LAB-AIDS[1] Correlations to
A Natural Approach to Chemistry

VIRGINIA STANDARDS OF LEARNING

HIGH SCHOOL CHEMISTRY

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 Virginia SOL for high school chemistry. It is not an exhaustive list; other locations may exist that are not listed here.

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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).

SE 1.2 pp. 19-25

Means Student Book Chapter 1 Section 1.2 pages 19 – 25

LM 1A, 3D, 11A

Means Lab Investigations Manual Chapter 1 Investigation 1A;

Chapter 3 Investigation 3D;

Chapter 11 Investigation 11A

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.

VA Standard of Learning	*Where taught in NAC*	*Where assessed*
CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include		
a) designated laboratory techniques;	See for example, Student Laboratory Manual (LM) for Natural Approach to Chemistry	Safety quiz, LM pp. xv-xvi
b) safe use of chemicals and equipment;	See for example, Student Laboratory Manual (LM) for Natural Approach to Chemistry, Laboratory Safety, p. xiii-xvi	Safety quiz, LM pp. xv-xvi
c) proper response to emergency situations;	See for example, Student Laboratory Manual (LM) for Natural Approach to Chemistry, Laboratory Safety, p. xiii-xvi	Safety quiz, LM pp. xv-xvi
d) manipulation of multiple variables, using repeated trials;	See for example LM 12B LM pp. 91-94; 13B, LM pp. 107-108; 13C, LM pp. 109-112; 14A, LM 117-120; etc.	LM 4 a-e, 6a-k, pp.97-98
e) accurate recording, organization, and analysis of data through repeated trials;	Throughout, see for example See for example LM 12B LM pp. 91-94; 13B, LM pp. 107-108; 13C, LM pp. 109-112; 14A, LM 117-120; etc.	LM 13B 4a-f, p. 108
f) mathematical and procedural error analysis;	See for example, LM 3B, LM pp. 27-30; 8A LM pp. 63-64; 9B, LM pp. 69-72; 11B, LM pp. 87-90; 12B, LM pp. 95-98; 13B, LM pp. 107-108; 14A, LM 117-120	3B 6 a-e, p. 30 8A 3a-f, p. 64
g) mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis;	Throughout the Lab Manual (LM); see for example, LM Appendix C "Chemistry Mathematics, Scientific Notation, Logarithms, Scientific Notation," pp. 167-172; Dimensional Analysis, Lab 1D, pp. 7-8; LM 3B, LM pp. 27-30; 8A LM pp. 63-64	3B 6 a-e, p. 30 8A 3a-f, p. 64 9B Pts 3-6, pp. 70-71
h) use of appropriate technology including computers, graphing calculators, and probeware, for gathering	A Natural Approach to Chemistry features the use of specially designed probeware package, the LAB-MASTER ™, which accepts temperature and	

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data, communicating results, and using simulations to model concepts;	conductivity probes, boils water, has a built in spectrophotometer, and more; and also specially designed atomic models and and atom-building model to show electron orbital filling, isotopes, and much more.	
i) construction and defense of a scientific viewpoint; and	1.2, SE pp. 19-26	1.2, 51-55, p. 34
j) the use of current applications to reinforce chemistry concepts.	See, for example, Chemistry Connections for each chapter, e.g., 1.3, pp 30-31 Environmental monitoring, health effects of lead, air quality, forensic chemistry; 2.3, pp. 64-65 Sodium and chlorine are toxic but form a vital compound for health; 3.3, pp. 96-97 Evaporative cooling used in sub-Saharan Africa; 4.3, pp. 126-127 Movie set chemistry, special effects, pyrotechnics; 6.3, pp. 190-191 Group I and II metal ions and our bodies, health effects 7.3, pp. 222-223 Chemistry of trans fats and fatty acids, saturated fats, cis- and trans isomers 8.4, pp. 254-255 Nanotechnology, food, cosmetics, and medicine	
CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of		

