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Webb Alignment Study Report

Science

Grades 5, 8 and 10

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Table of Contents

0.	Executive Summary.....	4
I.	Alignment Study Process.....	5
II.	Overview of the Assessments.....	8
III.	Committee Composition	9
IV.	Alignment Study Results.....	12
V.	Reliability of Reviewer Classifications.....	22
VI.	Reviewer Feedback,.....	24.
VII.	Appendices	36
	Appendix A-Agendas	
	Appendix B-Training Slides	
	Appendix C-Packet Materials	
	Appendix D-Detailed Science Results	

0. Executive Summary

On March 5 and 6, 2007 Grade 5, 8, and 10 educators in Ohio met in Columbus, Ohio to review test forms and content classifications to determine the alignment of the Ohio Achievement Tests and Ohio Graduation Tests to the Ohio benchmarks and standards. Eighteen educators across three committees of six reviewers used the Webb Alignment Tool to generate data for the alignment study.

The alignment workshop was directed by the Ohio Department of Education. The staff from the Ohio Department of Education provided a support function to the process. They were directly involved in the classification process.

This report will document the process that was undertaken, describe the materials used in the process, present the results of the alignment study, and provide feedback from the reviewers.

The Webb Alignment process is well documented and has been done in many states across the country. This process ran very smoothly. This is probably due to the tremendous effort which was made to set up the system at the beginning. The facilities were first rate, especially the online stations which were more than adequate for the task. The Webb Alignment Tool software worked very well. With 18 reviewers online there were very few problems with the system and software.

Training materials were excellent and provided good support for defining and explaining the alignment tasks. The test materials were well organized and easily accessible to the committees.

The reviewers and their Table Leaders worked hard at the task. They came away from the process with a good experience and an interesting one. A study like this often has a benefit beyond the results of the alignment. This task provided some good training for teachers in ways of looking at assessments and perhaps interested some in the assessment program.

The report presents the results of the alignment study. In summary the tests appear to be aligned to the benchmarks and standards from which they were created. The system provides four primary aspects of alignment to test. In over 90% of the comparisons the Ohio tests met the criterion set by the alignment model. The results not only confirm that the tests conform to the benchmarks and standards, but also point to the areas where further work is needed to guide item development or further specification of benchmarks.

As a measurement specialist who has worked hard to establish test development procedures that produce content test validity, the wisdom of the post-hoc evaluation of this nature has not always been evident. However, I believe the alignment study results will be used to further develop the content validity. The results certainly can be used to document existing content validity.

I. Alignment Study Process

In March 2007 Ohio used the Webb Alignment Tool (WAT) to study the alignment of its Grades 5, 8, and 10 Science assessments to its standards and benchmarks. The workshop was held over a two day period from March 5-6. The Webb process consists of content reviewers making classifications of items in terms of standards, objectives and cognitive level. The reviewers also classify objectives and standards into cognitive levels. These classifications produce alignment data that can be matched to criteria set by the WAT system.

The WAT system provides extensive training materials and structures the workshop. The committees were structured to review a specific grade. Three review committees were formed:

Grade 5 Science
Grade 8 Science
Grade 10 Science

Each committee had a Group Leader and 5 other committee members. Each item was reviewed by 6 members. The Group Leaders duties were to structure the tasks and assist with learning the process and to act as one of the six reviewers. Group Leader training took place on February 16 prior to the March 5 and 6 workshop. Group Leaders were given training materials and became familiar with the process and their duties. They were trained in the task, the process, and using the WAT system. Training materials for the Group Leaders and reviewers can be found in Appendix B. The specific duties of the Group Leaders are listed below.

- Lead the review of sample items
- Lead the consensus process for standards/benchmarks and DOK levels for grades
- Lead the practice set coding
- Code the DOK for standards into system
- Code the assessment to standards/benchmarks and DOK levels
- Conduct daily debriefing
- Lead the recalibration on standards/benchmarks and DOK levels
- Conduct the review process
- Answer questions
- Conduct the standards/benchmark review for the different grades
- Conduct the recalibration on the DOK levels for grades
- Distribute and collect the meeting evaluation forms
- Instruct participants to write their names on the test folders

On March 5 the morning was devoted to training the reviewers and refreshing the Group Leaders. Reviewers were assembled in a large group and given an overview of the process. The Training Slides can be seen in Appendix B. The Agenda for the two day workshop is in Appendix A.

After the overview and presentation of the alignment process, a description of the procedures, and training on the Depth of Knowledge classification task, the reviewers reconvened in their grade level groups. In these groups they practiced working with the Depth of Knowledge classifications, by coding non-Ohio Benchmarks and items. When the reviewers were confident about the task they then began the process of coding the Ohio Benchmarks.

Once the Ohio Benchmark were coded, reviewers began work on practice items. The reviewers coded a set of practice items and then discussed their classifications in the grade level groups.

