LAB-AIDS Correlations to

West Virginia CONTENT STANDARDS AND OBJECTIVES for Science[1]

High School CHEMISTRY

*A Natural Approach to Chemistry* (NAC) is written by Hsu, Chaniotakis, Carlisle, and Damelin, This correlation is intended to show selected locations in NAC programs that support the West Virginia CSO for chemistry. It is not an exhaustive document; other citations may exist that are not listed here.

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[1] Source: http://wveis.k12.wv.us/Teach21/public/cso/cso.cfm

| 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.<br><br>*"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.<br><br>*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.<br><br>*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).

**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.

| WV CSO | Description | Location in NAC | | Assessed |
|---|---|---|---|---|
| | | Text | Lab manual | |
| SC.S.C.1<br>Nature and Application of Science<br>Students will:<br>• demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists.<br>• demonstrate the ability to use the inquiry process to solve problems.<br>• relate science-technology-societal issues while using a variety of sources to construct and defend their solutions | | | | |
| SC.O.C.1.1 | Implement safe procedures and practices when manipulating equipment, materials, organisms, and models. | | See for example, xiii-xiv; safety notes in all labs | Lab safety quiz xv-xvi |
| SC.O.C.1.2 | Formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results. | See, for example 1.2, p. 20, 22 ; 5.1, pp. 135-136 (atomic theory); 6.1, pp. 171-175 (periodic table); 14.2: p. 454 (gas laws) | | SB 1.2 18-30, pp. 32-33; 51-55, p. 34 |
| SC.O.C.1.3 | Conduct and/or design investigations that incorporate the skills and attitudes and/or values of scientific inquiry (e.g., established research protocol, accurate record keeping, replication of results and peer review, objectivity, openness, skepticism, fairness, or creativity and logic). | | Throughout, eg., 1A, 11A, 12A, 12B | Throughout, e.g., SB 1.2 18-30, pp. 32-33; 51-55, p. 34; 1.3 57, p. 34<br>LM 1A, Pts 3-4, p. 2; 11A Pt 6; 12A: Pt 6 p.94; 12B Pts 4, 6 p. 97-98 |
| SC.O.C.1.4 | Design, conduct, evaluate and revise experiments (e.g., compose a question | 1.2 pp. 19-25 | Throughout, eg., 1A, 11A, | Throughout, e.g., SB |

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|---|---|---|---|---|
| | | Text | Lab manual | |
| | to be investigated, design a controlled investigation that produces numeric data, evaluate the data in the context of scientific laws and principles, construct a conclusion based on findings, propose revisions to investigations based on manipulation of variables and/or analysis of error, or communicate and defend the results and conclusions). | | 12A, 12B | 1.2 18-30, pp. 32-33; 51-55, p. 34; 1.3 57, p. 34<br>LM 1A, Pts 3-4, p. 2; 11A Pt 6; 12A: Pt 6 p.94; 12B Pts 4, 6 p. 97-98 |
| SC.O.C.1.5 | Draw conclusions from a variety of data sources to analyze and interpret systems and models (e.g., use graphs and equations to measure and apply variables such as rate and scale, evaluate changes in trends and cycles, or predict the influence of external variances such as potential sources of error, or interpret maps). | | 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 |
| SC.O.C.1.6 | Investigate, compare and design scientific and technological solutions to address personal and societal problems. | 3.3, pp. 96-97; 7.3, pp. 222-223; 8.4, pp. 254-255; 10.4, pp. 318-319; 15.4, pp. 504-505 | 15B, 17A | LM 15B, 5-3, p. 126; 17A, 5c, d, f, p. 136 |
| SC.O.C.1.7 | Given current science-technology-societal issues, construct and defend potential solutions. | 1.2, pp. 19-26, 30; 2.1, p. 43; 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; | | SB 1.2 18-30, pp. 32-33; 51-55, p. 34; 5.1 & 5.2 23-28, 31-33, 37 p. 163 |

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|---|---|---|---|---|
| | | Text | Lab manual | |
| | | 18.4, p. 596 | | |
| SC.O.C.1.8 | Relate societal, cultural and economic issues to key scientific innovations. | See for example the 'Chemistry Connections' for each chapter, e.g., 7.3, pp. 222-223 (trans fats);10.4, pp. 318-319 (green chemistry); 19.3, pp. 628-629 (carbon sequestration); 20.5, pp. 658-659 (nuclear medicine) | | |
| SC.O.C.1.9 | Synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time) | 3.3, pp. 96-97; 7.3, pp. 222-223; 8.4, pp. 254-255; 10.4, pp. 318-319; 15.4, pp. 504-505 | 15B, 17A | LM 15B, 5-3, p. 126; 17A, 5c, d, f, p. 136 |
| SC.S.C.2<br>Content of Science<br>Students will:<br>• demonstrate knowledge, understanding and applications of scientific facts, concepts, principles, theories and models as delineated in the objectives.<br>• demonstrate an understanding of the interrelationships among physics, chemistry, biology, earth/environmental science and astronomy.<br>• apply knowledge, understanding and skills of science subject matter/concepts to daily life experiences. | | | | |
| SC.O.C.2.1 | Classify pure substances by their chemical and physical properties. | 2.1, p. 39-40; 4.1, p. 104-106 | | SB 4.2: 53-55, p. 130 |
| SC.O.C.2.2 | Research and evaluate contributions to the evolution of the atomic theory. | 5.1, pp. 134-136 | | SB 5.1: 23-25, 29-33, p. 163 |
| SC.O.C.2.3 | Describe atoms using the Quantum Model. | 5.2/5.3, pp. 144-154 | | SB 5.1: 23-25, 29-33, p. 163 |
| SC.O.C.2.4 | Produce electron configurations and orbital diagrams for any element on the periodic table and predict the chemical properties of the element from the electron configuration. | 5.3, p. 152-154<br>6.2. pp 171-174 | 6C | SB 6.2: 46-48; 6.2: 51-52, p. 195 |
| SC.O.C.2.5 | Illustrate Lewis' dot structures for representative (main group) elements. | 7.3, p. 214-217 | 7A | SB 7.4: 53-62, p. 227 |
| SC.O.C.2.6 | Generate the correct formula and/or name for ionic and molecular | 2.2, pp 49-51 | 2B | SB 8.2: 59-62, p. 258 |

