 488-493, 509-513, 515
Building upon the K-10 expectations, all students in Grade 11 will be able to:	
- Construct models or diagrams (Lewis Dot structures, ball and stick models, or other models) of common compounds and molecules (i.e., NaCl, SiO ₂ , O ₂ , H ₂ , CO ₂) and distinguish between ionically and covalently bonded compounds. Based on the location of their component elements on the Periodic Table, explain the elements tendency to transfer or share electrons.	SE/TE: 201-202, 214-215, 219, 222-225, 226-232, 234-235, 238, 256-259, 261, 302, 342
- Explain why the average atomic mass of an element reflects the relative natural abundance of the element and therefore is not a whole number.	SE/TE: 116-119, 122-123
- Explain that unstable isotopes undergo spontaneous nuclear decay, emitting energy or particles and energy.	SE/TE: 880-881, 898, 900
- Compare and contrast the energy released by nuclear reactions to that released by chemical reactions.	SE/TE: 876, 888
- Describe the composition of alpha, beta, and gamma radiation and the shielding necessary to prevent penetration.	SE/TE: 877-879, 900, 905

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
- Use the half life of a radioactive isotope to calculate the amount of remaining radioactive substance after an integral number of half-lives.	SE/TE: 883-884, 886-887, 898-901, 905
- Use kinetic molecular theory to explain changes in gas volume, pressure, and temperature.	SE/TE: 421-424, 442-444, 447
- Perform simple calculations to show that if the temperature is held constant, changes in pressure and volume of an enclosed gas have an inverse relationship. (Boyles Law).	SE/TE: 456-457, 463, 478, 480
- Perform simple calculations to show that if the pressure is held constant, changes in temperature (in Kelvin) and volume of an enclosed gas have a direct relationship. (Charles Law).	SE/TE: 458-459, 478, 480, 485
- Perform simple calculations to show that if the volume is held constant, changes in pressure and temperature (in Kelvin) of an enclosed gas have a direct relationship (Gay-Lussac's Law).	SE/TE: 460-461, 478, 480-481, 514, 552, 834
- Use the Periodic Table to show trends within periods and groups (families) regarding atomic size, size of ions, ionization energies and electronegativity.	SE/TE: 174-175, 177-182, 185-189, 191, 380, 416, 446
Strand - Mixtures and Solutions	
- Enduring Understanding: The properties of a mixture are based on the properties of its components.	
- Essential Questions: How can the properties of the components of a mixture be used to separate the mixture? How do the components determine the properties of mixtures?	
Grades 9-12	
1. Properties of solutions, such as pH, solubility, and electrical conductivity depend upon the concentration and interactions of the solute and solvents.	SE/TE: 494-497, 501, 509-513, 515, 518-521, 523, 534-537, 547-548, 552, 642, 656-657, 659, 662, 683-685, 689, 724, 758, 872
2. A variety of methods can be used to separate mixtures into their component parts based upon the chemical and physical properties of the individual components.	SE/TE: 40-41, 54-55, 57, 190
Building upon the K-8 expectations, all students in Grade 9 will be able to:	
- Recognize that mixtures can be separated by physical means into pure substances.	SE/TE: 40-41, 54-55, 57, 190

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
- Explain the effect of water's polarity on the solubility of substances (e.g., alcohol, salt, oil).	SE/TE: 494-495, 501, 509-511
- Separate mixtures into their component parts according to their physical properties such as melting point, boiling point, magnetism, solubility and particle size. Explain how the properties of the components of the mixture determine the physical separation techniques used.	SE/TE: 40-41, 54-55, 57, 190
- Describe how the process of diffusion or the movement of molecules from an area of high concentration to an area of low concentration (down the concentration gradient) occurs because of molecular collisions.	SE/TE: 472, 475
- Explore how various solutions conduct electricity and rank the liquids from good conductors to poor conductors. Explain the characteristics that allow some solutions to have better electrical conductivity than others.	SE/TE: 206-207, 213
- Measure the pH of a solution using chemical indicators to determine the relative acidity or alkalinity of the solution. Identify the physical properties of acids and bases.	SE/TE: 646, 652, 660-662, 682
- Investigate factors that affect the materials' solubility in water and construct solubility curves to compare the extent to which the materials dissolve.	SE/TE: 521-524, 546, 548-551
Building upon the K-10 expectations, all students in Grade 11 will be able to:	
- Express the concentration of various solutions in terms of the amount of solute dissolved in the solvent (molarity).	SE/TE: 525-526, 531, 546, 548, 551
- Collect data to calculate the unknown concentration of a solution by performing an acid-base titration using an appropriate indicator. Describe neutralization reactions using chemical equations.	SE/TE: 673-675, 677, 684, 686

