LAB-AIDS CORRELATIONS to KENTUCKY CORE CONTENT

FOR ASSESSMENT v.4.1

HIGH SCHOOL CHEMISTRY[1]

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 Kevin Stinson, LAB-AIDS Regional Sales Manager, at 513.900.0642, or by email at kstinson@lab-aids.com , or visit us on the web at www.labaids.com.

[1] http://www.kde.state.ky.us/KDE/Instructional+Resources/Curriculum+Documents+and+Resources/Core+Content+for+Assessment/Core+Content+for+Assessment+4.1/

[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. *“Big Picture”*
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. *All academic content and instruction standards for chemistry have been met by the end of Chapter 14.*
Applications	Chapter 15 - 21	Provide deeper exploration of significant areas of interest in chemistry. *Examples include rechargeable batteries, materials science, planetary atmospheres, etc.*
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).

SB 1.2 pp. 19-25

Means Student Book Chapter 1 Section 1.2 pages 19 – 25

LM 1A, 3A-D

Means Lab Investigations Manual Chapter 1 Investigation 1A;

Chapter 3 Investigation 3A, 3B, 3C, 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

Related Core Content for Assessment	NAC Location		
	Student Book Location	Lab Manual Location	Where assessed
Big Idea: Structure and Transformation of Matter (Physical Science) High School A basic understanding of matter is essential to the conceptual development of other big ideas in science. By high school, students will be dealing with evidence from both direct and indirect observations (microscopic level and smaller) to consider theories related to change and conservation of matter. The use of models (and an understanding of their scales and limitations) is an effective means of learning about the structure of matter. Looking for patterns in properties is also critical to comparing and explaining differences in matter.			
SC-HS-1.1.1 Students will classify or make generalizations about elements from data of observed patterns in atomic structure and/or position on the periodic table. The periodic table is a consequence of the repeating pattern of outermost electrons. DOK 2	Ch.2 pp.38-63; Ch.4 pp.104-125	2A-D; 4A	Ch. 2, 30-80, pp.67-69; Ch. 4, 36-72, pp.129-131
SC-HS-1.1.2 Students will understand that the atom's nucleus is composed of protons and neutrons that are much more massive than electrons. When an element has atoms that differ in the number of neutrons, these atoms are called different isotopes of the element.	Ch. 5 pp.134-159	5A-C	Ch. 5, 23-76, pp.163-165
SC-HS-1.1.3 Students will understand that solids, liquids and gases differ in the distances between molecules or atoms and therefore the energy that binds them together. In solids, the structure is nearly rigid; in liquids, molecules or atoms move around each other but do not move apart; and in gases, molecules or atoms move almost independently of each other and are relatively far apart. The behavior of gases and the relationship of the variables influencing them can be described and predicted.	Ch. 14 pp.442-465; Ch. 16 pp.512-529	14A-B; 16A-B	Ch. 14, 7-79, pp.468-471; Ch. 16, 38-86, pp.533-535
SC-HS-1.1.4 Students will understand that in conducting materials, electrons flow	16.3 p.521		

Related Core Content for Assessment	NAC Location		
	Student Book Location	**Lab Manual Location**	**Where assessed**
easily; whereas, in insulating materials, they can hardly flow at all. Semiconducting materials have intermediate behavior. At low temperatures, some materials become superconductors and offer no resistance to the flow of electrons.			
SC-HS-1.1.5 Students will explain the role of intermolecular or intramolecular interactions on the physical properties (solubility, density, polarity, conductivity, boiling/melting points) of compounds. The physical properties of compounds reflect the nature of the interactions among molecules. These interactions are determined by the structure of the molecule including the constituent atoms. DOK 2	Ch.2 pp.38-63; Ch.4 pp.104-125; Ch. 8 pp.230-253	2A-D; 4A-C; 8A-B	Ch. 2, 30-80, pp.67-69; Ch. 4, 36-72, pp.129-131; Ch. 8, 20-77, pp.257-259
SC-HS-1.1.6 Students will: • identify variables that affect reaction rates; • predict effects of changes in variables (concentration, temperature, properties of reactants, surface area and catalysts) based on evidence/data from chemical reactions. Rates of chemical reactions vary. Reaction rates depend on concentration, temperature and properties of reactants. Catalysts speed up chemical reactions. DOK 3	Ch.7 pp.198-221; Ch.10, pp.296-317; Ch.11 pp.328-357; Ch.12 pp.368-401	7A-B; 10A-C; 11A-B; 12A-C	Ch. 7, 18-69, pp.224-227; Ch. 10, 30-71, pp.323-325; Ch. 11, 9-69, pp.360-365; Ch. 12, 20-63, pp.405-407
SC-HS-1.1.7 Students will: • construct diagrams to illustrate ionic or covalent bonding; • predict compound formation and bond type as either ionic or covalent (polar, nonpolar) and represent the products formed with simple chemical formulas. Bonds between atoms are created when	2.2 pp.49-53; 4.1 pp.109-111	2B	2.2, 41-45, pp.67-68; 4.1, 44-47, p.129 2B (Part 5, 6)

