APPENDIX A
THE DOCUMENTS COMPARED

This alignment study used the science framework for the 2009 National Assessment of Educational Progress and the accompanying science assessment and item specifications as its baseline for comparison (National Assessment Governing Board, 2006). The two NAEP documents were developed by a steering and a planning committee made up of leaders in science, science education, general education, assessment, and various public constituencies. The documents went through public and committee review processes before finally being adopted and published in 2006 by the National Assessment Governing Board. The 2009 framework will guide the test development until approximately 2017.

NAEP assessments in science are administered across all states in the nation according to a statistical sampling plan and to some selected urban areas. The NAEP tests students at grades 4, 8, and 12 every four to five years and is intended to provide a snapshot of what students at those grades know and can do in science. In addition, the resulting data on student knowledge and performance have been accompanied by background information that allows analyses of student demographic and instructional factors related to achievement. The assessments have been designed to allow comparisons of student performance over time and among subgroups of students according to region, parental education, gender, and race/ethnicity.

The NAEP 2009 science assessment will include two separately timed, 25-minute sections of science items and extra 30-minute sections for hands-on performance tasks and interactive computer tasks, which will be given only to a subset of all students sampled. There will be multiple test booklet forms, and a matrix sampling design will be used so that students do not all receive the same items. Instead of detailing the number of test items that will fall in various categories, the NAEP outlines its distribution of items by "student response time" and stipulates that 50 percent of student response time will be used in answering multiple-choice items and the other 50 percent in constructed-response items. Constructed-response items will include short constructed-response, extended constructed-response, and concept-mapping tasks. In addition, at least one of each of the following item types must be used at each grade level: item clusters, predict-observe-explain item sets, hands-on performance tasks, and interactive computer tasks. Table A1 shows the stipulated distribution of items for the NAEP 2009 as a percent of student response time:

The NAEP science content used in this study is shown in detail in chapter two on science content from the science assessment and item specifications for the 2009 NAEP.

The New Mexico documents used in this review were the New Mexico science assessment framework for grades 3–9 and grade 11 (New Mexico Public Education Department, 2004), the *English NMSBA 2005 Total Items and Total Points* (New Mexico Public Education Department, 2005a)

TABLE A1
NAEP distribution of items and standards by content area and grade

	Grade 4		Grade 8		Grade 12	
Content area	Share of response time (percent)	Number of content standards	Share of response time (percent)	Number of content standards	Share of response time (percent)	Number of content standards
Physical	33.3	15	30.0	16	37.5	23
Life	33.3	7	30.0	12	37.5	13
Earth and space	33.3	11	40.0	15	25.0	13

and the science test blueprint for grades 3–9 (New Mexico Public Education Department, 2005b). New Mexico has readily available science assessment framework content standards for every grade level from 3 through 9, but the New Mexico website indicates that there is currently no science subtest for grade 11, as it will not be given until the 2007/08 school year. However, a copy of the science assessment framework for grade 11 was provided for this study by the New Mexico state science specialist. This study was therefore able to use the science assessment frameworks for grades 3–9 and grade 11. Since the grade 11 test will not be given until the 2007-2008 school year, the science test blueprints for grade 11 were not readily available and are not used in this study. The NMSBA Technical Report: 2005 Spring Administration (Harcourt, 2005) was also used for the test specifications analyses.

The NAEP is administered only to students in grades 4, 8 and 12. Therefore, in comparing New Mexico's science assessment framework to NAEP, the New Mexico frameworks at grades 4, 8 and 11 (New Mexico Public Education Department, 2004) were primarily used, although it was noted when alignments were found to other New Mexico grade levels.

The New Mexico Standards Based Assessment (NMSBA) is given at every grade level from grades 3 through 9 in mathematics, reading and science. It is a criterion-referenced test and the tests are developed from the assessment frameworks at each grade level for each subject. The New Mexico state standards were revised starting in 2003 to better fulfill No Child Left Behind requirements, and NMSBA tests were based on these revised standards. The NMSBA uses a combination of

TABLE A2
NMBSA distribution of items and points by strand and standard

		Grade 3		Grade 4		Grade 5		Grade 6		Grade 7		Grade 8		Grade 9	
Strand	Standards	Items	Points	Items	Points	Items	Points	Items	Points	Items	Points	Items	Points	Items	Points
I. Scientific thinking and practice	1 – Scientific investigations, using scientific inquiry	12	14	12	14	12	13	12	14	12	17	12	18	12	16
II. Content of science	1 – Physical science	12	17	12	18	12	17	12	15	12	20	12	14	12	16
	2 – Life science	12	16	12	16	12	14	12	22	12	14	12	18	12	20
	3 – Earth and space science	8	11	8	10	8	13	8	8	8	9	8	11	8	10
III. Science and society	1 – Science and society	4	4	4	4	4	7	4	5	4	4	4	5	4	4

TABLE A3
Number of assessment framework content standards by strand

Strand	Standards	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
I. Scientific thinking and practice	1 – Scientific investigations, using scientific inquiry	10	10	11	8	8	8	14
II. Content of science	1 – Physical science	10	11	15	10	7	18	28
	2 – Life science	8	10	10	7	26	9	20
	3 – Earth and space science	9	6	7	12	5	6	16
III. Science and society	1 – Science and society	4	4	2	2	3	4	19

Note: Only the standards that are eligible for the criterion-referenced test are included.

multiple-choice items and constructed-response items (both short-answer items and open-ended items). Table A2 shows the distribution of test items and points within each science strand and standard, and Table A3 shows the number of assessment framework content standards found within each strand and standard.

The NMSBA tests are given at all grades from 3–9, while the NAEP tests are given at grades 4, 8, and 12. Therefore, it was found most appropriate to primarily compare the New Mexico assessment framework standards at grades 4 and 8 to the NAEP's grade 4 and grade 8 content statements. For high school, the New Mexico grade 11 science assessment framework provided by the state science specialist was compared with the NAEP grade 12 content statement. In general, if a New Mexico standard at one grade level addressed an NAEP content statement at an earlier or later grade, that was noted in the alignment tables in appendixes C–E.

APPENDIX B
HOW THE STUDY WAS CONDUCTED

The chief research questions driving this study were these: "To what extent do current state assessment standards cover the content on which NAEP 2009 assessments will be based?" and "To what extent do current state assessment specifications align with the NAEP 2009 assessment specifications?"

The methodology used to answer these questions followed the successful pattern of a similar study conducted by WestEd in New England, which examined the alignment of math and reading standards with the NAEP. The methodology developed by WestEd for the New England study was designed to include all the most prominent alignment methodologies, discussed below. Thus far, alignment studies and methods have focused on aligning standards and tests, whereas the objective of this study was to compare one set of assessment standards and specifications with another. In this study, however, the methodology is based upon methodologies for aligning standards to tests, because similar principles are used in both types of alignments.

Eight independent alignment methodologies are examined in *Imperfect Matches: The Alignment of Standards and Tests* (Rothman, 2003), which describes methodologies by Norman L. Webb, Karen K. Wixson, Andrew C. Porter, Achieve, the Buros Center for Testing, the American Association for the Advancement of Science's Project 2061, CRESST, and SRI International.

- Webb's method involves evaluating the degree to which consistent content categories or content strands are found between the standards and assessments (categorical concurrence), the degree to which the standards and assessments cover content to the same depth and have similar cognitive demands (depth-of-knowledge consistency), the degree to which assessments cover the same range of content as the corresponding standards (range-of-knowledge correspondence), and the degree to which the distribution of assessment items match the distribution of content standards (balance of representation) (Webb, 1997, 1999).

- Wixson's method (Wixson et al., 2002) is a modified version of Webb's and includes range-of-knowledge correspondence, balance of representation, whether or not each objective was covered by at least one assessment item (coverage), depth-of-knowledge consistency, and the extent to which the philosophy underlying the assessment matched the philosophy of the standards (structure of knowledge comparability).

- Porter's method (Porter, 2002) involves a matrix with rows representing topics and columns representing categories of cognitive demand, in which reviewers record values to represent the level of alignment.

- Achieve's method (Achieve, 2003) involves examining test blueprints to see whether they adequately reflect the map of test items to standards. It also involves examining the quality of the match between an assessment item and its corresponding standard (content centrality), the degree to which an item appropriately assesses the "performance" or cognitive demand presented by a standard (performance centrality), the degree to which the assessment's difficulty matches the difficulty presented by the standard (challenge), the degree to which the assessment's emphasis on content matches the standard's emphasis on content (balance) and the degree to which the assessment's breadth of content matches the standard's breadth of content (range).

- The Buros Center's methodology uses teachers to record four levels of alignment of items to standards (Impara, 2001).

- The Project 2061 methodology, developed by the American Association for the Advancement of Science, includes independently rating materials and then meeting in two-person teams to

reach a consensus that would be reconciled by Project 2061 staff (Stern & Ahlgren, 2002).

- The CRESST methodology includes identifying corresponding content topics, rating the centrality of the item to the topic, and rating the depth-of-knowledge level (Herman, Webb, & Zuniga, 2003).

- SRI International created codes for various portions of standards that were used to perform the alignment and to determine the degree of matching (Kreikemeier, Quellmalz, & Haydel, 2004).

The WestEd New England methodology was designed to include the major alignment methodologies. The developed methodology involved a "quality review" of grade level expectations within grades and across grades. Within grades a methodology was employed to account for depth of knowledge, breadth of knowledge, clarity, consistency, reasonableness, and assessability. Across grades, the study examined categorical concurrence, consistency, and assessability.

The study also involved an "alignment review" in which a methodology of examining gaps, order, depth, and breadth was used in order to compare the under-review grade level expectations with external referents. More specifically, the first step in the alignment review was to perform "gap analyses." Reviewers were to identify content in the grade level expectations that was absent in the external referent and content in the external referent absent in the grade level expectations. Reviewers then examined "order" to determine whether grade level expectations were included at the same grade level as matching content in the external referent. Lastly, reviewers examined "depth and breadth" to determine whether the content of the grade level expectations reflected the intended depth and breadth of the external referent. Because the alignment study in this report, which compares New Mexico with the NAEP, focuses only on examining alignment between New Mexico assessment standards and specifications and NAEP 2009 assessment standards and specifications, only part of WestEd's New England study methodology was used.

In this study, reviewers followed the methodology of the portion of the previous study examining alignment between two sets of standards. Test blueprints were examined to find correspondence between the two documents, which follows the methodology of Achieve. Reviewers performed gap analyses to identify content included in one set of standards but not the other, identified issues of order so they could reveal differences in the grade levels at which standards appear, and examined depth-of-knowledge and range-of-knowledge correspondence (following Webb's and Wixson's criteria) to determine whether there was a match between New Mexico and the NAEP in the level of detail, cognitive demands, and range of content covered. A coding scheme (similar to that of the Buros Center) was used to indicate alignment issues and reviewer ratings, and a matrix-like format (similar to Porter's method) was created to facilitate alignment.

Reviewers attended several training sessions and then met in teams of two to reach consensus on ratings (similar to the Project 2061 method). This consensus method was designed to create one consensus rating per NAEP standard with the help of a moderator and was not intended to allow for disagreements. This methodology was determined to be best suited to the scope and timing of this study. The consensus methodology is designed to highlight areas for states to examine, not to gather large amounts of data, record multiple ratings, or measure inter-rater reliability.

The content reviews

State standards detail what students are expected to know and do, and as such they are a crucial area for examination. Assessment standards form the basis from which test items are conceived and developed, and they ultimately determine the content that appears on tests. Therefore, this study compared state assessment standards to NAEP content statements through the completion of content reviews.

The content reviews were conducted by a team of six science educators under the leadership of a senior reviewer. The team was directed by Dr. Timms, who is a senior assessment researcher in the mathematics, science and technology program at WestEd and managing director of the Center for Assessment and Evaluation of Student Learning. The senior reviewer is a retired biology and AP biology teacher with 37 years of classroom experience, is a recipient of the Outstanding Biology Teacher Award for the state of California, and has worked in various teacher professional development capacities, including work with the Teacher Assessment Project and the National Board for Professional Teaching Standards.

The six science educators were chosen based on recommendations by the senior reviewer. The team was composed of individuals with science education experience ranging from serving on the National Board for Professional Teaching Standards' Science Committee and co-chairing the California Science Teachers Association Conference to being a technology instructor at a local university to developing widely used science curricula. All six reviewers are current, credentialed middle and high school science teachers. The reviewers have science teaching experience covering the full range of science content areas. Currently, four of the reviewers teach integrated science, one teaches Earth science, three teach biology, one teaches chemistry, and another is a middle school science teacher. The team was also supported by two research assistants.

To ensure that the review was systematic, WestEd developed a crosswalk instrument that was used to evaluate the alignment of the state assessment standards with the content standards contained in the new NAEP 2009 science framework. These crosswalk instruments contained NAEP standards at the appropriate grade level in the leftmost column, blank cells in the next column for reviewers to fill in corresponding state assessment standards, another column for providing ratings, a column for assigning codes, and a final column for various notes. Completed crosswalk instruments, or "alignment tables," can be found in appendixes C–E. An extract of a completed crosswalk instrument is given, along with explanations, in figure B1.