Chemistry (Wilbraham) © 2012
Correlated to:
Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
Strand - Conservation of Matter	
- Enduring Understanding: When materials interact within a closed system, the total mass of the system remains the same.	
- Essential Questions: How does conservation of mass apply to the interaction of materials in a closed system?	
Grades 9-12	
1. The total mass of the system remains the same regardless of how atoms and molecules in a closed system interact with one another, or how they combine or break apart.	SE/TE: 50, 54, 56-57, 59
2. Radioactive isotopes are unstable and undergo spontaneous and predictable nuclear reactions emitting particles and/or radiation, and become new isotopes that can have very different properties. In these nuclear changes, the total of the mass and energy remains the same.	SE/TE: 876-881, 886, 898, 900, 902, 905
Building upon the K-8 expectations, all students in Grade 9 will be able to:	
- Conduct and explain the results of simple investigations to demonstrate that the total mass of a substance is conserved during both physical and chemical changes.	<i>Opportunities to address this standard can be found on the following page:</i> SE/TE: 50
Building upon the K-10 expectations, all students in Grade 11 will be able to:	
- Recognize that one mole is the amount of any substance that contains 6.02×10^{23} (Avogadro's number) representative particles of that substance. This quantity of particles will have the mass equivalent to the molecular weight (molar mass).	SE/TE: 308, 312-316, 338, 343
- Express various quantities of matter in terms of moles (e.g., 6.0 g carbon = .50 moles of carbon; 36 g H ₂ O = 2.0 moles H ₂ O).	SE/TE: 308-310, 315, 317, 319-321, 323-324, 337-338, 380, 416, 446
- Determine how the mass of the products compares to the mass of the reactants in chemical investigations. Show how this comparison links to the appropriate balanced chemical equation.	SE/TE: 50, 54, 56-57, 59, 387-389, 409, 411

Chemistry (Wilbraham) © 2012
Correlated to:
Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
Strand - Chemical Reactions	
- Enduring Understanding: There are several ways in which elements and/or compounds react to form new substances and each reaction involves energy.	
- Essential Question: What determines the type and extent of a chemical reaction?	
Grades 9-12	
1. Chemical reactions result in new substances with properties that are different from those of the component parts (reactants).	SE/TE: 48, 50, 54
2. There are different types of chemical reactions. Precipitation reactions produce insoluble substances (e.g., double replacement). The transfer of electrons between atoms is a reduction-oxidation (redox) reaction (e.g., single-replacement combustion, synthesis, decomposition). Some acid/base reactions involve the transfer of hydrogen ions.	SE/TE: 356-358, 360, 362-368, 375, 377-379, 381, 446, 484, 552, 672, 675, 707-709, 718, 720-721, 758
3. The rate of a chemical reaction depends on the properties and concentration of the reactants, temperature, and the presence or absence of a catalyst.	SE/TE: 598-601, 636, 638, 640, 643
4. Energy is transformed in chemical reactions. Energy diagrams can illustrate this transformation. Exothermic reactions release energy. Endothermic reactions absorb energy.	SE/TE: 556-558, 586
5. A catalyst lowers the activation energy of a chemical reaction. The catalyst remains unchanged and is not consumed in the overall reaction. Enzymes are protein molecules that catalyze chemical reactions in living systems.	SE/TE: 348, 600-601, 638-640, 643, 847-848, 868-869
6. Certain small molecules (monomers) react with one another in repetitive fashion (polymerization) to form long chain macromolecules (polymers). The properties of the macromolecules depend on the properties of the molecules used in their formation and on the lengths and structure of the polymer chain. Polymers can be natural or synthetic.	SE/TE: 822-829, 831, 833

