Lab-Aids Correlations for

2023 PENNSYLVANIA
SCIENCE, TECHNOLOGY & ENGINEERING, ENVIRONMENTAL LITERACY AND SUSTAINABILITY (STEELS) STANDARDS
PHYSICAL SCIENCE – GRADES 9-12

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This document is intended to show how *A Natural Approach to Chemistry, 3rd edition* materials align with the 2023 STEELS Standards.

ABOUT OUR PROGRAMS
Lab-Aids has based its home offices and operations in Ronkonkoma, NY, since 1963. We publish over 200 kits and core curriculum programs to support science teaching and learning, grades 6-12. All core curricula support an inquiry-driven pedagogy, with support for literacy skill development and with assessment programs that clearly show what students know, and can do. All programs have extensive support for technology and feature comprehensive teacher support. For more information, please visit www.lab-aids.com and navigate to the program of interest.

ABOUT *A NATURAL APPROACH TO SCIENCE*
A Natural Approach to Chemistry (NAC), written by Manos Chaniotakis, PhD, is published by, and available exclusively from, Lab-Aids, Inc., Ronkonkoma NY. Fully integrated instructional materials include a Student Book (SB), Lab Investigations Manual (LIM), Teacher Edition (TE), and a variety of materials packages.

Chapters 1-4 present a comprehensive overview of the "big picture," main ideas in chemistry, such as the atomic nature of matter, systems, temperature, and energy. Chapters 5-14 provide in-depth coverage 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. Chapters 15-21 dive deeper into significant areas of interest in chemistry related to the natural world and applications of chemistry to our daily lives.

ABOUT THE LAB-AIDS CITATIONS
This correlation is intended to show selected locations in NAC student materials that support the STEELS Standards for High School Physical Science. It is not an exhaustive list; other locations may exist that are not listed here.

Citations included in the correlation document are as follows:	
Student Book: Chapter, Section	SB: 6.2, 6.3
Lab Investigations Manual: Investigation	LIM: 7A, 7B

STEELS 3.2 Physical Science: Grades 9-12		
Strand	**Standard**	***A Natural Approach to Chemistry,* Student Book (SB) or Lab Investigation Manual (LIM)**
Structure and Properties of Matter	**3.2.9-12.A** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	SB: Chapter 6.2, 6.3 LIM: 7A
	3.2.9-12.B Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.	SB: Chapter 2.2, 8.1, 8.2, 8.3, 9.1, 16.4 LIM: 3B
	3.2.9-12.C Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	SB: Chapter 4.1, 6.1, 6.2, 7.2, 7.3 LIM: 4C, 7A
	3.2.9-12.D Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	SB: Chapter 4.1, 12.1, 12.3 LIM: 4C, 10C
Chemical Reactions	**3.2.9-12.E** Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.	SB: Chapter 12.2 LIM: 12A, 12B, 12C
	3.2.9-12.F Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.	SB: Chapter 12.2, 12.3, 12.4 LIM: 12A, 12B, 12C
	3.2.9-12.G Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	SB: Chapter: 4.2, 10.1, 10.2, 10.3, 11.1, 11.2, 11.3, 11.4, 12.2 LIM: 4A, 10A
Nuclear Processes	**3.2.9-12.H** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.	SB: Chapter: 20.1, 20.2, 20.3, 20.4 LIM: 20B
Forces and Motion	**3.2.9-12.I** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.	This physics topic is not typically addressed in a high school chemistry course.

STEELS 3.2 Physical Science: Grades 9-12		
Strand	**Standard**	***A Natural Approach to Chemistry,*** **Student Book (SB) or Lab Investigation Manual (LIM)**
	3.2.9-12.J Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.	This physics topic is not typically addressed in a high school chemistry course.
	3.2.9-12.K Apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision.	This physics topic is not typically addressed in a high school chemistry course.
Types of Interactions	**3.2.9-12.L** Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.	This physics topic is not typically addressed in a high school chemistry course.
	3.2.9-12.M Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.	This physics topic is not typically addressed in a high school chemistry course.
	3.2.9-12.N Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.	SB: Chapter: 8.1, 8.2, 8.3, 16.1, 16.2, 16.3, 16.4, 17.1, 17.2, 17.3 LIM: E7, E9, 16A, 16B, 17B
Definitions of Energy	**3.2.9-12.O** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.	SB: Chapter: 3.2, 10.4 LIM: 3A, 3B, 9C, 10C
	3.2.9-12.P Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).	SB: Chapter: 1.3, 3.1, 9.3 LIM: 3A, 3B, 3D, 4A, 9C, 10C, 15A, 15B
	3.2.9-12.Q Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	SB: Chapter: 9.3, 15.1, 15.4 LIM: 15A, 15B, 15C

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Conservation of Energy and Energy Transfer	**3.2.9-12.R** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	SB: Chapter: 3.2, 3.3, 3.4, 19.1 LIM: 3A, 3B
Relationship Between Energy and Forces	**3.2.9-12.S** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.	This physics topic is not typically addressed in a high school chemistry course.
Wave Properties	**3.2.9-12.T** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.	This physics topic is not typically addressed in a high school chemistry course.
	3.2.9-12.U Evaluate questions about the advantages of using digital transmission and storage of information.	This physics topic is not typically addressed in a high school chemistry course.
	3.2.9-12.V Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model and that for some situations one model is more useful than the other.	SB: Chapter: 5.2, 5.4
Electromagnetic Radiation	**3.2.9-12.W** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.	SB: Chapter: 20.5* This physics topic is not typically addressed in a high school chemistry course.
Information Technologies and Instrumentation	**3.2.9-12.X** Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	This physics topic is not typically addressed in a high school chemistry course.
Engineering, Technology, and Applications of Science (ETS)	**3.5.9-12.I (ETS)** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.	LIM: E7, E19

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	3.5.9-12.K (ETS) Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	LIM: E7
	3.5.9-12.T (ETS) Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	LIM: E4, E7, E15, E19
	3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	LIM: E7, E15, E19