A coding scheme was developed for the New Mexico performance standards to facilitate the ease of use of the standards. The coding scheme for New Mexico content follows the pattern of grade level, strand, benchmark, and performance standard. For example, the code "3 STP I.1" indicates grade 3, scientific thinking and practice, benchmark I, and performance standard 1. The following are the codes for the various strands found in the New Mexico science frameworks:

STP—Scientific thinking and practice
PS—Physical science
LS—Life science
ESS—Earth and space science
SS—Science and society.

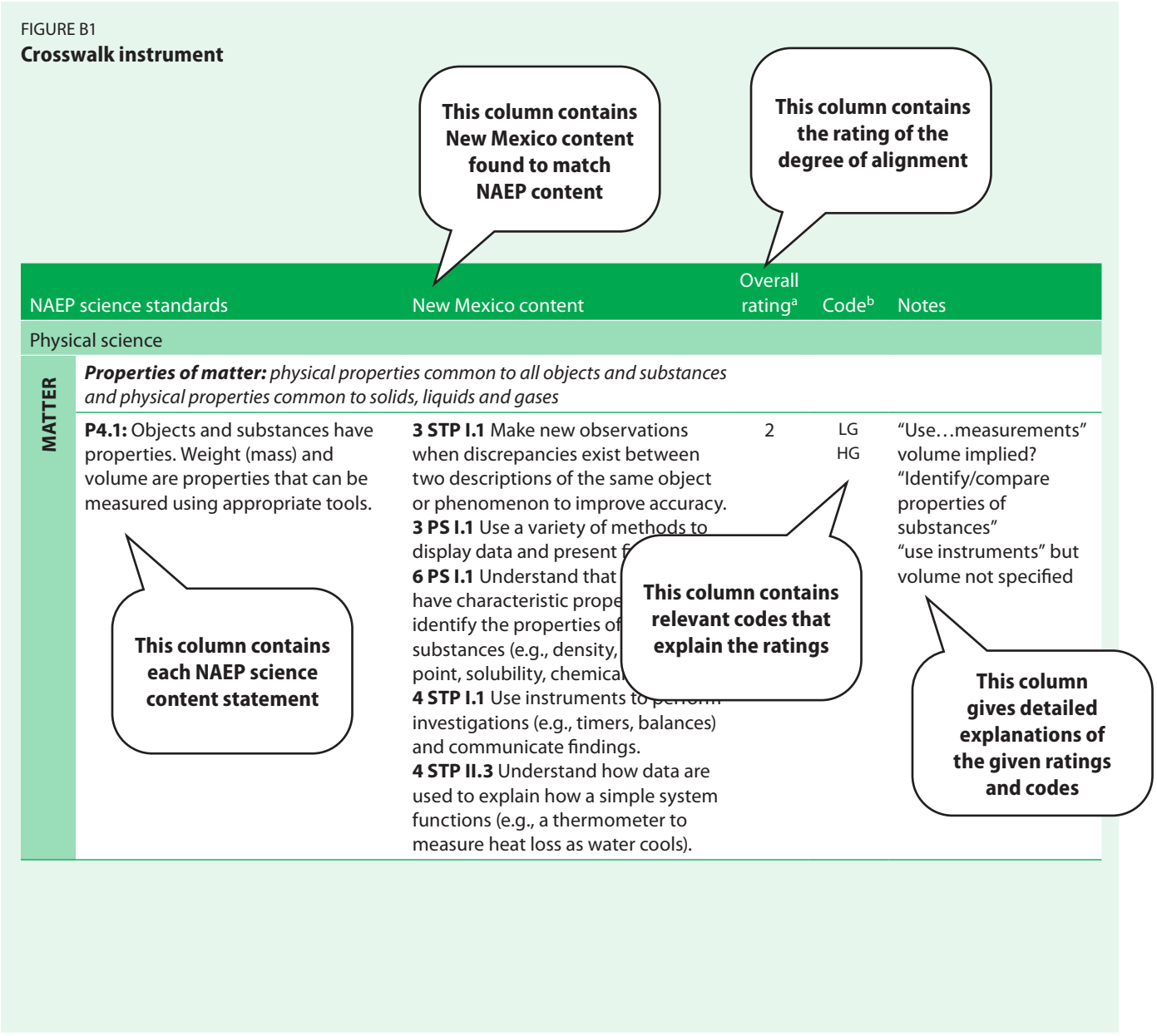
The rating scale used within the "overall rating" column was:

1—State standards do not address NAEP content statement
2—State standards partially address NAEP content statement
3—State standards fully address or exceed NAEP content statement by targeted grade level

When there was partial or nonalignment (ratings 2 or 1), the reviewers used a letter coding scheme to indicate the reason for the lack of alignment. The coding scheme was:

IC—Implied content	The content seems to be implied as part of the standard, but it is not explicitly stated.
LG—Content covered at a lower grade level	The NAEP standard is partially or fully covered at a lower state grade level.
HG—Content covered at a higher grade level	The NAEP standard is partially or fully covered at a higher state grade level.
MC—More content	The NAEP standard contains more content than do corresponding state standards.
MD—More detailed content	The NAEP standard contains content that is more detailed than corresponding state standards.

FIGURE B1
Crosswalk instrument



NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
MATTER	***Properties of matter:*** *physical properties common to all objects and substances and physical properties common to solids, liquids and gases*			
P4.1: Objects and substances have properties. Weight (mass) and volume are properties that can be measured using appropriate tools.	**3 STP I.1** Make new observations when discrepancies exist between two descriptions of the same object or phenomenon to improve accuracy. **3 PS I.1** Use a variety of methods to display data and present f **6 PS I.1** Understand that have characteristic prope identify the properties of substances (e.g., density, point, solubility, chemica **4 STP I.1** Use instruments to perform investigations (e.g., timers, balances) and communicate findings. **4 STP II.3** Understand how data are used to explain how a simple system functions (e.g., a thermometer to measure heat loss as water cools).	2	LG HG	"Use…measurements" volume implied? "Identify/compare properties of substances" "use instruments" but volume not specified

Reviewers also added explanatory notes to the alignment ratings to indicate precisely the reason for the partial or nonalignment. There were separate instruments for grades 4, 8, and 12, and within each grade level the content was divided into Earth and space science, life science, and physical science categories. Based on a combination of their scientific and grade level experience, the six reviewers worked in teams of two reviewers per grade level. When the NAEP and state grades being compared did not match (e.g. when comparing NAEP grade 12 with New Mexico grade 11), content statements were considered to be at the same grade for assignment of alignment ratings (1–3) and codes (such as HG and LG).

To ensure the consistent application of the crosswalk instrument by each reviewer, the alignment team attended training sessions spread over several weeks and conducted by Dr. Timms. The training comprised four sessions. Session one included a review of a previous WestEd alignment study to allow teachers to understand the scope of the project and the methodology. The team was also given an introduction to the NAEP standards and then asked to carefully read the NAEP

framework standards document before the second session. The second training session included a review and discussion of the NAEP standards and an overview of each of the REL Southwest Region's state assessment standards. Reviewers were then asked to complete an in-depth reading of one of the states' assessment standards. During the third training session, reviewers were introduced to the crosswalk instrument and asked to use it to begin performing an alignment. Reviewers then individually completed an alignment for one state on their own.

During the final training session, the teams at each grade level met to practice consensus-building and establish the criteria for assigning each rating. One criterion was to compare one NAEP standard with as many state standards as possible, and to assign an overall alignment rating based upon the sum of all state standards compared with the single NAEP standard in question. Another criterion was to give a rating of 2 for alignments in which the state standard addressed only one portion (sometimes one sentence) of the NAEP statement. A third criterion was to assign ratings of 2 to alignments for which the NAEP contained more content or more detailed content than the state standards, or for which the state appeared to imply but not explicitly state the content found in the NAEP. If a matching standard was found at a higher state grade level than the NAEP grade level, a rating of 2 was given. If a matching state standard was found at a lower grade level but did not appear to fully address the NAEP standard, a rating of 2 was also given.

As part of the stipulated methodology, the reviewers first conducted independent reviews without consulting their partners. Each began with a review of the set of state standards to get an overall impression of their content and structure. Next, the reviewer used the crosswalk instrument to do a more detailed examination starting with a NAEP content statement and then searching the state standards for those that covered all or part the same content. The reviewer continued in this way, systematically matching the state content standards to the NAEP content statements and recording the results in the crosswalk instrument table. After all the NAEP content statements had been covered, the reviewer applied the three-point rating system to determine the level of alignment for each NAEP content statement.

When both reviewers for a grade level had completed their individual reviews, they met under the guidance of the senior reviewer to compare their ratings and reach a consensus. When they disagreed on which state standard(s) matched a particular NAEP content statement or their ratings were not the same, they re-examined the content in question and discussed their differing viewpoints. The purpose was to reach a consensus so that there was a single alignment table for each grade level that represented their combined review. The senior reviewer moderated the discussion to reinforce the established rating criteria and help reviewers achieve consensus. The alignment tables are shown in detail in appendixes C–E.

When the consensus alignment tables were complete, a WestEd researcher summarized them quantitatively by calculating the average ratings organized by each of the three major NAEP content areas of physical science, life science, and Earth and space science. These average ratings are intended to be summaries of how the state's assessment content matches the NAEP content statements and to allow the reader to quickly identify possible areas for revision. In addition, the researcher wrote a report on the results, which summarized the areas of full alignment, partial alignment, nonalignment, and areas where the state standards went beyond the NAEP content statements.

Test specifications review

In addition to examining content, this study compared the state assessment specifications with the NAEP 2009 test and item specifications. It was deemed important for this study to perform a review of assessment specifications because the way a test is structured and implemented often has implications for what the test is able to reveal

about student understanding. The NAEP calls for a variety of test items due to the fact that different types of items demand varying levels of cognition, knowledge, and reasoning (National Assessment Governing Board, 2006). Thus, it is important to examine the extent to which states are attempting to develop assessment items that will provide an accurate picture of what students know and can do across the range of science content and skills. In addition, it was important to examine the proportion of time that students are expected to spend on each content strand of the NAEP and the New Mexico Standards Based Assessment (NMSBA). Examining the NMSBA's and the NAEP's distribution of items in these science strands creates a snapshot of the extent to which the breadth of content in New Mexico matches that of the NAEP.

Since the final NAEP 2009 tests have not yet been developed, it is currently possible only to compare the current NMSBA science assessment specifications with the stipulated specifications of the future NAEP 2009 science assessment. Accordingly, the translation of standards to actual test items and the comparison of items would also be important, but these comparisons will not be possible until the public release of the NAEP 2009 assessments. Therefore, this report details analyses of the available information on state and NAEP test items, which includes item types and item distribution.

For the purpose of examining assessment specifications, WestEd researchers compared parts of the Science Assessment and Item Specifications for the 2009 NAEP document with the test blueprints for New Mexico science assessments, found in the NMSBA science test blueprint (New Mexico Public Education Department, 2005b) and *English NMSBA 2005 Total Items and Total Points* (New Mexico Public Education Department, 2005a). The *NMSBA Technical Report: 2005 Spring Administration* (Harcourt, 2005) was also used for the test specifications portion of this report. NAEP's grade 12 test specifications were not compared with New Mexico, as the New Mexico grade 11 test will not be given until the 2007/08 school year.

The NAEP Science Assessment and Item Specifications is a detailed document that covers the science content, science practices, generation and interpretation of items, types of items and administration of the assessment. For this study the review of the test specifications focused on two main things: the types of items used in the state assessment, and the proportions of time that students spend on each of the main science topic areas of the NAEP. WestEd researchers used test blueprints and assessment specifications from the state and the NAEP to compare types of items and the distribution of items in each science content strand. First, differences between the NAEP and the state were examined for the types of items required on the tests (multiple-choice, constructed-response, and so on). Next, differences in the proportions allocated to each content strand (physical, life, and Earth and space science) were examined.