After the noon break, reviewers were trained on using the WAT online classification tool. Reviewers were allowed to log on to the system and become comfortable with its use. Once reviewers felt ready to begin actual classifications they began to work on the first test form. Committees for Grades 5 and 8 completed the classification task for two test forms. The committee for Grade 10 completed the task for 3 test forms. The rest of the first day and all of the second day was used for the classification process..

The process went very smoothly. The WAT online system functioned very well throughout and few problems were encountered. Reviewers were able to concentrate on the classification tasks and not software or computer problems. The facilities were excellent and each reviewer had easy access to an online computer. There was a considerable amount of work to set up the software and to download all the materials. The process seemed to take place without flaws. A lot of the focus and execution of the process depended on involvement of Ohio Department of Education staff. Their role is outlined below.

The study was facilitated by Ohio Department of Education (ODE) personnel as facilitators. Duties varied from arranging for facilities to preparing materials to assisting working teams of reviewers. It would be beyond the scope of this report to list all the tasks and exactly which ODE employ performed them.

Each study group had at least two ODE personnel assigned to the study group. At any one time the group should have a person from assessment and another person from curriculum. In general, curriculum personnel participated in the study by preparing training materials and exemplars, training the group leaders in the Depth of Knowledge levels (DOK), and serving as a general resource person during the training of the reviewers. Therefore curriculum personnel were matched to groups that were working on standards and benchmarks that were the same as the curriculum person's daily work

content. Assessment personnel were tasked with helping reviewers use the software and distributing test forms and collecting used materials for security purposes.

The assignments are shown in Table 1.

Table 1 – Assignment of ODE personnel to alignment study groups.

Group	Group leader	ODE Curriculum specialist	ODE Assessment specialist
GR 5 Science	Terrence Rounds	Lauren Monowar-Jones	Willa Brown
GR 8 Science	William Webb	Esther Hopkins	Patrice Corrigan
GR 10 Science	Holly Lavender	Kim Mullen	Wendy Stoica

Additional management was provided by “floaters” to either substitute or supplement or trouble shoot during the study. ODE floaters included Judy Feil, and Terrence Moore.

Participant registration was handled by ODE employee Veronica Price.

The study was performed at the Columbus Ohio scoring site of Pearson Educational Measurement and facility management was provided by Pearson site manager, Paul L. Brown.

II. Overview of the Assessments

This study examined Science tests used in the Ohio Achievement Test program and Ohio Graduation Test program. All test forms have been used with student census testing during the years 2005, 2006, and 2007 for the Spring assessments. Grades 5 and 8 had two forms. Form A was used for the regular administration and Form B was held as a breach form to be used if Form A was compromised. Three forms were reviewed in Grade 10. Form A was used in Spring 2005, Form B was used in 2006, and Form C was used in 2007. The assessments contain multiple-choice and open-ended items. The open-ended items are scored on a 1-2 or 1-4 point basis. All multiple-choice items are scored as correct or incorrect.

Assessments for Science

The table below provides a description of the test forms reviewed.. The table provides the Form Label used in this analysis, the total number of test items which includes field test items, the census items which were coded, the location of the field test block, the date the form was used or will be used, and the status of the forms release to the public. Note that forms marked “n/a” are not yet given so that they are not yet released.

**Table II-Table of Operational Science Test Forms for the Alignment Study
Grades 5, 8, and 10**

Study Group	Subject	Form Label	Total Number of Items	Number of Items to Code	Field Test Block	Operational Form	Full or Partial Public Release
GR5	Science	5A	42	36	Q16 – 22	Mar-07	Full
GR5	Science	5B	42	36	secure	breach	secure
GR8	Science	8A	42	36	Q16 – 22	Mar-07	Full
GR8	Science	8B	43	37	secure	breach	secure
GR10	Science	10A	44	38	Q29 – 34	Mar-05	Full
GR10	Science	10B	44	38	Q16 – 21	Mar-06	Full
GR10	Science	10C	44	38	Q11 – 16	Mar-07	Full

III. Committee Composition

The following tables show the demographics of the panelists in the alignment study. Those invited to participate in the study were selected from the rolls of participants in other assessment development and advisory committees and were, to some extent, known for their reliability in performing state committee work.

Special attention was given to committee composition with the intent to make the panels diverse yet composed of teachers with current classroom duties. Of the nine committees, six committees included a special education teacher, two committees included an ESL teacher, and one committee included a teacher in a gifted program. Of the 55 panelists, ten were male, eight were Black, two were Asian and one was listed as Hispanic.

Panelists had between three and 41 years of experience. The mean level of experience was 16.9 years (S.D. = 9.7) with a median experience of 14 years and a mode of nine years. The cumulative experience was 929 years.

Group leaders are shown in bold.

