Active Chemistry Correlation to the Delaware Science Content Standards, 9-12

Science Standard 1
Nature and Application of Science and Technology

Standards and Expected Performances	Location/Page where Standard is found
Understandings and Abilities of Scientific Inquiry	
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.	5-14, 15-22, 26-34, 35-43, 46-56, 58-67, 182-190, 308-315, 416-421, 766-776, 826-832, 910-912
2. Understand that: Science is distinguished from other ways of knowing by the use of empirical observations, experimental evidence, logical arguments and healthy skepticism.	7-10, 15-18, 35-37, 101-103, 113-113, 120-121, 126-127, 134-137, 144-146, 152-153, 157-158, 162-164, 182-184, 193-195, 201-203, 210-214, 224-227, 233-236, 241-242, 255-258, 287-291, 300-301, 308-311, 318-320, 329-332, 353-356, 369-371, 379-382, 390-392, 401-404, 408-410, 416-418, 433-435, 441-444, 448-451, 456-460, 468-469, 477-479, 485-488, 496-497, 511-513, 522-524, 532-535, 544-545, 551-554, 560-562, 568-569, 575-577, 599-602, 608-610, 618-520, 632-634, 641-643, 659-661, 677-679, 685-686, 693-697, 703-704, 712-713, 727-728, 743-745, 766-768, 779-783, 790-792, 799—803, 812-816, 843-848, 857-858, 867-869, 877-882, 892-896, 902-904, 910-912, 919-921

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.	5-14, 15-22, 26-34, 35-43, 46-56, 58-67, 182-190, 308-315, 416-421, 766-776, 826-832, 910-912
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.	5-14, 15-22, 26-34, 35-43, 46-56, 58-67, 182-190, 308-315, 416-421, 766-776, 826-832, 910-912
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)	15-18, 35-38, 46-50, 58-62, 101-103, 110-113, 120-121, 134-137, 144-146, 182-184, 193-195, 201-203, 210-214, 224-230, 233-235, 241-242, 255-258, 287-291, 300-301, 308-311, 329-332, 353-356, 361-364, 369-371, 379-382, 390-392, 401-404, 416-418, 433-435, 441-444, 448-451, 456-460, 468-469, 477-479, 485-488, 496-497,511-513, 522-524, 532-535, 544-545, 560-562, 575-577, 599-602, 608-610, 618-622, 632-634, 641-643, 659-662, 677-679, 685-686, 693-697, 703-704, 712-713, 727-729, 743-744, 779-783, 790-792, 799-804, 812-816, 826-827, 843-848, 857-859, 867-869, 877-882, 892-896, 902-904, 910-912, 919-921
6. Understand that: Knowledge and skill from sources other than science are essential to scientific inquiry. These include mathematics, reading, writing, and technology.	76, 109, 119, 131, 161, 169, 181, 192, 200, 209, 221, 232, 307, 328, 378, 400, 501, 574, 598, 607, 617, 629, 658, 684, 692, 702, 726, 733, 750, 778, 798, 833, 856, 866, 901, 909, 918, 927,
Science, Technology, and Society	
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.	15-18, 35-38, 46-50, 58-62, 101-103, 110-113, 120-121, 134-137, 144-146, 182-184, 193-195, 201-203, 210-214, 224-230, 233-235, 241-242, 255-258, 287-291, 300-301, 308-311, 329-332, 353-356,

	361-364, 369-371, 379-382, 390-392, 401-404, 416-418, 433-435, 441-444, 448-451, 456-460, 468-469, 477-479, 485-488, 496-497,511-513, 522-524, 532-535, 544-545, 560-562, 575-577, 599-602, 608-610, 618-622, 632-634, 641-643, 659-662, 677-679, 685-686, 693-697, 703-704, 712-713, 727-729, 743-744, 779-783, 790-792, 799-804, 812-816, 826-827, 843-848, 857-859, 867-869, 877-882, 892-896, 902-904, 910-912, 919-921
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.	162-164, 179-181, 193-195, 201-203, 233-235, 353-356, 416-418, 532-535, 560-562, 575-577, 607, 685-686, 743-744, 766-768, 812-816, 826-827, 902-904
History and Context of Science	
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.	15-18, 19-22, 29-32, 34, 35-37, 39-40, 54, 63-64, 82, 101-103, 152-153, 182-184, 416-418, 568-569, 608-610, 618-620, 703-704, 712-713, 919-921

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.