APPENDIX C
CONTENT ALIGNMENT TABLE FOR GRADE 4

TABLE C1
Alignment of National Assessment of Educational Progress grade 4 science and New Mexico grade 4 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
MATTER	***Properties of matter:*** *physical properties common to all objects and substances and physical properties common to solids, liquids and gases*			
P4.1: Objects and substances have properties. Weight (mass) and volume are properties that can be measured using appropriate tools.	**3 STP I.1** Make new observations when discrepancies exist between two descriptions of the same object or phenomenon to improve accuracy. **3 PS I.1** Use a variety of methods to display data and present findings. **6 PS I.1** Understand that substances have characteristic properties and identify the properties of various substances (e.g., density, boiling point, solubility, chemical reactivity). **4 STP I.1** Use instruments to perform investigations (e.g., timers, balances) and communicate findings. **4 STP II.3** Understand how data are used to explain how a simple system functions (e.g., a thermometer to measure heat loss as water cools).	2	LG HG	"Use…measurements" volume implied? "Identify/compare properties of substances" "use instruments" but volume not specified
P4.2: Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity.	**3 PS II.2** Know that light travels in a straight line until it strikes an object and then it is reflected, refracted, or absorbed. **4 PS II.1** Identify the characteristics of several different forms of energy and describe how energy can be converted from one form to another (e.g., light to heat, motion to heat, electricity to heat, light, or motion). **4 PS II.4** Demonstrate how electricity flows through a simple circuit (e.g., by constructing one). **5 PS II.1** Know that heat is transferred from hotter to cooler materials or regions until both reach the same temperature. **6 PS II.2** Understand that heat energy can be transferred through conduction, radiation and convection.	2	HG	NM doesn't say variance in conductance

	NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
MATTER	**P4.3:** Matter exists in several different states; the most commonly encountered are solid, liquid, and gas. Each state of matter has unique properties. For instance, gases are easily compressed while solids and liquids are not. The shape of a solid is independent of its container; liquids and gases take the shape of their containers.	**5 PS I.2** Describe how matter changes from one phase to another (e.g., condensation, evaporation). **5 PS I.1** Describe properties (e.g., relative volume, ability to flow) of the three states of matter.	2	HG	"describe properties of 3 states" does not mention gases compressible/solids not mentioned
	P4.4: Some objects are composed of a single substance; others are composed of more than one substance.	**3 PS I.1** Identify and compare properties of pure substances and mixtures (e.g., sugar, fruit juice). **3 PS I.2** Separate mixtures based on properties (e.g., by size or by substance; rocks and sand, iron filings and sand, salt and sand).	3	LG	
	P4.5: Magnets can repel or attract other magnets. They can also attract certain nonmagnetic objects at a distance.	**3 PS III.2** Describe how magnets have poles (N and S) and that like poles repel each other while unlike poles attract. **3 PS III.1** Recognize that magnets can produce motion by attracting some materials (e.g., steel) and have no effect on others (e.g., plastics).	3	LG	
	Changes in matter: *changes of state*				
	P4.6: One way to change matter from one state to another and back again is by heating and cooling.	**5 PS I.2** Describe how matter changes from one phase to another (e.g., condensation, evaporation). **4 PS II.1** Identify the characteristics of several different forms of energy and describe how energy can be converted from one form to another (e.g., light to heat, motion to heat, electricity to heat, light, or motion).	2	HG	Heating and cooling is implied in phase change. NM deals with identifying and describing changes.
ENERGY	***Forms of energy:*** *examples of forms of energy*				
	P4.7: Heat (thermal energy), electricity, light, and sound are forms of energy.	**3 PS II.1** Understand that light is a form of energy and can travel through a vacuum. **3 PS II.3** Observe that some forces produce motion without objects touching (e.g., magnetic force on nails). **4 PS II.1** Identify the characteristics of several different forms of energy and describe how energy can be converted from one form to another (e.g., light to heat, motion to heat, electricity to heat, light, or motion). **4 PS III.1** Know that energy can be carried from one place to another by waves (e.g., water waves, sound waves), by electric currents, and by moving objects.	3		sound is missing in 4 PS II.1 but in 4 PS III.1, "energy carried… by sound, electricity"

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 4 science and New Mexico grade 4 standards

	NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
ENERGY	**P4.8:** Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows though wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy.	**5 PS II.2** Know that heat is often produced as a by-product when one form of energy is converted to another form (e.g., when machines or organisms convert stored energy into motion). **4 PS II.1** Know that heat is often produced as a by-product when one form of energy is converted to another form (e.g., when machines or organisms convert stored energy into motion). **6 PS II.2** Understand that heat energy can be transferred through conduction, radiation and convection. **4 PS II.4** Demonstrate how electricity flows through a simple circuit (e.g., by constructing one). **3 PS II.3** Measure energy and energy changes (e.g., temperature changes).	2	HG	heat- "heat…by-product" burn—not mentioned rub—motion to heat electricity "electricity to heat" conductor heat "heat energy by conduction" conductor elect "electricity… circuit" does not say "conductor" addition of E—"measure energy changes (temp)"
	P4.9: Light travels in straight lines. When light strikes substances and objects through which it cannot pass, shadows result. When light travels obliquely from one substance to another (air and water), it changes direction.	**3 PS II.2** Know that light travels in a straight line until it strikes an object and then it is reflected, refracted, or absorbed.	2	LG	Shadow—not mentioned
	P4.10: Vibrating objects produce sound. The pitch of sound can be varied by changing the rate of vibration.	**4 PS II.3** Describe how some waves move through materials (e.g., water, sound) and how others can move through a vacuum (e.g., x-ray, television, radio). **6 PS II.4** Understand that some energy travels as waves (e.g., seismic, light, sound), including: • the sun as source of energy for many processes on Earth • different wavelengths of sunlight (e.g., visible, ultraviolet, infrared) • vibrations of matter (e.g., sound, earthquakes) • different speeds through different materials. **8 PS II.6** Understand that vibrations of matter (e.g., sound, earthquakes, water waves) carry wave energy, including: • sound transmission through solids, liquids, and gases • relationship of pitch and loudness of sound to rate and distance (amplitude) of vibration • ripples made by objects dropped in water	2	HG	NM adds vacuum "vibrations of matter…sound" pitch not specified

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
ENERGY	***Energy transfer and conservation:*** *electrical circuits*			
	P4.11: Electricity flowing through an electrical circuit produces magnetic effects in the wires. In an electrical circuit containing a battery, a bulb, and a bell, energy from the battery is transferred to the bulb and the bell, which in turn transfer the energy to their surroundings as light, sound, and heat (thermal energy).	**4 PS II.4** Demonstrate how electricity flows through a simple circuit (e.g., by constructing one). **9 PS III.5** Explain how electric currents cause magnetism and how changing magnetic fields produce electricity (e.g., electric motors, generators). **4 PS II.1** Identify the characteristics of several different forms of energy and describe how energy can be converted from one form to another (e.g., light to heat, motion to heat, electricity to heat, light, or motion). **4 PS III.1** Know that energy can be carried from one place to another by waves (e.g., water waves, sound waves), by electric currents, and by moving objects.	2	HG	
MOTION	***Motion at the macroscopic level:*** *descriptions of position and motion*			
	P4.12: An object's position can be described by locating the object relative to other objects or a background. The description of an object's motion from one observer's view may be different from that reported from a different observer's view.	**8 PS III.7** Know that an object's motion is always described relative to some other object or point (i.e., frame of reference). **4 PS III.1** Know that energy can be carried from one place to another by waves (e.g., water waves, sound waves), by electric currents, and by moving objects.	2	HG	"frame of reference" NM includes energy carried by waves and electrical currents. NAEP addresses moving objects (also in NM)
	P4.13: An object is in motion when its position is changing. The speed of an object is defined by how far it travels divided by the amount of time it took to travel that far.	**4 PS III.2** Describe the motion of an object by measuring its change of position over a period of time. **5 PS III.1** Understand how the rate of change of position is the velocity of an object in motion.	2	HG	

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 4 science and New Mexico grade 4 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
MOTION	***Forces affecting motion:*** *the association of changes in motion with forces and the association of objects falling toward Earth with gravitational force*			
P4.14: The motion of objects can be changed by pushing or pulling. The size of the change is related to the size of the force (push or pull) and the weight (mass) of the object on which the force is exerted. When an object does not move in response to a push or a pull, it is because another push or pull (friction) is being applied by the environment.	**5 PS III.4** Understand that when a force (e.g., gravity, friction) acts on an object, the object speeds up, slows down, or goes in a different direction. **8 PS III.8** Understand and apply Newton 's Laws of Motion: • Objects in motion will continue in motion and objects at rest will remain at rest unless acted upon by an unbalanced force (inertia). • If a greater force is applied to an object a proportionally greater acceleration will occur. • If an object has more mass the effect of an applied force is proportionally less. **5 PS III.3** Identify forces in nature (e.g., gravity, magnetism, electricity, friction). **4 PS III.4** Describe how some forces act on contact and other forces act at a distance (e.g., a person pushing a rock versus gravity acting on a rock).	2	HG	"force…speeds up, slows" changes "direction" - Newton's laws "forces in nature… friction" implied these are being applied by environment NAEP has a long explanation of the forces
P4.15: Earth pulls down on all objects with a force called gravity. With a few exceptions (helium filled balloons), objects fall to the ground no matter where the object is on Earth.	**4 PS III.3** Describe that gravity exerts more force on objects with greater mass (e.g., it takes more force to hold up a heavy object than a lighter one). **4 PS III.4** Describe how some forces act on contact and other forces act at a distance (e.g., a person pushing a rock versus gravity acting on a rock).	2	IC	NM adds "more force on object w/greater mass" Object fall is not mentioned, nor is Earth as reason for gravity
Life science				
STRUCTURES AND FUNCTIONS OF LIVING SYSTEMS	***Organization and development:*** *basic needs of organisms*			
L4.1: Organisms need food, water, and air; a way to dispose of waste; and an environment in which they can live.	**6 LS I.1** Understand how organisms interact with their physical environments to meet their needs (i.e., food, water, air) and how the water cycle is essential to most living systems. **7 LS III.3** Understand that many basic functions of organisms are carried out in cells, including: • growth and division to produce more cells (mitosis) • specialized functions of cells (e.g., reproduction, nerve-signal transmission, digestion, excretion, movement, transport of oxygen).	2	HG	-same as L4.1, except waste not mentioned -waste mentioned at cellular level in 7th

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Life science				
STRUCTURES AND FUNCTIONS OF LIVING SYSTEMS				
Matter and energy transformations: *the basic needs of organisms for growth*				
L4.2: Organisms have basic needs. Animals require air, water, and a source of energy and building material for growth and repair. Plants also require light.	**6 LS I.1** Understand how organisms interact with their physical environments to meet their needs (i.e., food, water, air) and how the water cycle is essential to most living systems. **4 LS I.3** Describe how roots are associated with the intake of water and soil nutrients and green leaves are associated with making food from sunlight (photosynthesis).	2	HG	-source of energy/ material 4 growth/ repair not specified -making food from sunlight
Interdependence: *the interdependence of organisms*				
L4.3: Organisms interact and are interdependent in various ways including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms.	**5 LS I.1** Identify the components of habitats and ecosystems (producers, consumers, decomposers, predators). **5 LS I.2** Understand how food webs depict relationships between different organisms. **4 LS I.4** Describe the components of and relationships among organisms in a food chain (e.g., plants are the primary source of energy for living systems). **6 LS I.1** Understand how organisms interact with their physical environments to meet their needs (i.e., food, water, air) and how the water cycle is essential to most living systems. **3 LS II.1** Identify how living things cause changes to the environments in which they live, and that some of these changes are detrimental to the organism and some are beneficial.	2	HG	food webs not mean shelter See L4.1
L4.4: When the environment changes, some plants and animals survive and reproduce; others die or move to new locations.	**4 LS II.1** Know that in any particular environment some kinds of plants and animals survive well, some survive less well, and others cannot survive at all. **5 LS I.3** Know that changes in the environment can have different effects on different organisms (e.g., some organisms move, some survive, some reproduce, some die).	2	HG	Refers to "any particular environment" not one which has changed, so does not mention "move" -almost same as L4.4

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TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 4 science and New Mexico grade 4 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Life science				
CHANGES IN LIVING SYSTEMS	***Heredity and reproduction:*** *life cycles*			
L4.5: Plants and animals have life cycles. Both plants and animals begin life and develop into adults, reproduce, and eventually die. The details of this life cycle are different for different organisms.	**5 LS II.1** Know that plants and animals have life cycles that include birth, growth and development, reproduction, and death and that these cycles differ for different organisms.	2	HG	-same wording as L4.5, except in 5th not 4th.
L4.6: Plants and animals closely resemble their parents.	**5 LS II.2** Identify characteristics of an organism that are inherited from its parents (e.g., eye color in humans, flower color in plants) and other characteristics that are learned or result from interactions with the environment. **5 LS II.3** Understand that heredity is the process by which traits are passed from one generation to another. **4 LS II.3** Describe how some living organisms have developed characteristics from generation to generation to improve chances of survival (e.g., spines on cacti, long beaks on hummingbirds, good eyesight on hawks).	2	HG	
	Evolution and diversity: *differences and adaptations of organisms*			
L4.7: Different kinds of organisms have characteristics that enable them to survive in different environments. Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.	**3 LS I.1** Know that an adaptation in physical structure or behavior can improve an organism's chance for survival (e.g., horned toads, chameleons, cacti, mushrooms). **4 LS II.1** Know that in any particular environment some kinds of plants and animals survive well, some survive less well, and others cannot survive at all. **4 LS II.2** Know that a change in physical structure or behavior can improve an organism's chance of survival (e.g., a chameleon changes color, a turtle pulls its head into its shell, a plant grows toward the light). **9 LS I.9** Understand variation within and among species, including: • mutations and genetic drift • factors affecting the survival of an organism • natural selection.	2	HG	- genetic diversity within species not mentioned until 9th.