Table IIIA – Reviewers for the Study of Grade 5 Science

Grade Band	First Name	Last Name	Organization	Grade	Gender	Ethnicity	Years Experience
Grades 3-5	Karen	Smith	Fairfield City Schools	G4	F	Caucasian	
Grades 3-5	Jennifer	Stormer	Northmont City Schools	G5	F	Caucasian	
Grades 3-5	Terrence	Rounds*	Cleveland Heights/University Hgts.	G5	M	Caucasian	36
Grades 3-5	Kim	Rado	Bedford City School District	G5	F	Caucasian	17
Grades 3-5	Cheryl	Pilatowski	Toledo Public Schools	G5	F	Caucasian	27
Grades 3-5	Susan	Poultney	Parma City School District	EL	F	Caucasian	23

Table IIIB – Reviewers for the Study of Grade 8 Science

Grade Band	First Name	Last Name	Organization	Grade	Gender	Ethnicity	Years Experience
Grades 6-8	Mary	Leonard	Waterloo Middle School	G8	F	Caucasian	29
Grades 6-8	Paul	Aukerman	Mechanicsburg Ex. Village	G8	M	Caucasian	20
Grades 6-8	Gwen	McLaughlin	Toledo Public Schools	G8	F	Caucasian	14
Grades 6-8	William	Webb	Gallia County Local SD	G8	M	Caucasian	37
Grades 6-8	Stacy	Beck	Akron Public Schools	MS	F	Afr Amer	8

Table IIIC – Reviewers for the Study of Grade 10 Science

Grade Band	First Name	Last Name	Organization	Grade	Gender	Ethnicity	Years Experience
Grades 9-12 (OGT)	Toni	Evans	River Valley Local School District	HS	F	Caucasian	11
Grades 9-12 (OGT)	Holly	Lavender	Liberty Union	HS	F	Caucasian	3
Grades 9-12 (OGT)	Debrah	Fulkman	Akron City School	HS	F	Caucasian	14
Grades 9-12 (OGT)	James	Duxbury	Orrville City School District	HS	M	Caucasian	15
Grades 9-12 (OGT)	Rick	Nestoff	North Royalton School District	HS	M	Caucasian	6
Grades 9-12 (OGT)	Geraldine	DeWitt-Tichnor	Youngstown City Schools	HS	F	Caucasian	19

IV. Alignment Study Results

This section provides an analysis of the results of the alignment study. A complete set of tables for the study appear in Appendix D. The tables in this section summarize the tables in the appendix. Reviewers provided alignment classifications for 2 test forms in Grade 5 and 8 Science and 3 test forms in Grade 10 Science. The tables below summarize by grade and form the first four tables in the appendix. These tables focus on four aspects of alignment: categorical concurrence, depth-of-knowledge concurrence, range of knowledge correspondence, and balance of representation. The tables present the weighted result. This takes into account items with more than one point awarded for the answer. Items with point values greater than one are treated as if they are representing as many items as they have possible score points. A review of the alignment categories follows.

Categorical Concurrence

The categorical concurrence aspect has to do with whether the standards and the assessment focus on the same content categories. The Webb Alignment Tool (WAT) uses a criteria of 6 items or points matched to a content area to demonstrate categorical concurrence. The basis for this is that 6 items/points usually can produce a reliable subscale score.

Depth-of-Knowledge Consistency

With the WAT items and standards are classified by their Depth of Knowledge (DOK). The consistency criteria for Depth-of-Knowledge is 50% or items/points at or above the corresponding standard's DOK level. Using fifty percent as the minimum criteria allows for students scoring at or above fifty percent of the items to get at least some of the more complex items in terms of DOK correct.

Range of Knowledge Correspondence

The range of knowledge analysis deals with how many objectives within a standard are measured compared to the total number of objectives in the standard. The criteria is that 50% of the objectives need to have one or more items measuring that objective. If 41% to 49% of objectives are represented the criteria is weakly met.

Balance of Representation

The range of knowledge criteria does not focus on the balance of items across objectives within a standard. The balance of representation index gives an indication of the balance of items objectives within a standard. If the balance is perfect, for instance 10 items and 5 objectives and 2 in each objective the index is 1.0. An index value close to zero would indicate very little balance. Index values that are .70 or higher indicate a balanced distribution. An index value in the range of .6 to .7 indicates a "weak" balance.

The chart below shows the coding for the summary tables that follow. The summary tables for each grade/subject show the criteria values for each form and an average of the forms for that grade/subject. The table entries are coded green if they meet the WAT criteria, yellow if they are classified as weak, and pink if they do not meet the criteria. A discussion of the results follows the summary table set.

