



LAB-AIDS Alignment to Wisconsin Model Academic Science Standards

High School Chemistry, Grade 12¹

A Natural Approach to Chemistry (NAC) is written by Hsu, Chaniotakis, Carlisle, and Damelin, and is intended for use in general high school chemistry classes.

This document was prepared by Mark Koker, Ph D, Director of Curriculum and Training at LAB-AIDS. This is not an exhaustive document. It is designed to provide a general overview of the alignment of A Natural Approach to Chemistry to Wisconsin 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 Darin Christianson, LAB-AIDS Regional Manager, at 507.301.3355, or by email at darin@lab-aids.com. You may visit us on the web at www.lab-aids.com.

¹ <http://dpi.wi.gov/standards/sciintro.html>



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

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.

17A, 5a-f

Means Laboratory Investigations Manual Chapter 17 Investigation 17A Part 5 a-f.

Wisconsin Model Academic Science Standard	Location in NAC	Where Assessed
A. Science Connections		
A.12.1 Apply the underlying themes of science to develop defensible visions of the future	See 'Chemistry Connections' content for all chapters	
A.12.2 Show how conflicting assumptions about science themes lead to different opinions and decisions about evolution, health, population, longevity, education, and use of resources, and show how these opinions and decisions have diverse effects on an individual, a community, and a country, both now and in the future	Not applicable	
A.12.3 Give examples that show how partial systems, models, and explanations are used to give quick and reasonable solutions that are accurate enough for basic needs	LM 3D (phase change) LM 4A (water cycle) LM 17 A, B (carbon and hydrocarbons)	3D, 3a-f 4A, 3 a-e, 4 c-d 17A, 5a-f 17B, 3a-c
A.12.4 Construct arguments that show how conflicting models and explanations of events can start with similar evidence	SB 5.1, 5.2 (early theories about the structure of the atom)	5.1: 23, 25, 28 5.2: 4, 29-33, 37, 38
A.12.5 Show how the ideas and themes of science can be used to make real-life decisions about careers, work places, life-styles, and use of resources	See 'Chemistry Connections' content for all chapters	
A.12.6 Identify and, using evidence learned or discovered, replace inaccurate personal models and explanations of science-related events	Local and personal standard	Can be assessed using end-of-chapter questions and Exam View item banks
A.12.7 Re-examine the evidence and reasoning that led to conclusions drawn from investigations, using the science.	SB 5.1, 5.2, 6.1, 14.2	SB 1.2, 18-30; 51-55; 5.1, 23-25, 38; 6.1, 12-13, 15-16; 14.2, 25
B. Nature of Science		
B.12.1 Show how cultures and individuals have contributed to the development of major ideas in the earth and space, life and environmental, and physical sciences	Cultures, not covered; Individuals: Bohr, Dalton, Rutherford SB 5.1, 5.2, Le Chatelier, SB 12.1	5.1: 23, 25, 28 5.2: 4, 29-33, 37, 38
B.12.2 Identify the cultural conditions that are usually	Not covered	

