SCIENCE

Idaho

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	0
Chemistry	4
Earth & Space Science	2
Life Science	0
Clarity & Specificity	**0.4**

Average numerical evaluations

Overview

The Idaho science standards contain precious little science. What little appears tends to be couched in broad generalities that fail to delineate what, precisely, students should know and be able to do. Making matters worse, the quality of the prose is so poor that parsing what the writers are trying to convey can be difficult. These failings make it impossible to imagine how the Idaho standards could serve as an adequate foundation for a workable K-12 science curriculum.

Organization of the Standards

The ordering of these standards is enigmatic. That is not surprising, perhaps, since properly presenting the tight structure of a particular area of science implies a reasonable depth of understanding of these structures—something not demonstrated in this document.

The K-6 standards are divided first into five "standards," more commonly thought of as strands: nature of science, physical science, biology, earth and space systems, personal and social perspectives, and technology. Each strand is then divided into a series of goals common to all grades and finally into a set of grade-specific "objectives," or standards.

Beginning in seventh grade, the standards are presented by course. Seventh grade is devoted entirely to biology. Then follow two courses slated for eighth/ninth grade: physics and chemistry, and earth science. We presume the courses based on these standards are taken one per grade, and that students could take either course in either grade, but the standards do not make this clear. A ninth/tenth-grade course covers high school biology, and an eleventh/twelfth-grade course is devoted to chemistry.

Finally, certain objectives also have "content limits," presumably to restrict the scope of items that may appear on the state test.

Content and Rigor

The Idaho standards are remarkable in their almost total disregard for the essential content necessary to educate children in the sciences. With the exception of earth and space sciences—exceptional only in juxtaposition to the rest—no discipline receives even remotely adequate coverage. Generally speaking, the quality of the

Document(s) Reviewed

► *Idaho Science Content Standards by Grade Level*. 2006. Accessed from: http://www.sde.idaho.gov/site/content_standards/science_standards.htm

scientific content starts poorly in the primary grades and declines throughout each progressive grade level, as though the writers were grappling with the limits of their own knowledge of the subject matter.

Scientific Inquiry and Methodology

Idaho makes the unfortunate sacrifice of utility on the altar of brevity and vagueness, substituting wisps of fluff for meaningful content. Students are, for example, merely asked to "make observations," "use cooperation and interaction skills," "follow instructions," "follow multi-step instructions," "conduct scientific tests," "read and give multi-step instructions," and "read and follow technical instructions." There is no actual content in any of these broad generalities.

Physical Science/High School Physics

High school physics is not covered as a separate course. To the extent that it is present, it is under the heading of physical science.

The standards begin on a hopeful note, at least in the early grades. For example, in third grade we read: "Identify the physical properties of solids, liquids, and gases." This is followed in fourth grade by "describe the physical properties of solids, liquids, and gases," and in fifth grade with "compare the physical differences among solids, liquids, and gases." The associated fifth-grade content limit requires that "students will be able to recognize the differences in molecular distance between a solid, a liquid, and a gas, as well as differences in basic molecular motion."

Unfortunately, such bright spots are the exception. Too often, lofty goals are untethered to details. For instance, in high school, students are asked to do the following:

> **Describe the Kinetic Molecular Theory as it applies to phases of matter. (grades 11-12)**

But the mere mention of kinetic theory has no value as a stand-alone standard. What is intended here? And why are both of these important topics mentioned for the first time in high school?

High School Chemistry

The Gem State's high school chemistry standards address roughly half of our evaluation criteria, including the mole concept (and molarity), the connection between light and atomic structure, and the key concepts of kinetic molecular theory—all topics that many states ignore. Moreover, they include some important additional information, such as electron configurations; strong and weak electrolytes, and nonelectrolytes; and the Law of Definite Proportions.

Unfortunately, most of the content that is presented lacks necessary rigor or clarity, making it difficult to ascertain the actual content that is to be taught. Take, for example, the following expectation:

> **Distinguish the common theories defining acids and bases. (high school chemistry)**

This standard does not make clear what, precisely, the state expects students to know or be able to do.

Much important content is also missing, including: gases; specific mention of ionic, covalent, metallic, and hydrogen bonding; molecular shapes and polarities; oxidation/reduction reactions; and carbon chemistry.

Earth and Space Science

If the Idaho standards can be said to have a silver lining, it can be only in their treatment of earth and space sciences, which contains a few examples of thoughtfulness. Students in fourth grade, for example, are asked to "explain the effect of moon's gravity on Earth's tides," a quite reasonable and timely expectation. In eighth/ninth grade, students should know how to "identify methods used to estimate geologic time"—an important and useful objective that perhaps might have been introduced earlier but nevertheless is commendable.

Unfortunately, even here many important subjects are simply ignored or glossed over. Among those omitted topics are galaxies, plate tectonics, the properties of minerals and rocks, and fossils. Referenced only in passing are the Earth's layers (limited to a sixth-grade content limit and not to an objective itself), weather, climate (limited to the sixth-grade statement, "Explain the water cycle and its relationship to weather and climate"), and the rock cycle (mentioned with little detail in fifth grade.)

Life Science

The life science content is woefully inadequate. The full extent of the treatment of evolution, which comes in seventh grade, is this standard: "Describe how natural selection explains species change over time." That's it.

High school biology receives a similarly hasty sweep-over. The following standard in ninth/tenth grade represents the complete discussion of organelles: "Explain cell functions involving chemical reactions." The coverage of reproduction in those grades fits, implausibly, into thirteen words: "[Explain] how cells use DNA to store and use information for cell functions."

Further, biology cannot recover from unfortunate statements like this, from the third-grade standards: "Diagram the food

web and explain how organisms both cooperate and compete in ecosystems." *The* "food web"?

Taken together, these failings earn Idaho an average score of two out of seven for content and rigor. (See Appendix A: Methods, Criteria, and Grading Metric.)

Clarity and Specificity

The Idaho science standards are as poorly organized as they are vague and repetitious. This is particularly true for standards addressing scientific inquiry and methodology, where statements are repeated almost verbatim across grades.

And head-scratching confusion abounds. Students in sixth grade, for example, are asked to "define the properties of matter." Huh?

In eighth/ninth grade, students must somehow "describe the characteristics of isotopes" and "state the basic electrical properties of matter," but it's impossible to understand what, exactly, is expected here. Also in these grades, students are expected to "describe the relationships between magnetism and electricity." A mighty big order! We may take it for granted that these students won't be expected to expound on Maxwell's equations, foundations of electrodynamics, and electric circuits.

Even more perplexing, some of the standards—particularly in biology—veer suddenly from the excessively vague into the highly specific, with jarring effect. For instance, while the standards contain nothing in depth on genes, ninth/tenth-grade students are asked to "explain how selective expression of genes can produce specialized cells from a single cell."

Finally, the content limits, which are included to add clarity to the document, too often only add confusion. For instance, a particularly tortured fifth-grade content limit asks students to "recognize the change(s) in physical properties that take place when physical changes occur including ice melting into water and water being heated into steam and the reverse processes." Sadly, this wandering sentence is far from unique in the Idaho standards.

Certainly, this document is useless for all the purposes for which science standards are intended. As a result, the standards earn a pitiful average score of zero out of three for clarity and specificity. (See Appendix A: Methods, Criteria, and Grading Metric.)