Aspect of Alignment	Status		
	Yes (Green)	Weak (Yellow)	No (Pink)
Categorical Concurrence	6 or more		5 or less
Depth-of-Knowledge Consistency	50% or more	40% to 49%	below 40%
Range of Knowledge Correspondence	50% or more	40% to 49%	below 40%
Balance of Representation Index Mean	.70 or more	.60 to .69	below .60
	Green	Yellow	Pink

Grade 5 Science Forms Alignment to WAT Categorical Concurrence, DOK Levels, Range of Knowledge and Balance Index

Grade 5	Categorical Concurrence (Want 6 or More Items per Standard)			DOK Consistency % At or Above (Want 50% or Above)			Range of Knowledge Correspondence % of Total (Want 50% or Above)			Balance Index Mean (Want .70 or Higher)		
	Form A 2006	Form B 2006	Average	Form A 2006	Form B 2006	Average	Form A 2006	Form B 2006	Average	Form A 2006	Form B 2006	Average
Earth and Space Science	16.83	18.83	17.83	66	47	57	100	83	92	0.84	0.86	0.85
Life Sciences	9.00	16.50	12.75	54	65	60	100	89	95	0.84	0.74	0.79
Physical Sciences	11.67	11.67	11.67	100	89	95	81	92	87	0.74	0.74	0.74
Scientific Methods and Applications	18.33	13.83	16.08	28	23	26	71	52	62	0.72	0.63	0.68

Grade 8 Science Forms Alignment to WAT Categorical Concurrence, DOK Levels, Range of Knowledge and Balance Index

Grade 8	Categorical Concurrence (Want 6 or More Items per Standard)			DOK Consistency % At or Above (Want 50% or Above)			Range of Knowledge Correspondence % of Total (Want 50% or Above)			Balance Index Mean (Want .70 or Higher)		
	Form A 2006	Form B 2006	Average	Form A 2006	Form B 2006	Average	Form A 2006	Form B 2006	Average	Form A 2006	Form B 2006	Average
Earth and Space Science	14.80	12.40	13.60	79	84	82	92	92	92	0.72	0.73	0.73
Life Sciences	12.20	13.20	12.70	86	80	83	95	100	98	0.85	0.68	0.77
Physical Sciences	12.80	11.80	12.30	86	88	87	86	95	91	0.77	0.74	0.76
Scientific Methods and Applications	18.60	18.00	18.30	59	64	62	53	37	45	0.74	0.84	0.79

Grade 10 Science Forms Alignment to WAT Categorical Concurrence and DOK Levels

Grade 10	Categorical Concurrence (Want 6 or More Items per Standard)				DOK Consistency % At or Above (Want 50% or Above)			
	Form A 2005	Form B 2006	Form C 2007	Average	Form A 2005	Form B 2006	Form C 2007	Average
Earth and Space Science	6.33	6.00	6.00	6.11	62	79	85	75
Life Sciences	10.33	10.50	10.33	10.39	55	51	42	49
Physical Sciences	8.00	8.00	8.00	8.00	66	71	79	72
Scientific Methods and Applications	7.33	7.17	7.50	7.33	64	87	69	73

Grade 10 Science Forms Alignment to WAT Range of Knowledge and Balance Index

Grade 10	Range of Knowledge Correspondence % of Total (Want 50% or Above)				Balance Index Mean (Want .70 or Higher)			
	Form A 2005	Form B 2006	Form C 2007	Average	Form A 2005	Form B 2006	Form C 2007	Average
Earth and Space Science	84	81	83	83	0.70	0.75	0.75	0.73
Life Sciences	66	75	74	72	0.65	0.75	0.74	0.71
Physical Sciences	85	75	69	76	0.74	0.74	0.76	0.75
Scientific Methods and Applications	49	63	63	58	0.80	0.80	0.76	0.79

Discussion of the Science Results

Grade 5 Science-Forms 5A (2007) and 5B (2007)

The Grade 5 Science forms were both assigned to the Spring 2007 assessment. Form B was designated as the “breach” form, so its use was limited to the exposure of Form A in special situations. Depending on the level of that exposure the form may be used in the future.

The Grade 5 Science forms meet the criteria for Categorical Concurrence. There are more than 6 items for each standard. This is a function of the number of items (38) and points (48) on the assessment, the number of standards (4), and the assessment blueprint which calls for balance in the content. All Ohio assessments that were reviewed met the Categorical Concurrence criteria.

The Depth-of-Knowledge Consistency criterion of 50% was met in 5 of 8 instances. The Earth and Space Science standard only had 47% Depth of Knowledge Consistency for Form B. On the Form A and B 2007 assessments only 23% and 28% of items in the Scientific Methods and Applications category were at or above their DOK level. The average of all forms yields a 26% average across the two test forms. The Acquisition of Vocabulary area is much weaker than the other standards in this assessment. The other standards had DOK Consistency averages of 57% or better. This is clearly a weakness in the Grade 5 Science assessment when compared to the criteria. This particular benchmark is very conceptual in nature and content descriptions tend to be high level. The items written at the Grade 5 level are not as highly classified in Depth of Knowledge. This difference will need to be carefully examined.

The Range of Knowledge Correspondence criterion is 50%. All standards and test forms met this criterion. In all cases at least 50% of objectives in a standard were measured. Averages across the two forms ranged from 62% for Scientific Methods and Applications to 95% for Life Sciences.

The last criterion is concerned with the balance of content representation. The criterion for the Balance Index is above .70 for the first three content areas for both forms, but is slightly below (.63) for Form B in Scientific Methods and Applications. or greater for each standard. The average Balance Index across the two forms was .68.