Related Core Content for Assessment	NAC Location		
	Student Book Location	**Lab Manual Location**	**Where assessed**
outer electrons are paired by being transferred (ionic) or shared (covalent). A compound is formed when two or more kinds of atoms bind together chemically. DOK 2			
SC-HS-1.1.8 Students will: • explain the importance of chemical reactions in a real-world context; • justify conclusions using evidence/data from chemical reactions. Chemical reactions (e.g., acids and bases, oxidation, combustion of fuels, rusting, tarnishing) occur all around us and in every cell in our bodies. These reactions may release or absorb energy. DOK 3	Ch.9 pp.262-287	9A-C	Ch. 9, 28-87, pp. 291-293
Big Idea: Energy Transformations (Unifying Concepts) High School Energy transformations are inherent in almost every system in the universe—from tangible examples at the elementary level, such as heat production in simple Earth and physical systems to more abstract ideas beginning at middle school, such as those transformations involved in the growth, dying and decay of living systems. The use of models to illustrate the often invisible and abstract notions of energy transfer will aid in conceptualization, especially as students move from the macroscopic level of observation and evidence (primarily elementary school) to the microscopic interactions at the atomic level (middle and high school levels). Students in high school expand their understanding of constancy through the study of a variety of phenomena. Conceptual understanding and application of the laws of thermodynamics connect ideas about matter with energy transformations within all living, physical and Earth systems.			
SC-HS-4.6.1 Students will: • explain the relationships and connections between matter, energy, living systems and the physical environment; • give examples of conservation of matter and energy. As matter and energy flow through different organizational levels (e.g., cells, organs, organisms, communities) and between living systems and the	9.3 p.285		9.3, 81-87, p.293

Related Core Content for Assessment	**NAC Location**		
	Student Book Location	**Lab Manual Location**	**Where assessed**
physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change. DOK 3			
SC-HS-4.6.2 Students will: • predict wave behavior and energy transfer; • apply knowledge of waves to real life phenomena/investigations. Waves, including sound and seismic waves, waves on water and electromagnetic waves, can transfer energy when they interact with matter. Apparent changes in frequency can provide information about relative motion. DOK 3	5.2, p.146; 5.4, pp.156-158	5B-C, 21A	5.2, 68-70, p.165; 5.4, 52-63, p.164
SC-HS-4.6.4 Students will: • describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide and oxygen); • explain the movement of matter and energy in biogeochemical cycles and related phenomena. The total energy of the universe is constant. Energy can change forms and/or be transferred in many ways, but it can neither be created nor destroyed. Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide and in all	Ch.3 pp.72-95; Ch.18 pp.570-597	3A-D	Ch. 3, 39-84, pp.99-101

Related Core Content for Assessment	NAC Location		
	Student Book Location	Lab Manual Location	Where assessed
organisms as complex molecules that control the chemistry of life. DOK 3			
SC-HS-4.6.5 Students will describe and explain the role of carbon-containing molecules and chemical reactions in energy transfer in living systems. Living systems require a continuous input of energy to maintain their chemical and physical organization since the universal tendency is toward more disorganized states. The energy for life primarily derives from the Sun. Plants capture energy by absorbing light and using it to break weaker bonds in reactants (such as carbon dioxide and water) in chemical reactions that result in the formation of carbon-containing molecules. These molecules can be used to assemble larger molecules (e.g., DNA, proteins, sugars, fats). In addition, the energy released when these molecules react with oxygen to form very strong bonds can be used as sources of energy for life processes. DOK 3	Ch.17 pp.538-561	17A-B	Ch. 17, 32-83, pp.565-567
SC-HS-4.6.6 Students will understand that heat is the manifestation of the random motion and vibrations of atoms.	Ch.3 pp.72-95; 9.3 p.285	3A-D	Ch. 3, 39-84, pp.99-101; 9.3, 81-87, p.293
SC-HS-4.6.10 Students will: • identify the components and mechanisms of energy stored and released from food molecules (photosynthesis and respiration); • apply information to real-world situations. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in the phosphate	18.2 pp.578-583		18.2, 60-79, pp.602-603

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<tr><th rowspan="2">Related Core Content for Assessment</th><th colspan="3">NAC Location</th></tr>
<tr><th>Student Book Location</th><th>Lab Manual Location</th><th>Where assessed</th></tr>
<tr><td>bonds of adenosine triphosphate (ATP). During the process of cellular respiration, some energy is lost as heat. DOK 3</td><td></td><td></td><td></td></tr>
<tr><td>SC-HS-4.6.11
Students will:
• explain the difference between alpha and beta decay, fission and fusion;
• identify the relationship between nuclear reactions and energy.
Nuclear reactions convert a fraction of the mass of interacting particles into energy, and they can release much greater amounts of energy than atomic interactions. Fission is the splitting of a large nucleus into smaller pieces. Fusion is the joining of two nuclei at extremely high temperature and pressure. Fusion is the process responsible for the energy of the Sun and other stars. DOK 2</td><td>Ch.20
pp.636-657</td><td>20A-B</td><td>Ch. 20, 40-90, pp.661-663</td></tr>
<tr><td>SC-HS-4.6.12
Students will understand that the forces that hold the nucleus together, at nuclear distances, are usually stronger than the forces that would make it fly apart.</td><td>20.4 p.647</td><td></td><td></td></tr>
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