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
Building upon the K-8 expectations, all students in Grade 9 will be able to:	
- Recognize that chemical changes alter the chemical composition of a substance forming one or more new substances. The new substance may be a solid, liquid, or gas.	SE/TE: 48, 50, 54
- Balance simple chemical equations and explain how these balanced chemical equations represent the conservation of matter.	SE/TE: 349-354, 359, 361, 363, 365, 367, 376-379, 381, 386-389, 411, 413-417, 446, 484, 514, 642, 758, 904
Building upon the K-10 expectations, all students in Grade 11 will be able to:	
- Conduct experiments and provide evidence (e.g., formation of a precipitate, evolution of gas, change of color, release/absorption of energy in the form of heat, light, or sound) to determine if a chemical reaction has occurred.	SE/TE: 354-355, 374
- Identify, name and write formulae for covalent and ionic compounds.	SE/TE: 271-288, 292-302, 313, 342, 380, 416, 446, 484, 590, 642
- Describe chemical reactions using correct chemical formulae and balance the resulting chemical equation.	SE/TE: 348-354, 359, 361, 363, 365, 367, 376-379, 381, 388-389, 411, 413-417, 446, 484, 514, 590, 642, 758, 904
- Classify various reactions as synthesis (combination), single replacement, double replacement, decomposition or combustion.	SE/TE: 356-358, 360, 362-368, 375, 377-379, 381, 446, 484, 552
- Explain whether or not a chemical reaction would occur given a set of reactants. Predict the product(s) if the reactions would occur.	SE/TE: 361-363, 365-367, 373-374, 376-379, 381, 671, 675, 684, 688
- Investigate factors (e.g., presence of a catalyst, temperature, concentration) that influence reaction rates.	SE/TE: 598-601, 636, 638, 640, 643
- Analyze reaction diagrams for some common chemical reactions to compare the amount of heat energy absorbed by the reaction to the amount of heat energy released. Explain, using the diagrams, that if the products of the reactions are at a higher level than the reactants, the reaction has absorbed heat energy (endothermic), but if the products of the reaction are at a lower level than the reactants, then heat energy has been released (exothermic).	SE/TE: 565-566, 579-580, 582
Strand - Material Technology	

Chemistry (Wilbraham) © 2012

Correlated to:

**Delaware Science Standards and Grade Level Expectations – Standards 1 and 2
(Grades 9-12)**

DELAWARE SCIENCE STANDARDS AND GRADE LEVEL EXPECTATIONS	Chemistry (Wilbraham) © 2012
<p>- Enduring Understanding: People develop new materials as a response to the needs of society and the pursuit of knowledge. This development may have risks and benefits to humans and the environment.</p>	
<p>- Essential Questions: How do you know which material is best for a particular product or need? What determines if new materials need to be developed? Why should people consider the risks and benefits before the production of new materials and/or the implementation of a new process?</p>	
<p>Grades 9-12</p>	
<p>1. Materials' properties determine their use. New materials can improve the quality of life. However, their development and production often raise social, economic, and environmental issues that require analyses of the risks and benefits.</p>	<p>SE/TE: 800, 803, 806-807, 810, 813-814, 821-827, 833</p>
<p>Building upon the K-8 expectations, all students in Grade 9 will be able to:</p>	
<p>- Research and report on a variety of manufactured goods and show how the chemical properties of the component materials were used to achieve the desired qualities.</p>	<p>SE/TE: 833</p>
<p>Building upon the K-10 expectations, all students in Grade 11 will be able to:</p>	
<p>- Identify polymers as large molecules with a carbon backbone. Recognize that polymers are comprised of repeating monomers. Investigate synthetic and naturally occurring polymers and relate their chemical structure to their current or potential use.</p>	<p>SE/TE: 822-829, 831, 833</p>
<p>- Research and report on materials that are used in response to human and societal needs. These materials might include but are not limited to synthetic polymers such as Kevlar or Gortex; or radioactive isotopes such as U235, or C14, etc... Recognize the intended (and realized) benefits as well as any risks or trade-offs required in their production and use.</p>	<p>SE/TE: 833</p>