Grade 8 Science-Forms 8A (2007) and 8B (2007)

As in Grade 5, the Grade 8 Science forms were both assigned to the Spring 2007 assessment. Form B was designated as the “breach” form, so its use was limited to the exposure of Form A in special situations. Depending on the level of that exposure the form may be used in the future.

The Grade 8 Science forms meet the criteria for Categorical Concurrence. There are more than 6 items for each standard. This is a function of the number of items (38) and points (48) on the assessment, the number of standards (4), and the assessment blueprint which calls for balance in the content. All Ohio assessments that were reviewed met the Categorical Concurrence criteria.

Forms A and B meet the Depth of Knowledge Consistency criteria in all four content areas. Percents range from 59% for Form A Scientific Methods and Applications to 88% for Form B Physical Sciences. The lack of consistency in Depth of Knowledge noted at Grade 5 in Scientific Methods and Applications does not seem to be present at the higher Grade 8 level.

The Range of Knowledge Correspondence criterion of 50% was met in for all standards except on Form B for the Scientific Methods and Applications standard. Only 37% of the objectives on average were present on the test. The average for Forms A and B was 45%.

The Balance Index Mean for all standards and test forms was above the .70 criteria. Except for Life Sciences Form B, where the Balance Index Mean was .68. Average across forms ranged from .73 for Earth and Space Science and .79 for Scientific Methods and Applications.

Grade 10 Science-Forms 10A (2005), 10B (2006), and 10C(2007)

As in Grades 5 and 8, the Grade 10 Science forms meet the criteria for Categorical Concurrence. There are more than 6 items/points for each standard. This is a function of the number of items (38) and points (48) on the assessment, the number of standards (4), and the assessment blueprint which calls for balance in the content. All Ohio assessments that were reviewed met the Categorical Concurrence criteria.

The three Grade 10 forms meet the criteria for Depth of Knowledge Consistency in all instances except for Form C Life Sciences. There the percent was below the 50% criteria at 42% consistency. This lower value caused the average consistency for Life Sciences to be only 49%. The averages for the other three standards were all above 70%. Since the Life Sciences values for all three forms were below 60%, this area should be reviewed and new item development should be sensitive to Depth of Knowledge considerations.

The percent of Range of Knowledge Correspondence criteria of 50% was met in all standards across the forms except for Form A Scientific Methods and Applications which was just below the criteria at 49%. The averages across all three forms at Grade 10 ranged from 58% for Scientific Methods and Applications to 83% for Earth and Space Science.

The Balance Index Means for Grade 10 all met the .70 criteria except for Form A Life Sciences which had a Balance Index Mean of .65. The averages for the four standards across the three forms ranges from .71 in Life Sciences to .79 in Scientific Methods and Applications.

Summary of the Science Analysis Grades 5, 8 and 10

A total of 7 test forms were reviewed in Science. Each test form had 4 standards. The Webb Alignment Tool looks at 4 main criteria to measure level of alignment. The reviewers classifications were compiled to yield 112 (7 tests BY 4 standards BY 4 criterion) possible instances alignment measures. The Science analysis shows that in

103 or 92.0% of the instances the assessment Met the criterion

6 or 5.4% of the instances the assessments just missed and were given a WEAK rating

3 or 2.7% of the instances the assessments did not meet the criterion

By the summary analysis above it would that the Science tests do meet the criteria for alignment. However, there are places that could use some further investigation.

Four of the 9 instances that did not meet the criteria were in Depth of Knowledge Consistency Three of these occurred at Grade 5. An analysis of the Grade 5 standards, benchmarks, and items in reference to Depth of Knowledge in the Scientific Methods and Applications standard needs to be a primary focus.

Of the remaining five misses, three took place in the Balance Index Mean and were all close to meeting the .70 criteria. They ranged from .63 to .68. Balance of items across benchmarks within standards needs to be considered during test building activities.

Overall the Science assessments present a picture of good alignment to the content and consistency in DOK classifications of content and assessment items. Investigation into the few problem areas discussed above could result in further strengthening that alignment.

V. Reliability of the Reviewer Classifications

Reliability and Concordance of Reviewers Classifications for Depth-of-Knowledge

The Webb Alignment Tool provides two statistics which can be used to evaluate the reliability and concordance of reviewer ratings: intra-class correlations and pair-wise comparisons. The intra-class correlations provide essentially a ratio of variances in the data. The variance of the item divided by the variance of the reviewer plus the variance of the item yields the intra-class correlation. Values of .70 or higher indicate that at least 70% of the variance in the data is due to item differences and less than 30% is due to reviewer differences. As this value reaches .50 the reviewer differences explain more data than the item differences. Where item differences or item variance is low the intra-class correlation will also be low.

A pair-wise comparison procedure can also be used to investigate reviewer reliability and concordance. Essentially the pair-wise comparison provides a percentage of rater agreement over all possible agreements. Pair-wise comparison only focuses on complete agreement, while intra-class correlations take into account relative classification. The intra-class correlation advantage requires that the variable be ordered.