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH IN SPACE AND TIME	***Objects in the universe:*** *patterns in the sky*			
	E4.1: Objects in the sky have patterns of movement. The sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The moon appears to move across the sky on a daily basis much like the sun.	**3 ESS I.2** Describe the relationships among the objects in the solar system (e.g., relative distances, orbital motions). **6 ESS I.4** Know that the regular and predictable motions of the Earth-moon-sun system explain phenomena on Earth, including: • Earth's motion in relation to a year, a day, the seasons, the phases of the moon, eclipses, tides, and shadows • moon's orbit around Earth once in 28 days in relation to the phases of the moon. **5 ESS II.4** Recognize that the seasons are caused by Earth's motion around the sun and the tilt of Earth's axis of rotation. **4 ESS I.3** Know that the pattern of stars (e.g., constellations) stays the same although they appear to move across the sky nightly due to Earth's rotation.	2	HG	NM just deals with stars/ constellations
	E4.2: The observable shape of the moon changes from day to day in a cycle that lasts about a month.	**6 ESS I.4** Know that the regular and predictable motions of the Earth-moon-sun system explain phenomena on Earth, including: • Earth's motion in relation to a year, a day, the seasons, the phases of the moon, eclipses, tides, and shadows • moon's orbit around Earth once in 28 days in relation to the phases of the moon.	2	HG	See E4.1 comments
	History of Earth: *evidence of change*			
	E4.3: The surface of Earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.	**3 ESS II.1** Know that Earth's features are constantly changed by a combination of slow and rapid processes that include the action of volcanoes, earthquakes, mountain building, biological changes, erosion, and weathering.	3		Same wording as E4.3

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TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 4 science and New Mexico grade 4 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH STRUCTURES	***Properties of Earth materials:*** *natural and human-made materials*			
E4.4: Earth materials that occur in nature include rocks, minerals, soils, water, and the gases of the atmosphere.	**4 ESS II.1** Know that the properties of rocks and minerals reflect the processes that shaped them (i.e., igneous, metamorphic, and sedimentary rocks). **7 LS I.1** Identify the living and nonliving parts of an ecosystem and describe the relationships among these components.	2	HG	NM deals with formation not abiotic aspect
E4.5: Natural materials have different properties, which sustain plant and animal life.	**4 LS I.3** Describe how roots are associated with the intake of water and soil nutrients and green leaves are associated with making food from sunlight (photosynthesis). **5 LS I.2** Understand how food webs depict relationships between different organisms. **6 LS I.1** Understand how organisms interact with their physical environments to meet their needs (i.e., food, water, air) and how the water cycle is essential to most living systems.	2	IC	
E4.6: Some Earth materials have properties that make them useful either in their present form or designed and modified to solve human problems and enhance the quality of life, as in the case of materials used for building or fuels used for heating and transportation.	**3 SS I.3** Know that naturally occurring materials (e.g., wood, clay, cotton, animal skins) may be processed or combined with other materials to change their properties. **4 SS I.2** Know that, through science and technology, a wide variety of materials not appearing in nature have become available (e.g., steel, plastic, nylon, fiber optics). **5 SS I.2** Describe how various technologies have affected the lives of individuals (e.g., transportation, entertainment, health). **8 SS I.3** Describe how technological revolutions have significantly influenced societies (e.g., energy production, warfare, space exploration). **8 SS I.4** Critically analyze risks and benefits associated with technologies related to energy production.	2	HG	

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH SYSTEMS	***Energy in Earth systems:*** *role of the sun*			
	E4.7: The sun warms the land, air, and water and helps plants grow.	**4 LS I.3** Describe how roots are associated with the intake of water and soil nutrients and green leaves are associated with making food from sunlight (photosynthesis). **4 ESS II.3** Know that local weather information describes patterns of change over a period of time (e.g., temperature, precipitation symbols, cloud conditions, wind speed/direction). **7 PS II.1** Know how various forms of energy are transformed through organisms and ecosystems, including: • sunlight and photosynthesis • energy transformation in living systems (e.g., cellular processes changing chemical energy to heat and motion) • effect of mankind's use of energy and other activities on living systems (e.g., global warming, water quality).	2	IC	"sunlight & photosynthesis" partially addressed
	Climate and weather: *local weather*			
	E4.8: Weather changes from day to day and over the seasons.	**4 ESS II.3** Know that local weather information describes patterns of change over a period of time (e.g., temperature, precipitation symbols, cloud conditions, wind speed/direction). **6 ESS II.5** Understand factors that create and influence weather and climate, including: • heat, air movement, pressure, humidity, oceans • how clouds form by condensation of water vapor • how weather patterns are related to atmospheric pressure • global patterns of atmospheric movement (e.g., El Niño) • factors that can impact Earth's climate (e.g., volcanic eruptions, impacts of asteroids, glaciers). **6 ESS II.6** Understand how to use weather maps and data (e.g., barometric pressure, wind speeds, humidity) to predict weather.	2	IC HG	"weather…change over time" day/season not specified

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TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 4 science and New Mexico grade 4 standards

	NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science					
EARTH SYSTEMS	**E4.9:** Scientists use tools for observing, recording, and predicting weather changes from day to day and over the seasons.	**6 ESS II.6** Understand how to use weather maps and data (e.g., barometric pressure, wind speeds, humidity) to predict weather. **4 STP I.1** Use instruments to perform investigations (e.g., timers, balances) and communicate findings.	2	HG	In NM, taking the data not specified nor are tools "use instruments" not specified for weather
	Biogeochemical cycles: *uses of Earth resources*				
	E4.10: The supply of many Earth resources such as fuels, metals, fresh water, and farmland is limited. Humans have devised methods for extending the use of Earth resources through recycling, reuse, and renewal.	**3 SS I.2** Know that science produces information for the manufacture and recycling of materials (e.g., materials that can be recycled [aluminum, paper, plastic] and others that cannot [gasoline]). **3 SS I.3** Know that naturally occurring materials (e.g., wood, clay, cotton, animal skins) may be processed or combined with other materials to change their properties. **7 LS I.5** Describe how the availability of resources and physical factors limit growth (e.g. quality of light and water, range of temperature, composition of soil) and how the water, carbon, and nitrogen cycles contribute to the availability of those resources to support living systems. **4 SS I.2** Know that, through science and technology, a wide variety of materials not appearing in nature have become available (e.g., steel, plastic, nylon, fiber optics).	2	IC HG	"recycling materials" "materials…processed" "factors limit growth" Both deal with humans making resources available. NAEP includes recycling and reusing them.

NAEP science standards		New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science					
EARTH SYSTEMS	**E4.11:** Humans depend on their natural and constructed environment. Humans change environments in ways that can either be beneficial or detrimental for themselves and other organisms.	**4 LS II.2** Know that a change in physical structure or behavior can improve an organism's chance of survival (e.g., a chameleon changes color, a turtle pulls its head into its shell, a plant grows toward the light). **4 SS I.2** Know that, through science and technology, a wide variety of materials not appearing in nature have become available (e.g., steel, plastic, nylon, fiber optics). **3 SS I.4** Know that using poisons can reduce the damage to crops caused by rodents, weeds, and insects, but their use may harm other plants, animals, or the environment **3 LS II.1** Identify how living things cause changes to the environments in which they live, and that some of these changes are detrimental to the organism and some are beneficial. **4 SS I.1** Know that science has identified substances called pollutants that get into the environment and can be harmful to living things.	3		"change in behavior… improve survival" "technol…wide variety…steel, plastic" "poisons…may cause harm" "cause changes.. detrimental… beneficial" "pollutants…harmful"

a. Rating is based on a scale of 1 to 3, where 1 indicates that state standards do not address NAEP content statement, 2 that state standards partially address NAEP content statement, and 3 that state standards fully address or exceed NAEP content statement by targeted grade level.

b. Codes are IC (implied content), LG (content covered at a lower grade level), HG (content covered at a higher grade level), MC (more content), and MD (more detailed content). See appendix C for further information.

TABLE C2

New Mexico grade 4 standards not covered by NAEP grade 4 content

Content area	New Mexico grade 4 standards
Scientific Thinking & Practice	Collect/interpret data 4 STP I.2, 4 STP I.3, 4 STP I.4 Commun findings 4 STP II.1, 4 STP II.2, 4 STP II.3 Math patterns/data 4 STP III.1, 4 STP III.2
Content Standard I—*Physical Science*	Chem/phys chg, atoms/molecules, Law conservation of matter 4 PS I.1, 4 PS I.2, 4 PS I.3 Energy stored (pot E) 4 PS II.2
Content Standard II—*Life Science*	Organisms…body structures/systems, senses and cells 4 LS I.1, 4 LS I.2, 4 LS I.5 Human body 4 LS III.1, 4 LS III.2
Content Standard III—*Earth and Space Science*	Astronomy & telescopes 4 ESS I.1, 4 ESS I.2, 4 ESS I.3 Weather patterns west to east 4 ESS II.2
Science and Society	Data tech & faults w/ 4 SS I.3 Men/women/all races choose science 4 SS I.4

APPENDIX D
CONTENT ALIGNMENT TABLE FOR GRADE 8

TABLE D1
Alignment of National Assessment of Educational Progress grade 8 science and New Mexico grade 8 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
MATTER	***Properties of matter:*** *chemical properties, particulate nature of matter, and the Periodic Table of Elements*			
P8.1: Properties of solids, liquids, and gases are explained by a model of matter that is composed of tiny particles in motion.	**5-PS-I.5** Describe the relative location and motion of the particles (atoms and molecules) in each state of matter.	3		*Covered three years earlier
P8.2: Chemical properties of substances are explained by the arrangement of atoms and molecules.	**9-PS-I.2** Identify, measure, and use a variety of physical and chemical properties (e.g., electrical conductivity, density, viscosity, chemical reactivity, pH, melting point).	1		Not covered until 9th grade
P8.3: All substances are composed of one or more of approximately one hundred elements. The periodic table organizes the elements into families of elements with similar properties.	***8-PS-I.5** Explain that elements are organized in the periodic table according to their properties.	2	MD IC	First sentence not covered
P8.4: Elements are a class of substances composed of a single kind of atom. Compounds are composed of two or more different elements. Each element and compound has physical and chemical properties, such as boiling point, density, color, and conductivity, which are independent of the amount of the sample.	**8-PS-I.3** Understand the differences among elements, compounds, and mixtures by: • classification of materials as elements, compounds, or mixtures • interpretation of chemical formulas • separation of mixtures into compounds by methods including evaporation, filtration, screening, magnetism. ***8-PS-I.6** Know that compounds are made of two or more elements, but not all sets of elements can combine to form compounds.	2	MD	State standards do not go into physical and chemical properties (look at 8-PS-I.1)

	NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
MATTER	**P8.5:** Substances are classified according to their physical and chemical properties. Metals and acids are examples of such classes. Metals are a class of elements that exhibit common physical properties such as conductivity and common chemical properties such as reacting with nonmetals to produce salts. Acids are a class of compounds that exhibit common chemical properties including a sour taste, characteristic color changes with litmus and other acid/base indicators, and the tendency to react with bases to produce a salt and water.	**8-PS-i.1** Know how to use density, boiling point, freezing point, conductivity, and color to identify various substances.	2	MC MD	State only addresses physical properties 9-PS-I.1 (higher grade level)
	Changes in matter: *physical and chemical changes and conservation of mass*				
	P8.6: Changes of state are explained by a model of matter composed of tiny particles that are in motion. When substances undergo changes of state, neither atoms nor molecules themselves are changed in structure. Mass is conserved when substances undergo changes of state.	**8-PS-I.7** Know that phase changes are physical changes that can be reversed (e.g., evaporation, condensation, melting).	2	IC MD	State standard does not mention composition of matter; it only mentions reversal of phase change.
	P8.7: Chemical changes can occur when two substances, elements, or compounds react and produce one or more different substances, whose physical and chemical properties are different from the reacting substances. When substances undergo chemical change, the number and kinds of atoms in the reactants are the same as the number and kinds of atoms in the products. Mass is conserved when substances undergo chemical change. The mass of the reactants is the same as the mass of the products.	****7-PS-I.2** Know that the total amount of matter (mass) remains constant although its form, location, and properties may change (e.g., matter in the food web). ***7-PS-I.4** Describe how substances react chemically in characteristic ways to form new substances (compounds) with different properties (e.g., carbon and oxygen combine to form carbon dioxide in respiration).	3		
ENERGY	***Forms of energy*:** *kinetic energy, potential energy, and light energy from the sun*				
	P8.8: Objects and substances in motion have kinetic energy. For example, a moving baseball can break a window; water flowing down a stream moves pebbles and floating objects along with it.	**8-PS-II.2** Know that kinetic energy is a measure of the energy of an object in motion and potential energy is a measure of an object's position or composition, including: • transformation of gravitational potential energy of position into kinetic energy of motion by a falling object.	2	MD	State mentions kinetic and potential energy. No examples given.

