



LAB-AIDS CORRELATIONS to DELAWARE HIGH SCHOOL CHEMISTRY¹

A Natural Approach to Chemistry (NAC)² is written by Hsu, Chaniotakis, Carlisle, and Damelin. This correlation is intended to show selected locations in NAC programs that support the standards for high school chemistry.

This document was prepared by Oralia Gil, LAB-AIDS Curriculum Specialist, and Mark Koker, Ph D, Director of Curriculum. This is not an exhaustive document. It is designed to provide a general overview of the alignment of *A Natural Approach to Chemistry* to the state science program standards, grades 9-12, for review and adoption purposes. Support for the state standards may be found at other locations besides those explicitly stated in this document.

For more information about this correlation or for questions about review copies, presentations, or any matters related to sales or service, please contact Nicole Young, LAB-AIDS Regional Sales Manager, at 609.707.4244, or by email at nyoung@lab-aids.com, or visit us on the web at www.lab-aids.com

¹ http://www.doe.k12.de.us/infosuites/staff/ci/content_areas/science.shtml

² http://www.anaturalapproachtochemistry.com/natc_home.php



The Natural Approach to Chemistry		
THEMES		
Energy is a unifying theme that explains why chemistry occurs		
The atomic model of matter is consistently woven through every chapter		
Understanding of 'why' chemistry occurs is emphasized		
Principles are illustrated with examples from the human body and the environment		
ORGANIZATION OF CONTENT		
Fundamentals	Chapters 1 -4	Present comprehensive overview of all main ideas in chemistry such as the atomic nature of matter, systems, temperature, and energy. <i>"Big Picture"</i>
Core Concepts	Chapters 5 - 14	Present in-depth coverage of all major topic areas. They developed usable understanding of the big ideas laid out in the first four chapters. The treatment includes strong conceptual development as well as algebra-based quantitative problem solving. <i>All academic content and instruction standards for chemistry have been met by the end of Chapter 14.</i>
Applications	Chapter 15 - 21	Provide deeper exploration of significant areas of interest in chemistry. <i>Examples include rechargeable batteries, materials science, planetary atmospheres, etc.</i>
COMPLETE LEARNING SYSTEM		
Coordinated student textbook		
Integrated laboratory investigations manual containing 58 labs to choose from		
New laboratory control, data collection and probe system		
Evaluation elements throughout the curriculum (student book and lab investigation manual) through which student knowledge or skills are assessed or applied		

Correlation Citation Reference Key:

Locations are given in the student book (SB) and/or laboratory manual (LM).

1.2 pp. 19-25

Means Student Book Chapter 1 Section 1.2 pages 19 – 25

1A, 3D

Means Lab Investigations Manual Chapter 1 Investigation 1A;

Chapter 3 Investigation 3D

Relevant questions from the student book (SB) and lab manual (LM) problem sets and questions are indicated, e.g.,

1.2 18-30, 51-55

Means Student Book Chapter 1 Section 1.2 questions 18-30 and questions 51-55

LM 9A (PART 4)

Means Laboratory Investigations Manual Chapter 9 Investigation 9A Part 4

Science Standard 2 Materials and Their Properties	NAC Location		
	Student Book Location	Lab Manual Location	Where assessed
Enduring Understanding: The structures of materials determine their properties.			
A. 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. Level: Essential	5.1 pp.134-143	5A	5.1, 66-67, p.165
B. 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. Level: Essential	Ch. 2 pp. 38-63		Ch. 2, 30-69, pp.67-69
C. Isotopes of a given element differ in the number of neutrons in the nucleus. Their chemical properties remain essentially the same. Level: Important	5.1 p.138	5A	5A (Part 4)
D. 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. Level: Important	Ch. 6 pp.168-189	6A-B	Ch. 6, 12-52, pp.192-195

Science Standard 2 Materials and Their Properties	NAC Location		
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E. 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. Level: Essential	6.3 pp.184-189; 16.1 pp.512-515; 16.3 pp.521-524	6C	6.3, 50-52, p.195; 16.1, 38-41, p.533
F. 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. Level: Essential	Ch. 7 pp.198-221; Ch. 8 pp.230-253	7A-B; 8A-B	Ch. 7, 18-69, pp.225-227; Ch. 8, 20-77, pp.257-259
G. 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. Level: Important	2.1 pp.39-40; Ch. 9 pp.262-287	9A	Ch. 9, 28-87, pp.291-293
H. A change of phase may occur when there is a change in the potential energy of the atoms or molecules of a substance. Level: Compact	3.3 pp.88-95; 9.3 pp.278-287	3D	3.3, 48-57, p.100
I. Temperature, pressure, and volume are important properties of a gas. A change in two of	Ch. 14 pp.442-465	14B	Ch. 14, 7-79, pp.468-471

Science Standard 2 Materials and Their Properties	NAC Location		
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these properties results in predictable changes in the third. Level: Compact			
Enduring Understanding: The properties of a mixture are based on the properties of its components.			
A. Properties of solutions, such as pH, solubility, and electrical conductivity depend upon the concentration and interactions of the solute and solvents. Level: Important	Ch. 9 pp.262-287; Ch. 13 pp.410-433	9A-C; 13A	Ch. 9, 28-87, pp.291-293
B. 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. Level: Important	2.3 pp.56-63	2C	
Enduring Understanding: When materials interact within a closed system, the total mass of the system remains the same.			
A. 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. Level: Essential	Ch. 11 pp.328-357	11A-B; 14A	Ch. 11, 9-69, pp.360-365
B. 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. Level: Important	Ch. 20 pp.636-657	20A-B	Ch. 20, 40-90, pp.661-663
Enduring Understanding: There are several ways in which elements and/or compounds react to form new substances and each reaction involves energy.			

Science Standard 2 Materials and Their Properties	NAC Location		
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A. Chemical reactions result in new substances with properties that are different from those of the component parts (reactants). Level: Essential	Ch. 4 pp.104-125	4B-C	Ch. 4, 36-72, pp.129-131
B. 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. Level: Important	Ch. 10 296-317; Ch. 13 pp.410-433; Ch. 15 pp.474-499	10B; 13B-C; 15C	Ch. 10, 30-71, pp.323-325; Ch. 13, 21-81, pp.347-439; 15.2, 56-62, 77-83, pp.508-509
C. The rate of a chemical reaction depends on the properties and concentration of the reactants, temperature, and the presence or absence of a catalyst. Level: Essential	Ch. 12 pp.368-401	12A-12C	Ch. 12, 20-63, pp.405-407
D. Energy is transformed in chemical reactions. Energy diagrams can illustrate this transformation. Exothermic reactions release energy. Endothermic reactions absorb energy. Level: Essential	10.4 pp.311-317	10C	10.4, 43-47, 66-71, pp.324-325
E. 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. Level: Important	12.4 pp.398-401; 18.3 p.592	18B	18.3, 94-98, p.603 18B (Part 3)
F. Certain small molecules (monomers) react with one	10.3 p.310; 17.3 pp.554-		17.3, 66-83, p.567

Science Standard 2 Materials and Their Properties	NAC Location		
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<p>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.</p> <p>Level: Compact</p>	561		
<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>A. 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>Level: Compact</p>	<p>Ch. 17 pp.538-561</p> <p>Throughout at end of chapters in section Chemistry Connections</p>	17A-B	