Wisconsin Model Academic Science Standard	Location in NAC	Where Assessed
present during great periods of discovery, scientific development, and invention		
B.12.3 Relate the major themes of science to human progress in understanding science and the world	See 'Chemistry Connections' content for all chapters	
B.12.4 Show how basic research and applied research contribute to new discoveries, inventions, and applications	See 'Chemistry Connections' content for all chapters, e.g., 1.3 forensic chemistry, 8.4 nanotechnology, 10.4 green chemistry, 15.4 catalytic converters, 20.5 nuclear medicine, PET and CAT scans	
B.12.5 Explain how science is based on assumptions about the natural world and themes that describe the natural world	SB 1.2, 5.4, 21.2	SB 5.4, 56, 61, 62; 21.1, 2, 3, 7 21.2 10, 12; 21.3, 21-23
C. Inquiry		
C.12.1 When studying science content, ask questions suggested by current social issues, scientific literature, and observations* of phenomena, build hypotheses that might answer some of these questions, design possible investigations*, and describe results that might emerge from such investigations	SB 1.2 pp. 19-25 LM 1A, 3D 11A: 6, 12A: 6 12B: 1, 6	SB 1.2, 51-55 1A, 4a-c 3D, 3a-f 11A, 4a-e 12A, 6a-e 12B, 6a-k
C.12.2 Identify* issues from an area of science study, write questions that could be investigated*, review previous research on these questions, and design and conduct responsible and safe investigations to help answer the questions	LM xi-xiv, 1C, 2A, 2C, 3A-D, 4A, 5B, 8A, 9A-C, 10B-C, 11A, 12A, 13A, 15A- D, 17B	1C, 7a-b 2A, 5a-b 3A, 8a-d 4A, 4a-d 8A, 3a-f 9A, 4a-e 10B, 8a-g 11A, 8a-e 12A, 7a-b 15A, 5a-e 17B, 3a-c
C.12.3 Evaluate* the data collected during an investigation*, critique the data-collection procedures and results, and suggest ways to make any needed improvements	SB 1.2 pp. 19-25 LM 3B: 6; 8A:3; 9B: 6; 11B: 6; 12B: 6; 13B: 4; 14A: 3	SB 1.2, 51-55 3B, 6a-e 8A, 3 a-f 9B, 6,1-4 11B, 5a-g 12B, 6a-k 13B, 4a-f

Wisconsin Model Academic Science Standard	Location in NAC	Where Assessed
		14A, 3a-h
C.12.4 During investigations*, choose the best data-collection procedures and materials available, use them competently, and calculate the degree of precision of the resulting data	LM 3A, 3C, 5A*, 9A, 12A	3A, 8a-d 3C, 4a-e 9A, 4a-e 9A, 4a-e 12A, 7a-b
C.12.5 Use the explanations* and models* found in the earth and space, life and environmental, and physical sciences to develop likely explanations* for the results of their investigations*	LM 3D (phase change) LM 17 A, B (carbon and hydrocarbons) LM 4A (water cycle)	3D, 3a-f 4A, 4a-d 17A, 5a-f 17B, 3a-c
C.12.6 Present the results of investigations* to groups concerned with the issues, explaining* the meaning and implications of the results, and answering questions in terms the audience can understand	3C: Pt 1; 4A: Pts 2-3; 5B: Pt 4; 5C: Pt 3; 7A-B; 9A: 2; 9B; 12B: 5; 13A: 8; 14B: 3...	LM 3C: 2d; 4A: 3a-d; 5B: 4c, e-g; 5C: see puzzle cards; 7A: Pt 3-4; 7B: 1a-b, 2a-c, 3a-d, 4a-d; 9A: 2a, e; 9B: Pts 4-5...
C.12.7 Evaluate* articles and reports in the popular press, in scientific journals, on television, and on the Internet, using criteria related to accuracy, degree of error, sampling, treatment of data, and other standards of experimental design	Not covered	
D. Physical Science		
STRUCTURE OF ATOMS AND MATTER		
D.12.1 Describe* atomic structure and the properties of atoms, molecules, and matter during physical and chemical interactions*	SB 2.2, 5.1, 5.2, 10.3, 10.4	2.2, 42-46 5.1, 23-28 5.2, 20-40 10.3, 39-40 10.4, 42-46
D.12.2 Explain* the forces that hold the atom together and illustrate* how nuclear interactions* change the atom	SB 5.1, 7.1, 20.2	5.1, 23-28 7.1, 15-20 20.2, 43-53
D.12.3 Explain* exchanges of energy* in chemical interactions* and exchange of mass and energy in atomic/nuclear reactions	SB 10.3, 10.4, 20.4	10.3, 39-40 10.4, 42-46 20.4 57-64
CHEMICAL REACTIONS		