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TABLE D1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 science and New Mexico grade 8 standards

NAEP science standards		New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
ENERGY	**P8.9:** Three forms of potential energy are gravitational, elastic, and chemical. Gravitational potential energy changes in a system as the relative positions of objects are changed. Objects can have elastic potential energy due to their compression, or chemical potential energy due to the nature and arrangement of the atoms.	**8-PS-II.2** Know that kinetic energy is a measure of the energy of an object in motion and potential energy is a measure of an object's position or composition, including: • transformation of gravitational potential energy of position into kinetic energy of motion by a falling object.	2	MD	Gravitational potential energy is mentioned; not elastic or chemical. No examples given or explained. Mentions potential vs kinetic
	P8.10: Energy is transferred from place to place. Light energy from the sun travels through space to Earth (radiation). Thermal energy travels from a flame through the metal of a cooking pan to the water in the pan (conduction). Air warmed by a fireplace moves around a room (convection). Waves—including sound and seismic waves, waves on water, and light waves—have energy and transfer energy when they interact with matter.	***8-PS-II.1** Know that energy exists in many forms and that when energy is transformed some energy is usually converted to heat. ****8-PS-II.5** Understand how light and radio waves carry energy through vacuum or matter by: • straight-line travel unless an object is encountered • reflection by a mirror, refraction by a lens, absorption by a dark object • separation of white light into different wavelengths by prisms • visibility of objects due to light emission or scattering. ****8-ESS-i.1** Understand how energy from the sun and other stars, in the form of light, travels long distances to reach Earth. *****8-PS-II.6** Understand that vibrations of matter (e.g., sound, earthquakes, water waves) carry wave energy, including: • sound transmission through solids, liquids, and gases • relationship of pitch and loudness of sound to rate and distance (amplitude) of vibration • ripples made by objects dropped in water.	2	MD	*Heat energy in NAEP but state standard is very general mentioning only "many forms of energy."

	NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
MOTION	**P8.11:** A tiny fraction of the light energy from the sun reaches Earth. Light energy from the sun is Earth's primary source of energy, heating Earth surfaces and providing the energy that results in wind, ocean currents, and storms.	**6-PS-II.4** Understand that some energy travels as waves (e.g., seismic, light, sound), including: • the sun as source of energy for many processes on Earth • different wavelengths of sunlight (e.g., visible, ultraviolet, infrared) • vibrations of matter (e.g., sound, earthquakes) • different speeds through different materials. ***8-ESS-I.1** Understand how energy from the sun and other stars, in the form of light, travels long distances to reach Earth.	2	IC	9-ESS-II.8 (higher grade level)
	Energy transfer and conservation: *energy transfer and conservation of energy*				
	P8.12: When energy is transferred from one system to another, the quantity of energy before transfer equals the quantity of energy after transfer. For example, as an object falls, its potential energy decreases as its speed, and consequently, its kinetic energy increases. While an object is falling, some of the object's kinetic energy is transferred to the medium through which it falls, setting the medium into motion and heating it.	**8-PS-II.1** Know that energy exists in many forms and that when energy is transformed some energy is usually converted to heat.	2	IC MD	State standard is very general mentioning only "many forms of energy." But state does not address the conservation of energy but rather the second law …loss to heat
	P8.13: Nuclear reactions take place in the sun. In plants, light from the sun is transferred to oxygen and carbon compounds, which, in combination, have chemical potential energy (photosynthesis).	* not covered ** 8-LS-III.2 Explain that photosynthesis in green plants captures the energy from the sun and stores it chemically.	2	MC IC	9-LS-I.7 (higher grade level-photosynthesis) Nuclear reactions not covered
	***Motion at the macroscopic level*:** *speed as a quantitative description of motion and graphical representations of speed*				
	P8.14: An object's motion can be described by its speed and the direction in which it is moving. An object's position can be measured and graphed as a function of time. An object's speed can be measured and graphed as a function of time.	**8-PS-III.8** Understand and apply Newton 's Laws of Motion: • Objects in motion will continue in motion and objects at rest will remain at rest unless acted upon by an unbalanced force (inertia). • If a greater force is applied to an object a proportionally greater acceleration will occur. • If an object has more mass the effect of an applied force is proportionally less.	2	MD	State notes Newton's Laws but does not address graphing

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TABLE D1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 science and New Mexico grade 8 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
MOTION	***Forces affecting motion:*** *qualitative descriptions of magnitude and direction as characteristics of forces, addition of forces, contact forces, forces that act at a distance, and net force on an object and its relationship to the object's motion*			
P8.15: Some forces between objects act when the objects are in direct contact or when they are not touching. Magnetic, electrical, and gravitational forces can act at a distance.	**8-PS-iii.1** Know that there are fundamental forces in nature (e.g., gravity, electromagnetic forces, nuclear forces). **8-PS-iii.3** Analyze the separate forces acting on an object at rest or in motion (e.g., gravity, elastic forces, friction), including how multiple forces reinforce or cancel one another to result in a net force that acts on an object.	2	MC	State does not address when objects are not in direct contact
P8.16: Forces have magnitude and direction. Forces can be added. The net force on an object is the sum of all the forces acting on the object. A nonzero net force on an object changes the object's motion; that is, the object's speed and/or direction of motion changes. A net force of zero on an object does not change the object's motion; that is, the object remains at rest or continues to move at a constant speed in a straight line.	***8-PS-III.2** Know that a force has both magnitude and direction. ****8-PS-III.3** Analyze the separate forces acting on an object at rest or in motion (e.g., gravity, elastic forces, friction), including how multiple forces reinforce or cancel one another to result in a net force that acts on an object.	3		Both state standards need to be addressed.

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Life science				
STRUCTURES AND FUNCTIONS OF LIVING SYSTEMS	***Organization and development: basic needs of organisms:*** *the levels of organization of living systems*			
L8.1: All organisms are composed of cells, from just one cell to many cells. About two-thirds of the weight of cells is accounted for by water, which gives cells many of their properties. In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells and function to serve the needs of cells for food, air, and waste removal. The way in which cells function is similar in all living organisms.	***4-LS-I.5** Describe how all living things are made up of smaller units that are called cells. ***7-LS-III.1** Understand that organisms are composed of cells and identify unicellular and multicellular organisms. ****4-LS-III.2** Recognize that the human body is organized from cells, to tissues, to organs, to systems, to the organism. *****5-LS-III.2** Know that some organisms are made of a collection of similar cells that cooperate (e.g., algae) while other organisms are made of cells that are different in appearance and function (e.g., corn, birds). *****7-LS-III.2** Explain how organs are composed of tissues of different types of cells (e.g., skin, bone, muscle, heart, intestines). ******7-LS-III.3** Understand that many basic functions of organisms are carried out in cells, including: • growth and division to produce more cells (mitosis) • specialized functions of cells (e.g., reproduction, nerve-signal transmission, digestion, excretion, movement, transport of oxygen).	2	MD	Water weight in cells is not addressed, nor is cell's role in serving the needs of the organism
L8.2: Following fertilization, cell division produces a small cluster of cells that then differentiate by appearance and function to form the basic tissues of an embryo.		2		Did a search for "fertilization", "cell division", and "embryo" with no results.
	Matter and energy transformations: *the role of carbon compounds in growth and metabolism*			
L8.3: Cells carry out the many functions needed to sustain life. They grow and divide, thereby producing more cells. Food is used to provide energy for the work that cells do and is a source of the molecular building blocks from which needed materials are assembled.	***8-LS-III.1** Describe how cells use chemical energy obtained from food to conduct cellular functions (i.e., respiration). ******7-LS-III.3** Understand that many basic functions of organisms are carried out in cells, including: • growth and division to produce more cells (mitosis) • specialized functions of cells (e.g., reproduction, nerve-signal transmission, digestion, excretion, movement, transport of oxygen).	2	MD	Mentions cell functions and chem. energy from food. Growth and division mentioned in 7-LS-III.3 Underlined portion not addressed

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TABLE D1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 science and New Mexico grade 8 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Life science				
STRUCTURES AND FUNCTIONS OF LIVING SYSTEMS				
L8.4: Plants are producers—they use the energy from light to make sugar molecules from the atoms of carbon dioxide and water. Plants use these sugars along with minerals from the soil to form fats, proteins, and carbohydrates. These products can be used immediately, incorporated into the plant's cells as the plant grows, or stored for later use.	**8-LS-III.2** Explain that photosynthesis in green plants captures the energy from the sun and stores it chemically.	2	MD	State standard is very general. Does not mention the word "producers" nor is it specific about the macromolecules.
L8.5: All animals, including humans, are consumers that meet their energy needs by eating other organisms or their products. Consumers break down the structures of the organisms they eat to make the materials they need to grow and function. Decomposers, including bacteria and fungi, use dead organisms or their products to meet their energy needs.	**8-LS-I.2** Describe how energy flows through ecosystems (e.g., sunlight, green plants, food for animals).	2	MD	State standard "energy flow in ecosystem" but no examples/ no details. State standard does not mention role of decomposers
Interdependence: *specific types of interdependence*				
L8.6: Two types of organisms may interact with one another in several ways: They may be in a producer/ consumer, predator/prey, or parasite/ host relationship. Or, one organism may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other.	**5-LS-I.1** Identify the components of habitats and ecosystems (producers, consumers, decomposers, predators). **5-LS-I.2** Understand how food webs depict relationships between different organisms.	2	MD	State does not mention specific relationships just mentions interactions (too general)
L8.7: The number of organisms and populations an ecosystem can support depends on the biotic resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition.	**8-LS-I.3** Explain how a change in the flow of energy can impact an ecosystem (e.g., the amount of sunlight available for plant growth, global climate change).	2	MD	State standard does not specify "biotic" and "abiotic" terms
L8.8: All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organisms or other organisms, whereas others are beneficial.	***5-LS-I.4** Describe how human activity impacts the environment. **7-ESS-II.2** Understand how living organisms have played many roles in changes of Earth's systems through time (e.g., atmospheric composition, creation of soil, impact on Earth's surface). **7-ESS-II.3** Know that changes to ecosystems sometimes decrease the capacity of the environment to support some life forms and are difficult and/or costly to remediate.	2	MC	Ozone specifically environmentally impacted by humans 9-SS-I.7 (higher grade) State does not mention beneficial changes

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Life science				
CHANGES IN LIVING SYSTEMS				
Heredity and reproduction: *reproduction and the influence of heredity and the environment on an offspring's characteristics*				
L8.9: Reproduction is a characteristic of all living systems**;** because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually.	***5-LS-II.1** Know that plants and animals have life cycles that include birth, growth and development, reproduction, and death and that these cycles differ for different organisms. ****7-LS-II.1** Know that reproduction is a characteristic of all living things and is essential to the continuation of a species. *****7-LS-II.2** Identify the differences between sexual and asexual reproduction.	3		
L8.10: The characteristics of organisms are influenced by heredity and environment. For some characteristics, inheritance is more important; for other characteristics, interactions with the environment are more important.	***7-LS-II.5** Understand that some characteristics are passed from parent to offspring as inherited traits and others are acquired from interactions with the environment. ***5-LS-II.2** Identify characteristics of an organism that are inherited from its parents (e.g., eye color in humans, flower color in plants) and other characteristics that are learned or result from interactions with the environment.	2	MD	State does not differentiate levels of influence of environmental vs inherited factors
Evolution and diversity: *preferential survival and relatedness of organisms*				
L8.11: Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. When an environment changes, the advantage or disadvantage of characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the Earth no longer exist.	***7-LS-II.7** Describe how typical traits may change from generation to generation due to environmental influences (e.g., color of skin, shape of eyes, camouflage, shape of beak). ****7-LS-II.12** Explain how species adapt to changes in the environment or become extinct and that extinction of species is common in the history of living things. *****7-LS-II.13** Know that the fossil record documents the appearance, diversification, and extinction of many life forms.	3		
L8.12: Similarities among organisms are found in anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance.		1		9-LS-I.8 Covered at higher grade