The table below entitled DOK Reliability Measures presents the intra-class correlations and pair-wise comparisons for each test form. It is organized by subject and a mean value for each subject is provided. Using a criterion of .70 for intra-class correlation and a criterion of .50 for pair-wise comparisons as suggested in the WAT manual for adequate agreement, the mean values for intra-class correlations and pair-wise comparisons better these criteria: intra-class correlation mean is .8472 and for the pair-wise comparisons the mean for is .6410.

Looking at the intra-class correlation by test form there are no values less than .70., the lowest value is .8090 for Grade 5 Science Form A. The test form pair-wise correlations also all meet the WAT manual criteria of .50 for adequate agreement. They range from a .5877 for Grade 10 Form C to a .7509 for Grade 5 Form A.

In all cases the reliability of the Depth-of-Knowledge classifications meets the minimum criterion suggested by the WAT manual.

Table V-1 DOK Reliability Measures

Grade	Form	Intra-class Correlations	Pair-wise Comparisons
5	5A	0.8090	0.7509
	5B	0.8109	0.6877
8	8A	0.9098	0.6632
	8B	0.8445	0.6132
10	10A	0.8341	0.5737
	10B	0.8812	0.6105
	10C	0.8407	0.5877
Mean		0.8472	0.6410

In addition to the classification of DOK levels discussed above, reviewers also reviewed standards, objectives, and items for content classifications. Unlike the DOK variable there is no ordered scale to classify by content. All items were classified to a standard and/or benchmark. The following table provides the pair-wise comparison values for the classification of items to Objectives and Standards by test form. The pair-wise comparison values for classifying at the standard level are all above the .50 criteria, but some values for classifying at the objective level are lower than .50. These values are in the .43 to .47 range and occur in Grade 8 Form A and in all three Grade 10 classifications. The number of exact matches is much more difficult to achieve when the number of classification categories is increased as it is in the Objective level classification task.

Table V-2 Pair-wise comparisons for Pair-wise Agreement on Objectives and Standards

Grade	Form	Objective Pair-wise comparison	Standard Pair-wise comparison
5	5A	0.6469	0.7956
	5B	0.6583	0.7948
8	8A	0.4785	0.7291
	8B	0.5227	0.8575
10	10A	0.4616	0.7630
	10B	0.4306	0.7576
	10C	0.4370	0.7522
Mean		0.5194	0.7785

VI. Reviewer Feedback

After reviewers completed the test form review task, they were asked to complete an evaluation form. Reviewers completed this task after each test form. This section presents a summary of the evaluation which was provided by the reviewers for each form.

Reviewers were asked the five questions below about their classification tasks.

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

D. What is your general opinion of the alignment between the standards and assessment:

- i. Perfect Alignment**
- ii. Acceptable Alignment**
- iii Needs Slight Improvement**
- iv. Needs Major Improvement**
- v. Not Aligned In Any Way**

E. Comments

Grade 5 Form A

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- The most important topics were covered.
- yes
- I was surprised that the students were not required to construct an experiment. Overall I felt that it was an appropriate level of knowledge required.
- Yes. I thought concepts were worded well and written at the level of the student taking the test.
- I was expecting more of Standard 4.2.3 to be touched on more. There was not a question in there at all where the kids had to develop an investigation to solve a problem. They did talk about keeping conditions the same, but I was actually expecting the kids to have to design an experiment.
- Yes, I believe so. I did expect to see a question or 2 on electricity since 5th Grade is the only one that contains this in the Standards.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- I thought that food chains and webs could be addressed at a level 3
- yes, although level 4 was not met.
- Overall I am surprised at the amount of Level 1's on the DOK. Although, at the grade band of 3-5 it should be at the lower level. I feel, as an educator, I keep hearing that we need to have the students ready to think at higher problem solving levels. They need to have a strong working knowledge of the basic facts that the standards require.
- I did not see the higher level application and reasoning levels. I observed most of these questions as rote memorization.
- Unless I scored them wrong, I felt that there were a lot of level 1s and 2s, and not so much 3s.
- I think so.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- Yes
- yes
- I feel the vocabulary is in line with the standards but the vocabulary is still difficult for fifth graders.
- yes
- Yes, this was written appropriately and I feel the students would be able to read the questions and understand what is being asked of them.

· I think so.

D. What is your general opinion of the alignment between the standards and assessment:

ii. Acceptable Alignment (6) : 100%

E. Comments

· I would like the opportunity to go back and look at the questions and tally the division of the questions to the standards. It was difficult for me to judge the level of difficulty and the standard and try and keep a realistic judgement of the variety. I would have liked to have more time and not have it squeezed in at the end of a important but long day. I look forward to doing the next form with a fresh start of the day.