Wisconsin Model Academic Science Standard	Location in NAC	Where Assessed
D.12.4 Explain* how substances, both simple and complex, interact* with one another to produce new substances	SB 2.1, 10.3, 10.4, 17.3	2.1, 30-36 10.3, 39-40 10.4, 42-46 17.3, 66-72, 81-83
D.12.5 Identify* patterns in chemical and physical properties and use them to predict* likely chemical and physical changes and interactions	SB 2.1, 10.3	2.1, 30-36 10.3, 39-40
D.12.6 Through investigations*, identify* the types of chemical interactions*, including endothermic, exothermic, oxidation, photosynthesis, and acid/base reactions	SB 10.3, 13.4	10.3, 39-40 13.4, 52-60
CONSERVATION OF ENERGY AND THE INCREASE IN DISORDER		
D.12.10 Using the science themes*, illustrate* the law of conservation of energy* during chemical and nuclear reactions	SB 3.1, 3.2, 3.3, 20.4	3.1, 34-38 3.2, 39-46 3.3, 48-57 20.4, 57-64
INTERACTIONS OF MATTER AND ENERGY		
D.12.11 Using the science themes*, explain* common occurrences in the physical world	See for example, chemistry connections, SB 1.3, 2.3, 3.3, 4.3, 5.4, etc.	
D.12.12 Using the science themes* and knowledge of chemical, physical, atomic, and nuclear interactions*, explain* changes in materials, living things, earth's features, and stars	See for example, chemistry connections, SB 1.3, environmental monitoring, 6.3, Group I, II metal ions and our bodies, 9.4 chemistry of ocean water, 12.4 cave chemistry, 13.4, pH ranges for living things, 21.1 sun, stars, and solar system	
G. Science Applications		
G.12.1 Identify personal interests in science and technology, implications that these interests might have for future education, and decisions to be considered	See 'Chemistry Connections' content for all chapters	
G.12.2 Design, build, evaluate, and revise models and explanations related to the earth and space, life and environmental, and physical sciences	LM 3D (phase change) LM 17 A, B (carbon and hydrocarbons) LM 4A (water cycle)	3D, 3a-f 4A, 4a-d 17A, 5a-f 17B, 3a-c

Wisconsin Model Academic Science Standard	Location in NAC	Where Assessed
G.12.3 Analyze the costs, benefits, or problems resulting from a scientific or technological innovation, including implications for the individual and the community	SB 1.3 health effects of lead & forensic chemistry, 8.4 nanotechnology, 10.4, PERC alternatives, 15.4 catalytic converters, 20.5 nuclear medicine, PET and CAT scans	
G.12.4 Show how a major scientific or technological change has had an impact on work, leisure, or the home		
G.12.5 Choose a specific problem in our society, identify alternative scientific or technological solutions to that problem and argue it merits	SB 8.4 nanotechnology, 10.4 biodegradable polymers, 19.3 carbon sequestration	
H. Personal and Social Perspectives		
H.12.1 Using the science themes and knowledge of the earth and space, life and environmental, and physical sciences, analyze the costs, risks, benefits, and consequences of a proposal concerning resource management in the community and determine the potential impact of the proposal on life in the community and the region	Not applicable	
H.12.2 Evaluate proposed policy recommendations (local, state, and/or national) in science and technology for validity, evidence, reasoning, and implications, both short and long-term	Not applicable	
H.12.3 Show how policy decisions in science depend on social values, ethics, beliefs, and time-frames as well as considerations of science and technology	See 'Chemistry Connections' content for all chapters	
H.12.4 Advocate a solution or combination of solutions to a problem in science or technology	See 'Chemistry Connections' content for all chapters, e.g., 1.3 forensic chemistry, 8.4 nanotechnology, 10.4 green chemistry, 15.4 catalytic converters, 20.5 nuclear medicine, PET and CAT scans	
H.12.5 Investigate how current plans or proposals concerning resource management, scientific knowledge, or technological development will have an impact on the environment, ecology, and quality of life in a community or region	Not applicable	
H.12.6 Evaluate data and sources of information when using scientific information to make decisions	LM 3B, 8A, 9B, 11B, 12B, 13B, 14A	LM 3B: 6; 8A:3; 9B: 6; 11B: 6; 12B: 6; 13B: 4; 14A: 3

Wisconsin Model Academic Science Standard	Location in NAC	Where Assessed
H.12.7 When making decisions, construct a plan that includes the use of current scientific knowledge and scientific reasoning	SB 1.2 LM 3A, 3C, 5A*, 9A, 12A	1.2, 51-55 3A, 8a-d 3C, 4a-e 9A, 4a-e 9A, 4a-e 12A, 7a-b