| WV CSO | Description | Location in NAC | | Assessed |
|---|---|---|---|---|
| | | Text | Lab manual | |
| | compounds. | 8.1, p. 233-237<br>8.2, p. 244 | | |
| SC.O.C.2.7 | Analyze periodic trends in atomic size, ionic size, electronegativity, ionization energy and electron affinity. | 6.1, p.176,<br>7.1, 204 | | SB 6.3: 35, p. 194 |
| SC.O.C.2.8 | Predict the type of bonding that occurs between atoms and characterize the properties of the ionic, covalent or metallic substances. | 7.1, p. 201-203 | | SB 7.2: 43-46, p. 226 |
| SC.O.C.2.9 | Identify oxidation numbers to determine electron movement. | 6.3, p. 184-186 | | SB 6.2: 51-52, p. 195 |
| SC.O.C.2.10 | Construct models to explain the structure and geometry of organic and inorganic molecules. | 8.1, pp. 230-236<br>8.2, pp 237-241 | | SB 8.1: 22-26, p. 257 |
| SC.O.C.2.11 | Given the reactants, anticipate the products and create balanced equations for the five general types of chemical reactions:<br>• synthesis or combination,<br>• decomposition,<br>• single replacement,<br>• double replacement and<br>• combustion. | 10.3, p. 306<br><br>15.2, p. 478, 489-492 | 15C, 15D | SB 10.3, 7-14, p. 322; 29-37, p. 323<br><br>SB 15.4: 83-87, p. 509 |
| SC.O.C.2.12 | Determine experimentally the effects of temperature and concentration on solution properties:<br>• solubility,<br>• conductivity,<br>• density and<br>• colligative properties. | 9.3, pp. 284-286 | | SB 9.3: 57, 58*, 68, 74, p. 292 |
| SC.O.C.2.13 | Classify reactions as exothermic and endothermic reactions by the direction of heat flow in a chemical reaction. | 4.2, p. 118-119 | 4B, 4C | SB 4.2: 56-58, p. 130 |
| SC.O.C.2.14 | Explain the chemical and physical concepts involved in dynamic equilibrium. | 12.1, p. 385-389 | 12B, 12C | SB 12.2: 44-46, p. 406 |
| SC.O.C.2.15 | Generate mole conversions that demonstrate correct application of scientific notation and significant:<br>• mass to number of particles,<br>• number of particles to volume,<br>• volume to mass. | 2.2, pp. 53-55 | 2B | SB 2.2: 66, p. 69<br>SB 2.3: 80, p. 69 |
| SC.O.C.2.16 | Perform calculations using the combined gas laws. | 14.3, p. 462-465 | | SB 14.3: 32, p. 469 |

| WV CSO | Description | Location in NAC | | Assessed |
|---|---|---|---|---|
| | | Text | Lab manual | |
| SC.O.C.2.17 | Perform the following "mole" calculations showing answers rounded to the correct number of significant figures:<br>• molarity<br>• percentage composition<br>• empirical formulas<br>• molecular formulas<br>• formulas of hydrates<br>• mole-mole and mass-mass stoichiometry<br>• determination of limiting reactant<br>• theoretical yield. | 8.4, p. 250-251<br><br>8.4, pp. 252-253<br><br>11.3, p. 345-348<br><br>11.2, pp. 339-342 | 2B, 8A | SB 8.4: 65-67, p. 259<br><br>SB 8.4: 75-77, p. 259<br><br>SB 11.3: 30-37, p. 361<br><br>SB 11.2: 46-47, p. 363 |
| SC.O.C.2.18 | Compare and contrast the Arrhenius and Bronsted-Lowry definitions of acids and bases. | 13.1, p. 413-4.14 | | SB 13.1: 28, 30, 31-32, p. 437 |
| SC.O.C.2.19 | Compare methods of measuring pH:<br>• indicators<br>• indicator papers<br>• pH meters. | 13.2, p. 416-420 | 13A | SB 13.2: 35, 36, 40, p. 437 |
| SC.O.C.2.20 | Predict the product of an acid-base reaction. | 13.4, p. 428, 430-431 | 13B, 13C | SB 13.4: 52-53, p. 438 |
| SC.O.C.2.21 | Investigate and explain water's role as a solvent based upon principles of polarity of substances. | 9.1, pp. 262-269 | | SB 9.1: 31-42, p. 291 |