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TABLE D1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 science and New Mexico grade 8 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH IN SPACE AND TIME	***Objects in the universe:*** *a model of the solar system*			
E8.1: In contrast to an earlier theory that Earth is the center of the universe, it is now known that the sun, an average star, is the central and largest body in the solar system. Earth is the third planet from the sun in a system that includes eight other planets and their moons, as well as smaller objects, such as asteroids and comets.		1		3-ESS-I.1 3-ESS-I.1 Covered 5 years earlier (in the 3rd grade) - too long to be of any significance Possibly 8-ESS-I.3 but weak
E8.2: Gravity is the force that keeps most objects in the solar system in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.	**8-ESS-i.3** Understand how gravitational force acts on objects in the solar system and the universe, including: • similar action on masses on Earth and on other objects in the solar system • explanation of the orbits of the planets around the sun.	2	MC MD	State does not address cycles. Only gravity.
EARTH STRUCTURES	***History of Earth:*** *estimating the timing and sequence of geologic events*			
E8.3: Fossils provide important evidence of how life and environmental conditions have changed in a given location.	**6-ESS-II.8** Understand the history of Earth and how information about it comes from layers of sedimentary rock, including: • sediments and fossils as a record of a very slowly changing world • evidence of asteroid impact, volcanic and glacial activity. **7-ESS-II.1** Understand how the remains of living things give us information about the history of Earth, including layers of sedimentary rock, the fossil record, and radioactive dating showing that life has been present on Earth for more than 3.5 billion years.	3		
E8.4: Earth processes seen today, such as erosion and mountain building, made possible the measurement of geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations.		1		9-ESS-II.4 higher grade

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH STRUCTURES	***Properties of Earth materials:*** *soil analysis and layers of the atmosphere*			
	E8.5: Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them. Some formations show evidence that they were deposited by volcanic eruptions. Others are composed of sand and smaller particles buried and cemented by dissolved minerals to form solid rock again. Still others show evidence that they were once earlier rock types that were exposed to heat and pressure until they changed shape and in some cases melted and recrystallized.	**8-ESS-II.1** Describe the role of pressure (and heat) in the rock cycle.	2	MD	Mentions rock cycle in terms of the role of pressure and heat in rock cycle. No specific details.
	E8.6: Soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Soils are often found in layers with each having a different chemical composition and texture.	**7-ESS-II.2** Understand how living organisms have played many roles in changes of Earth's systems through time (e.g., atmospheric composition, creation of soil, impact on Earth's surface).	2	MD MC	State does not address composition of soil or layers of soil
	E8.7: The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has a different physical and chemical composition at different elevations.	**6-ESS-II.4** Describe the composition (i.e., nitrogen, oxygen, water vapor) and strata of Earth's atmosphere, and differences between the atmosphere of Earth and those of other planets.	2	MD	9-ESS-II.11(naturally and artificially) State does not mention composition at different elevations
	Tectonics: *the basics of tectonic theory and Earth magnetism*			
	E8.8: The Earth is layered with a lithosphere; hot, convecting mantle; and dense, metallic core.	**6-ESS-II.1** Know that Earth is composed of layers that include a crust, mantle, and core.	2	MD	State does not mention convection, density or composition
	E8.9: Lithospheric plates on the scale of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle. Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.	**6-ESS-II.2** Know that Earth's crust is divided into plates that move very slowly, in response to movements in the mantle.	2	MD MC	Too general 9-ESS-II.3
	E8.10: Earth as a whole has a magnetic field that is detectable at the surface with a compass. Earth's magnetic field is similar to the field of a natural or human-made magnet with north and south poles and lines of force. For thousands of years, people have used compasses to aid in navigation on land and sea.	**8-PS-III.6** Know that Earth has a magnetic field.	2	MD	"Earth has a magnetic field" But no details

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TABLE D1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 science and New Mexico grade 8 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH SYSTEMS	***Energy in Earth systems:*** *the sun's observable effects*			
E8.11: The sun is the major source of energy for phenomena on Earth's surface. The sun provides energy for plants to *grow and **drives convection within the atmosphere and oceans, producing winds, ocean currents, and the water cycle.	**6-PS-II.4** Understand that some energy travels as waves (e.g., seismic, light, sound), including: • the sun as source of energy for many processes on Earth • different wavelengths of sunlight (e.g., visible, ultraviolet, infrared) • vibrations of matter (e.g., sound, earthquakes) • different speeds through different materials. **5-ESS-II.1** Understand that water and air relate to Earth's processes, including: • how the water cycle relates to weather • how clouds are made of tiny droplets of water, like fog or steam.	2	IC MD MC	State does not address convection or underlined sections
E8.12: Seasons result from annual variations in the intensity of sunlight and length of day, due to the tilt of Earth's rotation axis relative to the plane of its yearly orbit around the sun.	***6-ESS-I.4** Know that the regular and predictable motions of the Earth-moon-sun system explain phenomena on Earth, including: • Earth's motion in relation to a year, a day, the seasons, the phases of the moon, eclipses, tides, and shadows • moon's orbit around Earth once in 28 days in relation to the phases of the moon. ****5-ESS-II.4** Recognize that the seasons are caused by Earth's motion around the sun and the tilt of Earth's axis of rotation.	3		
	Climate and Weather: *global weather patterns*			
E8.13: Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate because water in the oceans holds a large amount of heat.	**6-ESS-II.5** Understand factors that create and influence weather and climate, including: • heat, air movement, pressure, humidity, oceans • how clouds form by condensation of water vapor • how weather patterns are related to atmospheric pressure • global patterns of atmospheric movement (e.g., El Niño) • factors that can impact Earth's climate (e.g., volcanic eruptions, impacts of asteroids, glaciers).	2	MD	Underlined portion not addressed

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH SYSTEMS	***Biogeochemical cycles:*** *natural and human-induced changes in Earth materials and systems*			
E8.14: Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from Earth's surface, rises and cools as it moves to higher elevations, condenses as clouds, falls as rain or snow, and collects in lakes, oceans, soil, and underground.	**8-LS-I.1** Describe how matter moves through ecosystems (e.g., water cycle, carbon cycle). **8-ESS-II.2** Understand the unique role water plays on Earth, including: • ability to remain liquid at most Earth temperatures • properties of water related to processes in the water cycle: evaporation, condensation, precipitation, surface run-off, percolation • dissolving of minerals and gases and transport to the oceans • fresh and salt water in oceans, rivers, lakes, and glaciers • reactant in photosynthesis.	3		
E8.15: Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed Earth's land, oceans, and atmosphere. Studies of plant and animal populations have shown that such activities can reduce the number and variety of wild plants and animals and sometimes result in the extinction of species.	**5-LS-I.4** Describe how human activity impacts the environment.	2	MD MC	Too general 9.III.I.I.7 (higher grade)

a. Rating is based on a scale of 1 to 3, where 1 indicates that state standards do not address NAEP content statement, 2 that state standards partially address NAEP content statement, and 3 that state standards fully address or exceed NAEP content statement by targeted grade level.

b. Codes are IC (implied content), LG (content covered at a lower grade level), HG (content covered at a higher grade level), MC (more content), and MD (more detailed content). See appendix C for further information.

TABLE D2

New Mexico grade 8 standards not covered by NAEP grade 8 content

Content area	New Mexico grade 8 standards
Scientific thinking and practice	8-STP-I.1, 8-STP-I.2, 8-STP-I.3, 8-STP-II.1, 8-STP-II.2, 8-STP-II.3, 8-STP-III.1, 8-STP-III.2
Content Standard I—*Physical science*	Properties of matter: 8-PS-I.2 Energy transformation: 8-PS-II.3, 8-PS-II.4 Matter: 8-PS-I.4; Changes in matter: 8-PS-I.8, 8-PS-I.9, 8-PS-I.10 Forces: 8-PS-III.4, 8-PS-III.5;
Content Standard II—*Life science*	Genetics/evolution: 8-LS-II.1, 8-LS-II.2, 8-LS-II.3, Function of cells: 8-LS-III.3
Content Standard III—*Earth and space science*	8-ESS-I.2, Geology: 8-ESS-II.3
Science and society	8-SS-I.1, 8-SS-I.2, 8-SS-I.3, 8-SS-I.4.

APPENDIX E
CONTENT ALIGNMENT FOR GRADE 12

TABLE E1

Alignment of National Assessment of Educational Progress grade 12 science and New Mexico science assessment framework grade 11 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
MATTER	***Properties of matter:*** *characteristics of subatomic particles and atomic structure*			
P12.1: Differences in the physical properties of solids, liquids, and gases are explained by the ways in which the atoms, ions, or molecules of the substances are arranged and the strength of the forces of attraction between the atoms, ions, or molecules.	**11 PS I.1** Classify matter in a variety of ways (e.g., element, compound, mixture; solid, liquid, gas; acidic, basic, neutral). **11 PS I.10** Know that states of matter (i.e., solid, liquid, gas) depend on the arrangement of atoms and molecules and on their freedom of motion.	2	IC	NM-Limited to "classify" matter NM- Does not specify force of attraction
P12.2: Electrons, protons, and neutrons are parts of the atom and have measurable properties including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.	**11 STP I.5** Understand how scientific theories are used to explain and predict natural phenomena (e.g., plate tectonics, ocean currents, structure of atom). **11 PS I.5** Understand that matter is made of atoms and that atoms are made of subatomic particles. **11 PS I.6** Understand atomic structure, including: • most space occupied by electrons • nucleus made of protons and neutrons • isotopes of an element • masses of proton and neutron 2000 times greater than mass of electron • atom held together by proton-electron electrical forces.	2	IC	NM-States subatomic particles, but does not specify protons, neutrons, electrons NM-does not refer to nuclear force or how charged particles react
P12.3: In the Periodic Table, elements are arranged according to the number of protons (called the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements.	**11 PS I.4** Describe trends in properties (e.g., ionization energy or reactivity as a function of location on the periodic table, boiling point of organic liquids as a function of molecular weight). **11 PS I.8** Make predictions about elements using the periodic table (e.g., number of valence electrons, metallic character, reactivity, conductivity, type of bond between elements).	3		

	NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
MATTER	**P12.4:** In a neutral atom, the positively charged nucleus is surrounded by the same number of negatively charged electrons. Atoms of an element whose nuclei have different numbers of neutrons are called isotopes.	**11 PS I.6** Understand atomic structure, including: • most space occupied by electrons • nucleus made of protons and neutrons • isotopes of an element • masses of proton and neutron 2000 times greater than mass of electron • atom held together by proton-electron electrical forces.	2	IC	NM- Does not specify different number of neutrons or charged particles
	Changes in matter: *particulate nature of matter, unique physical characteristics of water, and changes at the atomic and molecular level during chemical changes*				
	P12.5: Changes of state require a transfer of energy. Water has a very high specific heat, meaning it can absorb a large amount of energy while producing only small changes in temperature.	**11 PS I.10** Know that states of matter (i.e., solid, liquid, gas) depend on the arrangement of atoms and molecules and on their freedom of motion.	2	IC	11 PS I.10 Water isn't mentioned in NM, nor energy.
	P12.6: An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules or between oppositely charged ions are called chemical bonds.	**11 PS I.7** Explain how electrons determine the properties of substances by: • interactions between atoms through transferring or sharing valence electrons • ionic and covalent bonds • the ability of carbon to form a diverse array of organic structures.	3		
	P12.7: A large number of important reactions involve the transfer of either electrons (oxidation/reduction reactions) or hydrogen ions (acid/base reactions) between reacting ions, molecules, or atoms. In other chemical reactions, atoms interact with one another by sharing electrons to create a bond. An important example is carbon atoms, which can bond to one another in chains, rings, and branching networks to form, along with other kinds of atoms—hydrogen, oxygen, nitrogen, and sulfur—a variety of structures, including synthetic polymers, oils, and the large molecules essential to life.	**11 PS I.12** Know that chemical reactions involve the rearrangement of atoms, and that they occur on many timescales (e.g., picoseconds to millennia). **11 PS I.13** Understand types of chemical reactions (e.g., synthesis, decomposition, combustion, redox, neutralization) and identify them as exothermic or endothermic.	3		

(CONTINUED)

TABLE E1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 12 science and New Mexico science assessment framework grade 11 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
ENERGY	***Forms of energy*:** *nuclear energy and waves*			
P12.8: Atoms and molecules that compose matter are in constant motion (translational, rotational, or vibrational).	**11 PS II.2** Explain how thermal energy (heat) consists of the random motion and vibrations of atoms and molecules and is measured by temperature. **11 PS II.5*** Explain how heat flows in terms of the transfer of vibrational motion of atoms and molecules from hotter to colder regions.	2	MD *IC	NAEP goes in more detail about the types of motion.
P12.9: Energy may be transferred from one object to another during collisions.	**11 PS II.2** Explain how thermal energy (heat) consists of the random motion and vibrations of atoms and molecules and is measured by temperature.	2	IC	NM-Does not specify collisions
P12.10: Electromagnetic waves are produced by changing the motion of charges or by changing magnetic fields. The energy of electromagnetic waves is transferred to matter in packets. The energy content of the packets is directly proportional to the frequency of the electromagnetic waves.	**11 PS II.1** Identify different forms of energy, including kinetic, gravitational (potential), chemical, thermal, nuclear, and electromagnetic. **11 PS II.7** Understand that electromagnetic waves carry energy that can be transferred when they interact with matter. **11 PS II.8** Describe the characteristics of electromagnetic waves (e.g., visible light, radio, microwave, X-ray, ultraviolet, gamma) and other waves (e.g., sound, seismic waves, water waves), including: • origin and potential hazards of various forms of electromagnetic radiation • energy of electromagnetic waves carried in discrete energy packets (photons) whose energy is inversely proportional to wavelength.	2	IC	NM-does not specify how EM waves are produced NM-There is no mention of packets of energy or frequency

	NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
ENERGY	**P12.11:** Fission and fusion are reactions involving changes in the nuclei of atoms. Fission is the splitting of a large nucleus into smaller nuclei and particles. Fusion involves joining of two relatively light nuclei at extremely high temperature and pressure. Fusion is the process responsible for the energy of the sun and other stars.	**11 PS I.11** Know that some atomic nuclei can change, including: • spontaneous decay • half-life of isotopes • fission • fusion (e.g., the sun) • alpha, beta, and gamma radiation. **11 PS II.10** Explain how wavelengths of electromagnetic radiation can be used to identify atoms, molecules, and the composition of stars.	2	IC	NM-Does not specify splitting of atoms or fusing of two atoms 11 PS II.10—NM asks to explain how wavelengths of EM radiation can be used to identify the composition of stars, but not how fusion is the process responsible for the energy of the stars.
	Energy transfer and conservation: *translational, rotational, and vibrational energy of atoms and molecules, and chemical and nuclear reactions*				
	P12.12: Heating increases the translational, rotational, and vibrational energy of the atoms composing elements and the molecules or ions composing compounds. As the translational energy of the atoms, molecules, or ions increases, the temperature of the matter increases. Heating a sample of a crystalline solid increases the vibrational energy of the atoms, molecules, or ions. When the vibrational energy becomes great enough, the crystalline structure breaks down and the solid melts.	**11 PS I.15** Describe how the rate of chemical reactions depends on many factors that include temperature, concentration, and the presence of catalysts. **11 PS II.2** Explain how thermal energy (heat) consists of the random motion and vibrations of atoms and molecules and is measured by temperature. **11 PS II.3** Understand that energy can change from one form to another (e.g., changes in kinetic and potential energy in a gravitational field, heats of reaction, hydroelectric dams) and know that energy is conserved in these changes. **11 PS II.5** Explain how heat flows in terms of the transfer of vibrational motion of atoms and molecules from hotter to colder regions.	2	IC	NM-Does not specify translational, rotational, vibrational motion NM-Does not specify breakdown of crystalline solid
	P12.13: The potential energy of an object on Earth's surface is increased when the object's position is changed from one closer to Earth's surface to one farther from Earth's surface.	**11 PS II.3** Understand that energy can change from one form to another (e.g., changes in kinetic and potential energy in a gravitational field, heats of reaction, hydroelectric dams) and know that energy is conserved in these changes.	2	IC	NM-only mentions potential energy, but not relative to distance from earth

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TABLE E1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 12 science and New Mexico science assessment framework grade 11 standards

	NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
ENERGY	**P12.14:** Chemical reactions either release energy to the environment (exothermic) or absorb energy from the environment (endothermic).	**11 PS I.13** Understand types of chemical reactions (e.g., synthesis, decomposition, combustion, redox, neutralization) and identify them as exothermic or endothermic. **11 PS II.3** Understand that energy can change from one form to another (e.g., changes in kinetic and potential energy in a gravitational field, heats of reaction, hydroelectric dams) and know that energy is conserved in these changes.	2	IC	NM-Does not specify release or absorb energy It is implied that endo- and exothermic reactions are taking place when NM discusses heat and changing of energy, and energy conservation.
	P12.15: Nuclear reactions—fission and fusion—convert very small amounts of matter into appreciable amounts of energy.	**11 PS I.11** Know that some atomic nuclei can change, including: • spontaneous decay • half-life of isotopes • fission • fusion (e.g., the sun) • alpha, beta, and gamma radiation.	2	IC	NM-Only lists fission and fusion
	P12.16: Total energy is conserved in a closed system.	**11 PS I.14** Know how to express chemical reactions with balanced equations that show: • conservation of mass • products of common reactions. **11 PS II.3** Understand that energy can change from one form to another (e.g., changes in kinetic and potential energy in a gravitational field, heats of reaction, hydroelectric dams) and know that energy is conserved in these changes.	2	IC	NM-write equations
MOTION	***Motion at the macroscopic level*:** *velocity and acceleration as quantitative descriptions of motion and the representation of linear velocity and acceleration in tables and graphs*				
	P12.17: The motion of an object can be described by its position and velocity as functions of time and by its average speed and average acceleration during intervals of time.	**11 PS III.8** Apply Newton's Laws to describe and analyze the behavior of moving objects, including: • displacement, velocity, and acceleration of a moving object • Newton's Second Law, F = ma (e.g., momentum and its conservation, the motion of an object falling under gravity, the independence of a falling object's motion on mass) • circular motion and centripetal force.	3		-at the macroscopic level, not microscopic….

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science				
MOTION				
P12.18: Objects undergo different kinds of motion—translational, rotational, and vibrational.		1		
Forces affecting motion: *quantitative descriptions of universal gravitational and electric forces, and relationships among force, mass, and acceleration*				
P12.19: The motion of an object changes only when a net force is applied.	**11 PS III.8** Apply Newton's Laws to describe and analyze the behavior of moving objects, including: • displacement, velocity, and acceleration of a moving object • Newton's Second Law, F = ma (e.g., momentum and its conservation, the motion of an object falling under gravity, the independence of a falling object's motion on mass) • circular motion and centripetal force.	3		
P12.21: Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted by the second object back on the first object. In closed systems, momentum is the quantity of motion that is conserved. Conservation of momentum can be used to help validate the relationship $a=F_{net}/m$.	**11 PS III.7** Know that when one object exerts a force on a second object, the second object exerts a force of equal magnitude and in the opposite direction on the first object (i.e., Newton's Third Law). **11 PS III.2** Know that every object exerts gravitational force on every other object, and how this force depends on the masses of the objects and the distance between them.	2	IC	NM-Does not include momentum
P12.22: Gravitation is a universal attractive force that each mass exerts on any other mass. The strength of the gravitational force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.	**11 PS III.1** Know that there are four fundamental forces in nature: gravitation, electromagnetism, weak nuclear force, and strong nuclear force. **11 PS III.2** Know that every object exerts gravitational force on every other object, and how this force depends on the masses of the objects and the distance between them. **11 PS III.7** Know that when one object exerts a force on a second object, the second object exerts a force of equal magnitude and in the opposite direction on the first object (i.e., Newton's Third Law).	3	IC	

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TABLE E1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 12 science and New Mexico science assessment framework grade 11 standards

NAEP science standards		New Mexico content	Overall rating[a]	Code[b]	Notes
Physical science					
MOTION	**P12.23:** Electric force is a universal force that exists between any two charged objects. Opposite charges attract while like charges repel. The strength of the electric force is proportional to the magnitudes of the charges and inversely proportional to the square of the distance between them. Between any two charged particles, the electric force is vastly greater than the gravitational force.	**11 PS III.1** Know that there are four fundamental forces in nature: gravitation, electromagnetism, weak nuclear force, and strong nuclear force. **11 PS III.3** Know that materials containing equal amounts of positive and negative charges are electrically neutral, but that a small excess or deficit of negative charges produces significant electrical forces.	2	IC	NM-Does not mention strength
Life science					
STRUCTURES AND FUNCTIONS OF LIVING SYSTEMS	***Organization and Development:*** *basic needs of organisms: the chemical basis of living systems*				
	L12.1: Living systems are made of complex molecules (including carbohydrates, fats, proteins, and nucleic acids) that consist mostly of a few elements, especially carbon, hydrogen, oxygen, nitrogen, and phosphorous.	**11 LS III.3** Describe the mechanisms for cellular processes (e.g., energy production and storage, transport of molecules, waste disposal, synthesis of new molecules). **11 LS III.1** Know that cells are made of proteins composed of combinations of amino acids.	2	IC	NM-Refers to mechanism of cellular process 11 LS III.1—NM only covers proteins, and only goes to the level of aa's, not elements.
	L12.2: Cellular processes are carried out by many different types of molecules, mostly proteins. Protein molecules are long, usually folded chains made from combinations of amino-acid molecules. Protein molecules assemble fats and carbohydrates and carry out other cellular functions. The function of each protein molecule depends on its specific sequence of amino acids and the shape of the molecule.	**11 LS III.1** Know that cells are made of proteins composed of combinations of amino acids. **11 LS III.7** Describe how most cell functions involve chemical reactions, including: • promotion or inhibition of biochemical reactions by enzymes • processes of respiration (e.g., energy production, ATP) • communication from cell to cell by secretion of a variety of chemicals (e.g., hormones).	2	IC	NM-Specify proteins made of amino acids NM-States DNA directs protein building 11 LS III.1—NM says that it is combinations of amino acids but doesn't go into the processes that a cell carries out.

NAEP science standards		New Mexico content	Overall rating[a]	Code[b]	Notes
Life science					
STRUCTURES AND FUNCTIONS OF LIVING SYSTEMS	**L12.3:** Cellular processes are regulated both internally and externally by environments in which cells exist, including local environments that lead to cell differentiation during the development of multicellular organisms. During the development of complex multicellular organisms, cell differentiation is regulated through the expression of different genes.	**11 LS III.5** Explain how cells differentiate and specialize during the growth of an organism, including: • differentiation, regulated through the selected expression of different genes • specialized cells, response to stimuli (e.g., nerve cells, sense organs).	3		
	Matter and energy transformations: *the chemical basis of matter and energy transformation in living systems*				
	L12.4: Plants have the capability (through photosynthesis) to take energy from light to form higher energy sugar molecules containing carbon, hydrogen, and oxygen from lower energy molecules. These sugar molecules can be used to make amino acids and other carbon-containing (organic) molecules and assembled into larger molecules with biological activity (including proteins, DNA, carbohydrates, and fats).	**11 LS I.7** Understand and explain the principles of photosynthesis (i.e., chloroplasts in plants convert light energy, carbon dioxide, and water into chemical energy). **11 LS III.3** Describe the mechanisms for cellular processes (e.g., energy production and storage, transport of molecules, waste disposal, synthesis of new molecules).	2	IC MD	NM-Does not mention sugar molecule, C,H,O or amino acids NAEP goes into more detail about the molecules and biological activity
	L12.5: The chemical elements that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in an ecosystem, some energy is stored in newly made structures, but much is dissipated into the environment as heat. Continual input of energy from sunlight keeps the process going.	**11 LS I.5** Explain how matter and energy flow through biological systems (e.g., organisms, communities, ecosystems), and how the total amount of matter and energy is conserved but some energy is always released as heat to the environment. **11 LS I.6** Describe how energy flows from the sun through plants to herbivores to carnivores and decomposers. **11 LS I.7** Understand and explain the principles of photosynthesis (i.e., chloroplasts in plants convert light energy, carbon dioxide, and water into chemical energy).	2	IC MD	NM doesn't cover how some energy is stored in newly made structures

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TABLE E1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 12 science and New Mexico science assessment framework grade 11 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Life science				
STRUCTURES AND FUNCTIONS OF LIVING SYSTEMS				
L12.6: As matter cycles and energy flows through different levels of organization of living systems—cells, organs, organisms, communities—and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.	**11 LS I.5** Explain how matter and energy flow through biological systems (e.g., organisms, communities, ecosystems), and how the total amount of matter and energy is conserved but some energy is always released as heat to the environment. **11 LS I.6** Describe how energy flows from the sun through plants to herbivores to carnivores and decomposers. **11 LS I.7** Understand and explain the principles of photosynthesis (i.e., chloroplasts in plants convert light energy, carbon dioxide, and water into chemical energy).	2	IC	NM-Refers to competition-producers, decomposers, herbivores, etc. rather than storage/dissipation of energy NM-Does not specify chemical elements NM-Casts living systems in herbivore, carnivore, omnivore
Interdependence: *consequences of interdependence*				
L12.7: Although the interrelationships and interdependence of organisms may generate biological communities in ecosystems that are stable for hundreds or thousands of years, ecosystems always change when climate changes or when one or more new species appear as a result of migration or local evolution. The impact of the human species has major consequences for other species.	**11 LS I.1** Know that an ecosystem is complex and may exhibit fluctuations around a steady state or may evolve over time. **11 LS I.2** Describe how organisms cooperate and compete in ecosystems (e.g., producers, decomposers, herbivores, carnivores, omnivores, predator-prey, symbiosis, mutualism). **11 LS I.3** Understand and describe how available resources limit the amount of life an ecosystem can support (e.g., energy, water, oxygen, nutrients). **11 LS I.4** Critically analyze how humans modify and change ecosystems (e.g., harvesting, pollution, population growth, technology).	3		

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Life science				
CHANGES IN LIVING SYSTEMS	***Heredity and Reproduction:*** *the molecular basis of heredity*			
L12.8: Hereditary information is contained in genes, located in the chromosomes of each cell. A human cell contains many thousands of different genes. One or many genes can determine an inherited trait of an individual, and a single gene can influence more than one trait.	**11 LS II.1** Know how DNA carries all genetic information in the units of heredity called genes, including: • the structure of DNA (e.g., subunits A, G, C, T) • information-preserving replication of DNA • alteration of genes by inserting, deleting, or substituting parts of DNA. **11 LS II.2** Use appropriate vocabulary to describe inheritable traits (i.e., genotype, phenotype). **11 LS II.3** Explain the concepts of segregation, independent assortment, and dominant/recessive alleles. **11 LS II.4** Identify traits that can and cannot be inherited.	3		
L12.9: The genetic information encoded in DNA molecules provides instructions for assembling protein molecules. Genes are segments of DNA molecules. Inserting, deleting, or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.	**11 LS II.1** Know how DNA carries all genetic information in the units of heredity called genes, including: • the structure of DNA (e.g., subunits A, G, C, T) • information-preserving replication of DNA • alteration of genes by inserting, deleting, or substituting parts of DNA. **11 LS II.5** Know how genetic variability results from the recombination and mutation of genes, including: • sorting and recombination of genes in sexual reproduction result in a change in DNA that is passed on to offspring • radiation or chemical substances can cause mutations in cells, resulting in a permanent change in DNA.	2	IC	NM doesn't cover how altered genes may help or harm the offspring's success in its environment.