Standards and Expected Performances	**Location/Page where Standard is found**
Properties and Structures of Materials	

1. All matter is composed of minute particles called atoms. Most of the mass in 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.	11-12, 15-25, 29-31, 33-34, 39-41, 47-49, 51-54, 59-63, 64-65, 71, 73 78, 79-85, 96, 159, 196, 200, 292, 304, 419, 448,499, 611, 646, 763, 838
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.	19, 30, 71, 101, 104-107, 110-113, 122, 125-126, 129-130, 164, 182, 185, 196, 215, 228, 243, 260, 262, 308, 312, 316, 337, 361-366, 436, 451-452, 595, 617, 626, 672, 763, 774, 784, 816, 823, 867, 869, 896, 932,
3. Isotopes of a given element differ in the number of neutrons in the nucleus. Their chemical properties remain essentially the same.	77, 79, 81-83, 87, 89-91, 96
4. The periodic table arranges the elements in the 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.	2, 3, 6, 7, 10-13 19-23, 24, 26-28-34, 36-41, 42-44, 47-56, 58, 59-62, 64-65, 66, 70, 71, 72-74, 77, 78, 79-85, 89-91, 93, 96, 112, 126-128, 141, 146-147, 159-161, 196-197, 199-200, 204, 250, 292, 297, 304, 339, 356, 366, 448, 476, 499, 595-596, 599, 602-604, 606, 611, 641, 643-647, 654, 672, 763, 772-774, 838, 851
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 that metallic properties such as conductivity, malleability, and ductibility.	20-23, 26-28, 32-34, 42-44, 48-52, 54, 71-74, 104-107, 139, 148, 164-165, 196, 200, 250, 758
6. Iconic 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.	19, 62, 68-74 105, 106, 153-155, 164, 196, 200, 228, 241-242, 250, 258, 280, 312, 362, 366, 450-453, 463, 452, 596, 643-644, 672, 722, 723, 725, 751-753, 760, 761, 765, 772-774, 758-759, 772-774, 798, 801, 808, 810, 818, 838, 851-852
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 exists between.	12, 96, 112, 126-128, 141, 146-147, 159-161, 166, 204,282, 292, 339, 433-439, 472, 476, 524-526, 547, 556, 595-596, 599, 602-604, 606, 654, 672, 677, 678

8. A change of phase may occur when there is a change in the potential energy of the atoms or molecules of a substance.	114-119, 260, 364, 404-406, 410-413, 546-550, 555-558, 714-719
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.	15, 20, 24, 54, 111,-115, 373, 383-387, 403-405, 410-415, 428, 470, 472, 515, 575-583, 698-700, 712, 715-721, 738,
Mixtures and Solutions	
1. Properties of solutions, such as pH, solubility, and electrical conductivity depend upon the concentration and interactions of the solute and solvents.	122, 405, 436, 437, 440, 463, 476, 480, 490, 617, 624-626, 633, 672, 697-698, 858-865, 867, 821-823, 848, 852, 857-859, 863, 869, 870, 884-888, 902-909, 914, 935
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.	101-109, 157-167, 390-397, 599-606, 618-628, 659-665, 867-874, 892-890,910-912
Conservation of Matter	
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.	21, 78, 82, 96, 102, 154, 163, 166, 186-190, 213-218, 222, 228-232, 256-258, 266-273, 276, 278-279, 280-283, 286, 325, 356-360, 392-397, 411, 412, 445, 456-463, 525-526, 570, 608, 613, 616, 619, 626-629, 636, 642-647, 672, 680-682, 725, 738, 761, 838, 885
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.	79-90
Chemical Reactions	
1. Chemical reactions result in new substances with properties that are difference from those of the component parts (reactants).	21, 96, 102, 154, 163, 166, 186-190, 213-218, 222, 228-232, 256-258, 266-273, 276, 325, 356-360, 392-397, 445, 456-463, 525-526, 608, 613, 616, 619, 626-629, 636, 642-647, 672, 680-682, 725, 738, 761, 838

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.	21, 96, 102, 154, 163, 166, 186-190, 213-218, 222, 228-232, 256-258, 266-273, 276, 325, 356-360, 392-397, 445, 456-463, 525-526, 608, 613, 616, 619, 626-629, 636, 642-647, 672, 680-682, 725, 738, 761, 838
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.	170, 324-325, 341, 470, 478-481, 528, 538-539, 613-614, 706
4. Energy is transformed in chemical reactions. Energy diagrams can illustrate this transformation. Exothermic reactions release energy. Endothermic reactions absorb energy.	86, 166, 262, 270, 318-328, 333-335, 337-338, 470-473, 514-518, 525, 535-536, 560-566, 623, 859, 861
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.	170, 324-325, 341, 470, 480-481, 528, 538-539, 613-614, 706
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.	114, 152-154, 168, 174, 337, 339, 362-363, 366, 419, 428, 437, 539, 568, 570-572, 588, 681, 706, 738, 754, 756, 793-795, 798, 827, 833, 838
Materials Technology	
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.	4, 44, 100, 132, 178, 222, 253, 298, 350, 388, 429, 466, 508, 542, 590, 630, 674, 710, 740, 788, 840, 890