Grade 5 Form B

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- I felt that rocks and soils could have been covered more in depth. I would have liked to have seen a question or two on renewable vs. nonrenewable resources.
- Physical and chemical changes were only addressed once. I also feel there was an over abundance of benchmark 1, especially 1.4. There could have been a few more benchmarks 4 covered.
- The Science and Technology, Scientific and Scientific Ways of Knowing were not tested as much as I thought they would have been. I am not sure that they should be 3 different standards to begin with. with the exception of reading and interpreting graphs and tables. Reading graphs and tables was covered a lot.
- yes, concepts were covered
- I felt that in the Physical Sciences standard there was little attention paid to physical and chemical changes and the physical properties of matter. In the Science Inquiry I felt again that the scientific process was left out. I was expecting more questions to be on there about creating and designing an experiment to solve a problem. I also felt on this test not enough was done about keeping experiments fair and how results can be affected by variables and testing conditions. Everything else was tested and covered pretty well.
- I think so.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- I felt that this form had higher DOK levels than Form A. This was what I expected.
- all levels were addressed, most at DOK1.
- I thought that the students would have to perform at a higher level of performance. Although, I feel this is a much more realistic expectation for 5th graders to perform at this level. It still is an amazing amount of reading and information for them to process in one sitting. I think the more mature student will fair better than the student with more knowledge of science. The average fifth grade student does not have the attention span to work diligently at each question.
- I did not identify any DOK 3 or 4 level questions
- Since most of our benchmarks were level 1s or 2s, I felt the questions did a pretty good jbb covering this. I would have liked to have seen one or two level 3 questions. Unless I scored them wrong I had none. They might be harder to score, but the students should be challenged on atleast a couple of the questions. This could have been done in the science inquiry section.
- I believe it did a pretty good job for this grade ban. I did expect to see some DOK 3 questions, and I didn't feel any of the items on this particular assessment reached the level 3.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- I think that everything was written appropriately.
- yes
- I feel the vocabulary in the test mirrors the vocabulary in the standards, but the vocabulary is still demanding for the typical let alone struggling students.
- Yes
- I feel that an average fifth grader should be able to take this test. What I am not so sure about are the special education students and the ESL students. These students, even with their discrepancies, have to take the same test and their scores count for/against their teacher. This is not a fair test to those students who have some learning discrepancies beyond anyone's control. If these tests are going to be administered to those students this must be taken into consideration.
- Yes.

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (5) : 83%
- iii. Needs slight improvement (1) : 17%

E. Comments

- The test itself seemed aligned to the benchmarks and indicators, but there was an overabundance of the Earth/Space benchmarks. Motion benchmarks were also covered more than the other Physical science benchmarks.

Grade 8 Form A

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- yes
- Yes, most of the topics were covered.
- Yes
- Yes
- I expected there to be more plate tectonics. (1.5) This unifying concept should be covered more heavily.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- yes
- I scored very few items at level 3 and none at level 4. It would be vrey difficult to have a level 4 paper & pencil item. I would have prefered to see fewer recall items.
- Yes

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- yes
- Yes.
- yes
- No,it assumes that the students taking this test are within the average to above average range in IQ and have no disabilities or other handicapping conditions. Many students who are not identified within the special education category have low-average or below average IQ's. They would have difficulty relaying what they know with this test format. Most in your special education population would find the design of this test impossible to show what they know. They will not pass this test.
- yes

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (5) : 100%

E. Comments

Grade 8 Form B

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- yes
- Scientific ways of knowing was under-represented. 3.3 another area not covered.
- yes
- Science and Technogy had the least amount of test items. There were no questions on 4.2.1
- I feel plate tectonics was not sufficiently addressed on this test.(1.5)

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- yes
- There were no level 4 items.
- not enough 3 DOK
- There were no questions that gave examples of how thinking scientifically is helpful in daily life.
- yes

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- yes
- Yes.
- yes
- There were more questions on Life Science topic than I thought appropriate for an 8th grade test where the focus is Earth and Space and Physical Science. There were not enough questions on the Scientific Methods and Applications. This test only tests average to above average students. It does not address the needs of special education students or general education students who have below level abilities.
- yes

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (4) : 80%
- iii. Needs slight improvement (1) : 20%

E. Comments

Grade 10 Form A

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- I expected a broader coverage of topics in physical science, there was a lack of coverage of chemistry. The biology lacked the coverage of evolution.
- For the most part, the test covered the important aspects of each standard.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- Yes, for the most part. There were only a couple of threes, and I didn't see any fours (I didn't expect to see fours).
- I had very few DOK 3 questions. I guess I expected a few more.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- Yes, they were clear and concise.
- Yes

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (4) : 80%
- iii. Needs slight improvement (1) : 20%

