CORRELATIONS FOR THE PENNSYLVANIA STANDARDS ALIGNED SYSTEM

Grades 10-12 – Chemistry (COURSE 3.2.C.A)

A Natural Approach to Chemistry (NAC) is written by Hsu, Chaniotakis, Carlisle, and Damelin, and is published by, and available exclusively from, LAB-AIDS, Ronkonkoma NY. This correlation is intended to show selected locations in *NAC* programs that support the Pennsylvania Science Standards for chemistry (http://www.pdesas.org/Standard/StandardsBrowser#25233). It is not an exhaustive list; other locations may exist that are not listed here.

Pennsylvania Assessment Anchors for chemistry are indicated by (A).*

This document was prepared by Mark Koker, Ph D, Director of Curriculum and Training at LAB-AIDS. For more information about this correlation or for questions about review copies, presentations, or any matters related to sales or service, please visit us on the web at www.lab-aids.com.

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, 3D, 11A: 6, 12A: 6, 12B: 1, 6

Means Lab Investigations Manual Chapter 1 Investigation 1A;

Chapter 3 Investigation 3D;

Chapter 11 Investigation 11A Part 6;

Chapter 12 Investigation 12B Part 1 and Part 6

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

SB 1.2 18-30, 51-55

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

LM 9A Pt 4a-c; **9B** Pts 3-5

Means Laboratory Investigations Manual Chapter 9 Investigation 9A Part 4 a-c, Investigation 9B Part 3 – Part 5.

PA Chemistry Standard	Location in *NAC*		Assessment
	Student book	**Lab manual**	
3.2.C.A1 Properties and bonding			
• Differentiate between physical properties and chemical properties.	2.1, pp. 39-40	2D, 3B, 13A	**SB 2.1**, 30, 32-37, p. 67
• Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures.	2.1, p. 38; 2.3, p. 56	2A	**SB 2.1**, 1-6, 12-13, 31; p. 66-67
• Explain the relationship of an element's position on the periodic table to its atomic number, ionization energy, electro-negativity, atomic size, and classification of elements.	5.1, pp. 137-139	5A	**SB 5.4**, 16-19, 22, p. 162
• Use electro-negativity to explain the difference between polar and non-polar covalent bonds.	7.1, p. 198-204	7A	**SB 7.2**, 18, 21-26, p. 224-225
3.2.C.A2 Periodic table, atomic structure, and the mole concept			
• Compare the electron configurations for the first twenty elements of the **periodic table.**	5.1, p. 138; 6.1, p. 175 6.2, pp. 177-182	6A, 6B, 6C	**SB 6.3**, 34-38, 43-44, p. 194-195
• Relate the position of an element on the **periodic table** to its electron configuration and compare its reactivity to the reactivity of other elements in the table.	6.1, pp. 171-182	6A, 6B, 6C	**SB 6.3**, 34-38, 43-44, p. 194-195
• Explain how atoms combine to form compounds through both ionic and covalent bonding.	7.1, p. 198-204	7A	**SB 7.2**, 18, 21-26, p. 224-225, 43-46, p. 226
• Predict chemical formulas based on the number of valence electrons.	7.2, p. 207-212	7A	**SB 7.2**, 3-5, p. 224; 43-46, p. 226

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	Student book	**Lab manual**	
• Draw Lewis dot structures for simple molecules and ionic compounds.	7.2, p. 207-217	7A	**SB 7.4,** 53-62, p. 227
• Predict the chemical formulas for simple ionic and molecular compounds.	2.2, pp. 49-50	2B	**SB 2.2**, 12-18, 42-46, p. 66-68
• Use the **mole** concept to determine number of particles and **molar mass** for elements and compounds.	2.1, pp. 45-46, 54		**SB 2.2**, 12-18, 42-46, p. 66-68
• Determine percent compositions, empirical formulas, and molecular formulas.	8.4, pp. 250-253	8A	**SB 8.4**, 48-51, pp 257-258; 65-77, p. 259
3.2.C.A3 Phases of matter and nuclear chemistry			
• Describe the three normal states of matter in terms of energy, particle motion, and phase transitions.	1.3, p. 27		**SB 1.3,** 31-34, 57, pp. 33-34
• Identify the three main types of radioactive decay and compare their properties.	20.2, pp. 639-641	20B	**SB 20.2**, 43-47, 48-53, p. 661-662
• Describe the process of **radioactive decay** by using nuclear equations and explain the concept of half-life for an isotope.	20.2, pp. 639-641 20.3, pp. 642-646	20A	**SB 20.2**, 43-47, 48-53, p. 661-662
a. Compare and contrast **nuclear fission** and **nuclear fusion.**	20.2, pp. 637-641; 20.4, pp. 652-655		**SB 20.2**, p. 660; 43-46, 49-50, p. 661
3.2.C.A4 Chemical changes and stoichiometry			
• Predict how combinations of	4.1, p. 104-106	4B, 4C	**SB 4.1**, 2, 4,

