SCIENCE

Wyoming

GRADE	SCORES		TOTAL SCORE
F	Content and Rigor	2/7	2/10
	Clarity and Specificity	0/3	

REPORT CARD

Content & Rigor	**1.5**
Scientific Inquiry & Methodology	2
Physical Science	1
Physics	1
Chemistry	1
Earth & Space Science	3
Life Science	1
Clarity & Specificity	**0.0**

Average numerical evaluations

Overview

The Wyoming science standards are—in a word—worthless, a travesty from top to bottom. How else to describe a document that does not even pay lip service to the content essential to building a curriculum? Terms appear but convey nothing tangible about their meaning or their place in a body of knowledge.

Organization of the Standards

Wyoming's science standards are divided first into three strands (called standards): science concepts and processes, science as inquiry, and the history and nature of science. Each strand is then divided into benchmarks for each of three sub-strands: life systems, earth and space science, and physical science. The benchmarks describe what students are expected to know and be able to do at each of the assessed grades—four, eight, and eleven. Finally, "performance level descriptors" articulate how well students must perform the benchmarks to be considered "advanced," "proficient," "basic," and "below basic."

No progression of grade-specific standards or benchmarks is provided.

Content and Rigor

The writers of the Wyoming science standards failed to articulate the critical science content that K-12 students should learn. In no discipline does more than a smattering of such content appear. And the few items that are included follow no logical pattern. Worse, they are abused by a lack of any context, as if the mere presence of scientific terms on a page could somehow convey knowledge. Which, of course, it cannot.

Scientific Inquiry and Methodology

The scientific inquiry and methodology standards are vague and omit nearly all of the essential content students should learn. There is virtually no coverage of the nature or history of science. Students in fourth grade, for example, are asked only to "recognize the nature and history of science" by discussing "how scientific ideas change over time," or to describe the "contributions of scientists." Sadly, no actual content or guidance is provided that might help students achieve these aims.

Document(s) Reviewed

► *Wyoming Science Content and Performance Standards*. November 2008. Accessed from: http://edu.wyoming.gov/Libraries/Publications/Standards_2008_Science_PDF.sflb.ashx

Worse, some critical concepts that should be introduced are missing entirely. For instance, with two exceptions, the word "theory" is absent from the standards, along with the words hypothesis and law.

Physical Science

To paraphrase Gertrude Stein, there is no there here. Most of what we consider to be essential content is missing entirely. For instance, a single benchmark, appearing in eighth grade, speaks to the structure and properties of matter:

> **The Structure and Properties of Matter: Students identify characteristic properties of matter such as density, solubility, and boiling point and understand that elements are the basic components of matter. (grade 8)**

One benchmark is simply insufficient. Moreover, although the standards do mention elements and compounds, they never use the word "atom." And absolutely basic topics—such as molecules, units of measurement, and mixtures—are M.I.A. throughout the document.

If the writers assumed that students in the lower grades are not up to the challenge of learning about these topics, they are flatly mistaken. If they simply forgot to include the material, they are sloppy. In either case, the end result—a transmission of ignorance—is the same.

High School Physics

Wyoming reduces the entire field of thermodynamics and statistical mechanics (including the laws of thermodynamics) to fewer than thirty words. Worse still is the following eleventh-grade benchmark:

> **Force and Motion: Develop a conceptual understanding of Newton's Laws of Motion, gravity, electricity, and magnetism. (grade 11)**

All of Newtonian mechanics, celestial mechanics, and electromagnetism is condensed to thirteen words. And sadly, too many important topics are similarly abbreviated.

High School Chemistry

Here, again, the coverage of essential content is sketchy. Atoms, electrons, and the periodic table are not mentioned until eleventh grade (about six grades too late). Bonding is mentioned, but without using the terms ionic, covalent, metallic, or hydrogen bonding, let alone citing examples of the application of these critical concepts.

Earth and Space Science

The entire earth and space science content comprises thirty-one lines, resembling more a rapid-fire list of topics than a set of standards. The material therein is broad and vague and provides no more than "study the encyclopedia" guidance.

Life Science

The Wyoming life science standards first mention evolution in the eighth-grade benchmarks, with a distinct (if subtle) creationist flavor:

> **Evolution as a Theory: Students explain evolution as a theory and apply the theory to the diversity of species, which results from natural selection and the acquisition of unique characters through biological adaptation. (grade 8)**

The term "theory" occurs only once more in the entirety of Wyoming's standards—in a reference to the Big Bang theory (which is almost as anathematic to creationists as biological evolution). This once-commonplace trick of classifying evolution—and only evolution, among all scientific constructs—as a "theory" has been largely abandoned as too transparent. But not in Wyoming.

Oddly, this misfortune is succeeded by a sound if excessively brief account of evolution in eleventh grade:

> **Biological Evolution: Explain how species evolve over time. Understand that evolution is the consequence of various interactions, including the genetic variability of offspring due to mutation and recombination of genes, and the ensuing selection by the environment of those offspring better able to survive and leave additional offspring. Discuss natural selection and that its evolutionary consequences provide a scientific explanation for the great diversity of organisms as evidenced by the fossil record. Examine how different species are related by descent from common ancestors. Explain how organisms are classified based on similarities that reflect their evolutionary relationships, with species being the most fundamental unit of classification. (grade 11)**

And that's it.

As for other core elements of the life sciences, the standards have nothing to say about the essential requirements of living things, or of respiration and photosynthesis, or embryogenesis, or the way that genes encode protein production, or gene expression, or the entire vast field of physiology.

Given these gaping holes in content, Wyoming receives a score of two out of seven for content and rigor. (See Appendix A: Methods, Criteria, and Grading Metric.)

Clarity and Specificity

While it's true that clarity can emerge from carefully crafted terseness, that is not a characteristic of the Wyoming standards. Here, the absence of words conveys merely the absence of information.

One line in particular serves to illustrate how vague and useless the standards are. To demonstrate "basic" proficiency, fourth graders are asked to "describe what a scientist does." No further detail is provided.

The whole standards document is little more than a vocabulary list that contains terms but no definitions. And, ironically, when Wyoming does seek to offer definitions, it botches the job, with definitions that are variously empty, silly, ungrammatical, and plain ignorant. For instance, "endothermic" and "exothermic" are defined as nouns; the biosphere is described as an "area"; "biodiversity" is defined as the range of variation within a single species; the universe is vitalized in that "all things, living and nonliving, seek to attain" equilibrium; the grammatically challenged definition of Newton's laws of motion is longer than their treatment in the main text, and so on. It can be hilarious, but not helpful.

All of this is consistent with the level of the entire document. This mess is reflected in an average score of zero out of three for clarity and specificity. (See Appendix A: Methods, Criteria, and Grading Metric.)