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TABLE E1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 12 science and New Mexico science assessment framework grade 11 standards

NAEP science standards		New Mexico content	Overall rating[a]	Code[b]	Notes
Life science					
CHANGES IN LIVING SYSTEMS	**L12.10:** Sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations from the offspring of any two parents.	**11 LS II.5** Know how genetic variability results from the recombination and mutation of genes, including: • sorting and recombination of genes in sexual reproduction result in a change in DNA that is passed on to offspring • radiation or chemical substances can cause mutations in cells, resulting in a permanent change in DNA. **11 LS II.6** Understand the principles of sexual and asexual reproduction, including meiosis and mitosis.	3		
	Evolution and Diversity: *the mechanisms of evolutionary change and the history of life on Earth*				
	L12.11: Modern ideas about evolution (including natural selection and common descent) provide a scientific explanation for the history of life on Earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms.	**11 LS II.10** Understand the data, observations, and logic supporting the conclusion that species today evolved from earlier, distinctly different species, originating from the ancestral one-celled organisms. **11 LS II.12** Explain how natural selection favors individuals who are better able to survive, reproduce, and leave offspring. **11 LS II.13** Analyze how evolution by natural selection and other mechanisms explains many phenomena including the fossil record of ancient life forms and similarities (both physical and molecular) among different species. **11 STP I.5** Understand how scientific theories are used to explain and predict natural phenomena (e.g., plate tectonics, ocean currents, structure of atom). **11 LS II.9** Critically analyze the data and observations supporting the conclusion that the species living on Earth today are related by descent from the ancestral one-celled organisms.	3		

NAEP science standards		New Mexico content	Overall rating[a]	Code[b]	Notes
Life science					
CHANGES IN LIVING SYSTEMS	**L12.12:** Molecular evidence substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descent branched.	**11 LS II.8** Describe the evidence for the first appearance of life on Earth as one-celled organisms, over 3.5 billion years ago, and for the later appearance of a diversity of multicellular organisms over millions of years. **11 LS II.9** Critically analyze the data and observations supporting the conclusion that the species living on Earth today are related by descent from the ancestral one-celled organisms. **11 LS II.10** Understand the data, observations, and logic supporting the conclusion that species today evolved from earlier, distinctly different species, originating from the ancestral one-celled organisms. **11 LS II.13** Analyze how evolution by natural selection and other mechanisms explains many phenomena including the fossil record of ancient life forms and similarities (both physical and molecular) among different species.	2	IC	NM doesn't specifically state molecular evidence.
	L12.13: Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection from environmental pressure of those organisms better able to survive and leave offspring.	**11 LS I.9** Understand variation within and among species, including: • mutations and genetic drift • factors affecting the survival of an organism • natural selection. **11 LS II.11** Understand that evolution is a consequence of many factors, including the ability of organisms to reproduce, genetic variability, the effect of limited resources, and natural selection. **11 LS II.12** Explain how natural selection favors individuals who are better able to survive, reproduce, and leave offspring. **11 LS I.3** Understand and describe how available resources limit the amount of life an ecosystem can support (e.g., energy, water, oxygen, nutrients).	3		

(CONTINUED)

TABLE E1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 12 science and New Mexico science assessment framework grade 11 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH IN SPACE AND TIME	***Objects in the Universe:*** *a vision of the universe*			
	E12.1: The origin of the universe remains one of the greatest questions in science. The "big bang" theory places the origin approximately 13.7 billion years ago when the universe began in a hot, dense state. According to this theory, the universe has been expanding ever since.	**11 ESS I.4** Describe the key observations that led to the acceptance of the Big Bang theory and that the age of the universe is over 10 billion years.	2	IC	NM-Refers to observations that lead to acceptance of big bang 11 ESS I.4 NM wants students to describe the observations that led to the acceptance of the theory. So it is implied that students would learn the theory.
	E12.2: Early in the history of the universe, matter, primarily the light atoms hydrogen and helium, clumped together by gravitational attraction to form countless trillions of stars and billions of galaxies.	**11 ESS I.1** Understand the scale and contents of the universe, including: • range of structures from atoms through astronomical objects to the universe • objects in the universe such as planets, stars, galaxies, and nebulae.	2	IC	NM-Refers to scaling and contents of universe
	E12.3: Stars, like the sun, transform matter into energy in nuclear reactions. When hydrogen nuclei fuse to form helium, a small amount of matter is converted to energy. These and other processes in stars have led to the formation of all the other elements.	**11 ESS I.6** Describe how stars are powered by nuclear fusion, how luminosity and temperature indicate their age, and how stellar processes create heavier and stable elements that are found throughout the universe.	2	IC	NM-Does not refer to formation of all other elements
	History of Earth: *theories about Earth's history*			
	E12.4: Early methods of determining geologic time, such as the use of index fossils and stratigraphic sequences, allowed for the relative dating of geological events. However, absolute dating was impossible until the discovery that certain radioactive isotopes in rocks have known decay rates, making it possible to determine how many years ago a given rock sample formed.	**11 ESS II.4** Understand the changes in Earth's past and the investigative methods used to determine geologic time, including: • rock sequences, relative dating, fossil correlation, and radiometric dating • geologic time scales, historic changes in life forms, and the evidence for absolute ages (e.g., radiometric methods, tree rings, paleomagnetism).	3		

NAEP science standards		New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science					
EARTH IN SPACE AND TIME	**E12.5:** Theories of planet formation and radioactive dating of meteorites and lunar samples have led to the conclusion that the sun, Earth, and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago.	**11 ESS II.2** Recognize that radiometric data indicate that Earth is at least 4 billion years old and that Earth has changed during that period. **11 ESS II.4** Understand the changes in Earth's past and the investigative methods used to determine geologic time, including: • rock sequences, relative dating, fossil correlation, and radiometric dating • geologic time scales, historic changes in life forms, and the evidence for absolute ages (e.g., radiometric methods, tree rings, paleomagnetism).	2	IC	NM-Does not specify nebular cloud or dust NM doesn't specifically cover theories of planet formation and radioactive dating of meteorites and lunar samples.
	E12.6: Early Earth was very different from today's planet. Evidence for one-celled forms of life—the bacteria—extends back more than 3.5 billion years. The evolution of life caused dramatic changes in the composition of Earth's atmosphere, which did not originally contain molecular oxygen.		1		
	E12.7: Earth's current structure has been influenced by both sporadic and gradual events. Changes caused by violent earthquakes and volcanic eruptions can be observed on a human time scale, but many geological processes, such as the building of mountain chains and shifting of entire continents, take place over hundreds of millions of years.	**11 ESS II.1** Describe the characteristics and the evolution of Earth in terms of the geosphere, the hydrosphere, the atmosphere, and the biosphere **11 ESS II.5** Explain plate tectonic theory and understand the evidence that supports it.	2	IC	NM-focus on geologic process

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TABLE E1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 12 science and New Mexico science assessment framework grade 11 standards

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH STRUCTURES	***Tectonics:*** *the basics of tectonic theory and Earth magnetism*			
E12.8: Mapping of the Mid-Atlantic Ridge, evidence of sea floor spreading, and subduction provided crucial evidence in support of the theory of plate tectonics. The theory currently explains plate motion as follows: the outward transfer of Earth's internal heat propels the plates comprising Earth's surface across the face of the globe. Plates are pushed apart where magma rises to form mid-ocean ridges, and the edges of plates are pulled back down where Earth materials sink into the crust at deep trenches.	**11 ESS II.3** Describe the internal structure of Earth (e.g., core, mantle, crust) and the structure of Earth's plates. **11 ESS II.5** Explain plate tectonic theory and understand the evidence that supports it. **11 ESS II.6** Know that Earth's systems are driven by internal (i.e., radioactive decay and gravitational energy) and external (i.e., the sun) sources of energy. **11 ESS II.7** Describe convection as the mechanism for moving heat energy from deep within Earth to the surface and discuss how this process results in plate tectonics, including: • geological manifestations (e.g., earthquakes, volcanoes, mountain building) that occur at plate boundaries • impact of plate motions on societies and the environment (e.g., earthquakes, volcanoes).	2	IC	NM-Does not specify motion of plates NM-Only specifies explain plate techtonics and understand evidence
EARTH SYSTEMS	***Energy in earth systems:*** *internal and external sources of energy in Earth systems*			
E12.9: Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from Earth's original formation.	**11 ESS II.6** Know that Earth's systems are driven by internal (i.e., radioactive decay and gravitational energy) and external (i.e., the sun) sources of energy.	3		
	Climate and Weather: *systems that influence climate*			
E12.10: Climate is determined by energy transfer from the sun at and near Earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover, atmospheric gases, and Earth's rotation, as well as static conditions such as the positions of mountain ranges and of oceans, seas, and lakes.	**11 ESS II.8** Describe the patterns and relationships in the circulation of air and water driven by the sun's radiant energy, including: • patterns in weather systems related to the transfer of energy • differences between climate and weather • global climate, global warming, and the greenhouse effect • El Niño, La Niña, and other climatic trends.	2	IC	NM-Context is patterns of weather

NAEP science standards	New Mexico content	Overall rating[a]	Code[b]	Notes
Earth and space science				
EARTH SYSTEMS	***Biogeochemical cycles:*** *biogeochemical cycles in Earth systems*			
	E12.11: Earth is a system containing essentially a fixed amount of each stable chemical atom or element. Most elements can exist in several different chemical forms. Earth elements move within and between the lithosphere, atmosphere, hydrosphere, and biosphere as part of biogeochemical cycles.	**11 ESS II.9** Know that Earth's system contains a fixed amount of natural resources that cycle among land, water, the atmosphere, and living things (e.g., carbon and nitrogen cycles, rock cycle, water cycle, ground water, aquifers).	2	IC	NM-Does not refer to different forms of chemicals
	E12.12: Movement of matter through Earth's systems is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in coal and other fossil fuels, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life.	**11 ESS II.10** Describe the composition and structure of Earth's materials, including: • the major rock types (i.e., sedimentary, igneous, metamorphic) and their formation • natural resources (e.g., minerals, petroleum) and their formation.	2	MC IC	NM-Does not mention sources of energy as driving force NM covers composition and structure of Earth's materials but doesn't go into as much detail at NAEP.
	E12.13: Natural ecosystems provide an array of basic processes that affect humans. These processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients.	**11 ESS II.11** Explain how layers of the atmosphere (e.g., ozone, ionosphere) change naturally and artificially. **11 ESS II.12** Explain how the availability of ground water through aquifers can fluctuate based on multiple factors (i.e., rate of use, rate of replenishment, surface changes, and changes in temperature).	2	IC	NM-Only focus on ground water which could be hydrologic cycle NAEP goes into more detail about the types of processes that affect humans.

a. Rating is based on a scale of 1 to 3, where 1 indicates that state standards do not address NAEP content statement, 2 that state standards partially address NAEP content statement, and 3 that state standards fully address or exceed NAEP content statement by targeted grade level.

b. Codes are IC (implied content), LG (content covered at a lower grade level), HG (content covered at a higher grade level), MC (more content), and MD (more detailed content). See appendix C for further information.

TABLE E2

New Mexico grade 11 standards not covered by NAEP grade 12 content

Content area	New Mexico grade 11 standards
Scientific thinking and practice	11 STP I.1-5 11 STP II.1-6 11 STP III.1-5
Content Standard I—*Physical science*	11 PS I.2, 3, 9 11 PS II.4, 6, 10,11 11 PS III.4, 6, 9, 10, 11, 12
Content Standard II—*Life science*	11 LS I.8 11 LS II.7 11 LS III.4
Content Standard III—*Earth and space science*	11 ESS I.2, 3, 5, 7
Science and society	11 SS I.1-19

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