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a) average atomic mass, mass number, and atomic number;	2.1, SE pp. 44- 45 5.1, SE pp. 138-139;	2.1, 38-39, p. 67
b) isotopes, half lives, and radioactive decay;	5.1, SE p 138, 20.2, SE pp 637-641 LM 5A pp. 47-48 20.2, SE pp. 637-641 20.3, SE pp. 642-646	20.2, 44-53, p. 661-662 20.3, 54-56, p. 662
c) mass and charge characteristics of subatomic particles;	5.1, 5.2, SE pp. 135-137, 141 6.3, SE pp. 183-185	5.2, 29-40, p. 163 6.3, 30-31, p. 193
d) families or groups;	2.1, SE p 44 6.2, SE pp. 177-182	6.2, 21-29, p. 193
e) periods;	2.1, SE pp. 43-44 6.2, SE pp. 175-181	2.1, 38-39, p. 67 6.3, 35-38, p. 194
f) trends including atomic radii, electronegativity, shielding effect, and ionization energy;	Reactivity, p. 112, atomic radii, electronegativity and ionization energy, 6.1, SE pp. 172-174	
g) electron configurations, valence electrons, and oxidation numbers;	Valence electrons, 6.3, pp. SE 183-186; Electron configurations 5.3, pp. 152-154; oxidation number pp. 479-480	6.3, 32-33, p. 193; 50-52, p. 195 5.3, 46-51, pp. 163-164
h) chemical and physical properties; and	4.2, 4.3, SE pp. 118-125	4.2, 48-59, p. 130
i) historical and quantum models.	5.1, SE pp. 134-136, 5.2, pp. 144-148	5.2, 29-39, 52-53, pp. 163-164
CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include		

VA Standard of Learning	*Where taught in NAC*	*Where assessed*
a) nomenclature;	4.2, SE pp. 115-117	4.2, 48-59, p. 130
b) balancing chemical equations;	4.2, SE pp. 115-117 10.1-10.2, pp. 300-304, 15.2 (redox) SE pp. 486-492	4.2, 48-59, p. 130 10.2, 53-63, pp. 324-325 15.2, 84-87, p. 509
c) writing chemical formulas;	2.2, SE p 49 4.2, SE pp. 115-117 LM 2B pp. 11-16	2.2, 64-67, p. 68-69 4.2, 48-59, p. 130 LM 2B, pts 5-6
d) bonding types;	4.1, SE pp. 107-111 7.1, SE pp. 198-206	4.1, 43-47, p. 129 7.1, 15-29, pp. 224-225
e) reaction types; and	4.3, SE pp. 122-125 10.3, SE pp. 305-310 LM 4C pp. 43-46	4.3, 31-33, p. 129 10.3, 30-41, 64-65, pp. 324-325
f) reaction rates, kinetics, and equilibrium.	12.1-12.2, SE pp. 386-392 LM 12A, 12B, 12C	12.1, 21-35, p. 405
CH.4 The student will investigate and understand that chemical quantities are based on molar relationships. Key concepts include		
a) Avogadro's principle and molar volume;	2.3, SE p 63 14.2, SE pp. 450-456 14.3, SE pp. 462-465 LM 14A	2.3, 53-78, pp. 68-69 14.2, 21, p. 468
b) stoichiometric relationships;	11.1-11.4, SE pp. 328-365 LM 11A, 11B	11.1-11.4, 38-53, pp. 363-364
c) solution concentrations; and	2.3, SE pp. 56-63 9.2, SE pp. 270-277 LM 2C, 9A, 9B	2.3, 68-76, p. 69 9.3,
d) acid/base theory; strong electrolytes, weak electrolytes, and nonelectrolytes; dissociation and ionization; pH and pOH; and the titration	4.3, SE pp. 124-125 13.1-13.4, SE pp. 410-439 LM 13A, 13B, 13C, 13D	4.3 28-34, p. 129 13.1-13.3, 21-51, pp. 437-438

VA Standard of Learning	*Where taught in NAC*	*Where assessed*
process.		
CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include		
a) pressure, temperature, and volume;	14.1, SE pp. 442-449 14.2, SE pp. 450-461	14.2, 36-72, pp. 469-471
b) partial pressure and gas laws;	2.3, SE p 63 14.2, SE pp. 450-461	14.2, 36-72, pp. 469-471
c) vapor pressure;	3.3, SE pp. 94-95 LM 14A	3.3, 48-57, p.100
d) phase changes;	3.3, SE pp. 88-101	3.3, 48-57, p.100
e) molar heats of fusion and vaporization;	3.3, SE pp. 88-101 LM 3D	3.3, 48-57, p.100
f) specific heat capacity; and	3.2, SE pp. 79-87 LM 3B	3.2, 64-73, p. 100-101
g) colligative properties.	9.2, SE pp. 285-6	9.2, 27, p. 291
CH.6 The student will investigate and understand how basic chemical properties relate to organic chemistry and biochemistry. Key concepts include		
a) unique properties of carbon that allow multi-carbon compounds; and	17.1, SE pp. 538-546	17.1, 32-54, p. 565-566

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b) uses in pharmaceuticals and genetics, petrochemicals, plastics, and food.	17.3, SE pp. 554-563	17.3, 69-83, p. 567