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	Student book	**Lab manual**	
substances can result in physical and/or chemical changes.			36-38, pp. 128-129
• Interpret and apply the laws of conservation of mass, constant composition (definite proportions), and multiple proportions.	4.2, p. 115-117		**SB 4.2**, 66-72, pp. 130-131
• Balance chemical equations by applying the laws of conservation of mass.	10.1, p. 298		**SB 10.1**, 5-6, p. 322; 29-31, p. 323
• Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion.	10.3, pp. 305-308	10B	**SB 10.3**, 7-14, p. 322
• Use stoichiometry to predict quantitative relationships in a chemical reaction.	11.1, p. 328-338 11.4, p. 353-357		**SB 11.1**, 38-45, p. 362-363; **SB 11.4**, 64-69, p. 364-365
3.2.C.A5 Atomic structure			
• Recognize discoveries from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus), and Bohr (planetary model of atom), and understand how each discovery leads to modern theory.	5.1, p. 134-135 5.2, p. 144		**SB 5.1**, 23, 28, 29-32; p. 163
• Describe Rutherford's "gold foil" experiment that led to the discovery of the nuclear atom. Identify the major components (protons, neutrons, and electrons) of the nuclear atom and explain how they interact.	5.1, p. 136		**SB 5.2**, 32, 37-40, p. 163

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	Student book	**Lab manual**	
3.2.C.A6 Inquiry and the nature of science			
• Compare and contrast scientific theories.	1.2 pp. 19-25 5.1, p. 134-135 5.2, p. 144	1A, 11A, 12A, 12B	**SB 5.1**, 23, 28, 29-32; p. 163 **LM 1A**, Pts 3-4, p. 2; **11A** Pt 6; **12A**: Pt 6 p.94; **12B** Pts 4, 6 p. 97-98
• Know that direct and indirect observations are used by scientists to study the natural world and universe.	1.2 pp. 19-25	1A	**SB 1.2** 18-30, pp. 32-33; 51-55, p. 34; **1.3** 57, p. 34
• Identify questions and concepts that guide scientific investigations.	1.2 pp. 19-25	1A, 11A, 12A, 12B	**SB 1.2** 18-30, pp. 32-33; 51-55, p. 34; **1.3** 57, p. 34 **LM 1A**, Pts 3-4, p. 2; **11A** Pt 6; **12A**: Pt 6 p.94; **12B** Pts 4, 6 p. 97-98
• Formulate and revise explanations and models using logic and evidence.	1.2, p. 20, 22; 5.1, pp. 135-136; 6.1, pp. 171-175; 14.2: p. 454		**SB 1.2** 18-30, pp. 32-33; 51-55, p. 34
• Recognize and analyze alternative explanations and models.	1.2, p. 20, 22; 5.1, pp. 135-136; 6.1, pp. 171-175; 14.2: p. 454		**SB 1.2** 18-30, pp. 32-33; 51-55, p. 34
• Explain the importance of accuracy and precision in making valid measurements.	1.2, pp. 19-26 5.1, pp. 135-136		**SB 1.2**, 18-30, p. 32; 5.1, 23-25, 26, p. 163
• Examine the status of existing	1.2, pp. 19-26, 30; 2.1, p. 43;		**SB 1.2** 18-30, pp. 32-33; 51-

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	Student book	**Lab manual**	
theories.	2.2, p. 48; 3.1, p. 72; 5.1 p. 132; 5.2, p. 149; 6.3, p. 189; 7.3, p. 222; 8.4, p. 254; 11.4, p. 359; 18.4, p. 596		55, p. 34; **5.1** & **5.2** 23-28, 31-33, 37 p. 163
• Evaluate experimental information for relevance and adherence to science processes.	1.2, pp. 19-26	14A, 14B	**SB 1.2**, 18-30, 54-55, pp. 32-34
• Judge that conclusions are consistent and logical with experimental conditions.		3B: 6; 8A: 3; 9B: 6; 11B: 5 & 6; 12B: 6; 13B: 4; 14A: 3	**LM 3B**: 6e; **8A**: 3a-f; **9B**: 6 steps 1-4; **11B**: 5g, 6d-f; **12B**: 6i-j; **13B**: 4b; **14A**: 3f
• Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.	1.2, pp. 22 - 24	5B, 5C, 6C, 10A, 10B, 12B, 13C, 13D, 14A	**SB 1.2**, 18-30, 54-55, pp. 32-34
• Communicate and defend a scientific argument.	1.2, pp. 19-26	2D, 3A, 5B, 5C, 6C, 9B, 9C, 10A, 12B, 13B	**SB 1.2**, 18-30, 51-55, pp. 32-34
GRADE 11 ASSESSMENT ANCHORS FOR PHYSICAL SCIENCE SHOWN BELOW			
S11.C.1.1.1 Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., protons, neutrons, electrons).	5.1, pp. 134-137	5A	**SB 5.1,** 23, 29, 30, 32, p. 162
S11.C.1.1.2 Explain the relationship between the physical properties of a substance and its	2.1, pp. 39-40		**SB 2.1,** 30-37, p. 67, **14.1**, 7,

PA Chemistry Standard	Location in *NAC*		Assessment
	Student book	**Lab manual**	
molecular or atomic structure.			p. 468
S11.C.1.1.3 Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.	7.1, pp. 201-203		**SB 7.1,** 16-18, p. 224
S11.C.1.1.4 Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.	6.1, pp. 171-173	6A, 6B	**SB 6.1,** p. 35, 43, p.194
S11.C.1.1.5 Predict the behavior of gases through the application of laws (e.g., Boyle's law, Charles' law, or ideal gas law).	14.2, pp. 450-456	14A	**SB 14.1,** 8, 9, 10, 38-41, pp. 468-469
S11.C.1.1.6 Describe factors that influence the frequency of collisions during chemical reactions that might affect the reaction rates (e.g., surface area, concentration, catalyst, temperature).	12.1, pp. 368-372	12A, 12B	**LM 12B,** 6e, 6h