E. Comments

Grade 10 Form B

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- Seemed to be a heavy weight on ecosystems and very light on 3.1, 3.2. It would be nice to see a more even distribution between physical and life.
- This is true especially for the science processes section. Each area seemed to be fairly represented.
- For ESL students, the amount of current events in the field of Biology and Life Science included in the test questions were so very broad. The level of language for most students brand new to the country is so basic that they can not grasp the concepts much less the language.
- Yes, I thought so.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- yes I think so
- Yes, I didn't find any true level fours, but one had the possibility if it were a novel concept. There were many ones and twos.
- I felt there were many topics that went way beyond the standards, too numerous to mention here (also because I feel braindead and can't think (sorry). There just doesn't seem to be enough time to teach to the depth that the test items are requiring. Especially ESL students-as they need time to practice and work not only with the content, but with the language as well, just to be able to remember information. There has never been enough time for any type of mastery!
- There tended to be many DOK level 1's and 2's, but I think that's appropriate.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- Some of the life science standards are very broad.
- Yes. Some may have been more difficult reading passages, but the topic covered and the questions were fair.
- Yes.

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (5) : 83%
- iii. Needs slight improvement (1) : 17%

E. Comments

- I think form b is better aligned than form a. I was able to locate the connections much easier. Graphs, charts, etc. were clear and concise. CAUTION - some of your questions are testing READING skills with Science as a back up! The construction of some questions that require lengthy reading or passages heavy with vocabulary are really difficult for the challenged reader EVEN WHEN the DOK may be a mere 1 or 2. For example, the Cataracs passage could be presented in more of an outline format of facts - thus eliminating the reading challenge.
- Couple questions need to be reviewed. I offered source of challenge
- I see lots of great test items that are aligned to the standards. However, there are also many test items that seem to go into much greater depth and breadth than what the standard states. Again-time is a major issue when it comes to teaching all the standards, especially for ESL students. I love the fact that we want to reach for the higher levels of thinking-but I feel that with so much content to teach, if we want our students to be able to answer these higher level questions, we must give them more time for mastery.

Grade 10 Form C

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- Fairly evenly distributed between life, physical, and earth/space. Still a heavy emphasis on biomes and ecosystems.
- This particular test did a very good job of representing all areas.
- No, I felt that many test items went much further than the standard states. Test item #19 was extremely broad; even though I comment test items that can cover more than 1 standard, this just seemed too broad. The particular content in this item is not necessarily taught; therefore students, especially ESL, would have to have had some other exposure to examples of this nature. The problem is that they do not have enough language to process at this high level required to answer this question.
- Yes, I believe so.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- Seemed to be a fairly even distribution.
- Yes, the items fit very well with the benchmarks and standards which made it easy to verify the dok levels.
- For the most part. There were many L1's and L2's, but that is probably to be expected.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- Yes, this does match what students should know and do.
- I believe that the standards are written at an appropriate level, however, the test items (some of them) are asking for knowledge that goes much deeper than time allows us to teach for any kind of mastery. Also-ESL students become frustrated when they spend the majority of their time using a dictionary to find words that aren't even there (i.e. telemedicine). Many ESL students give up as the language is too difficult. They have not had enough time in our country to learn English to the level of being able to process mentally at a higher level in English. It seems like we are testing their reading and English abilities rather than the content. I give my ESL students plenty of OGT practice questions. They consistently have difficulty. I, in turn, become frustrated when I know I have taught them, and they have shown some mastery; and then bomb the test. A large factor that must be taken into consideration is how the English language (vocabulary) is one of the richest in the world. We have so many synonyms, etc. that we have to have a Thesaurus to help us native speakers interpret reading passages sometimes. An ESL student, especially the majority of

the ones that have been immigrating here the last couple of years from countries where they have had no English, don't stand a chance when it comes to reading and understanding and processing the vocabulary on the OGT.

· Yes

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (5) : 83%
- iii. Needs slight improvement (1) : 17%

E. Comments

· Overall THIS is the hardest of the three forms, not because of SCIENCE CONTENT but because of READABILITY. There HAS TO BE A WAY to test content knowledge without handicapping poor readers. Rather than long reading passages, paragraphs, etc..try more outline formatted things. For example: Himalayan Rabbits 1. Himalayan rabbits a. native to Him. mountains i. lots of snow fall there b. mostly white fur c. black fur on ears, nose, feet, tails This gives students the SAME important information but helps them organize it when they read it for it is presented in an organized fashion rather than traditional paragraph format.

· Couple questions to review- challenge

· This test was well aligned

· Many of the questions are aligned perfectly. However, there are also many test items that seem to test much deeper than the stated standard. This is how it should be!! But because of the breadth of content, there is no time to teach the depth that we would like to teach. Especially for ESL students-who need time to practice with the language and the content as they learn it if-if we want them to retain the knowledge and be able to apply it. It just seems we can't have it both ways!!! I can only hope that maybe there can be some changes to the standards-take away the broadness and let us teach more deeper so that we CAN expect higher level thinking, from ESL students as well as native speakers. I thank you for your time in reading my rantings from a sometimes frustrated teacher who only wants to see her ESL students be able to graduate with the skills necessary to make them productive citizens of the US! ###These are the kids that we want to graduate-they are "the keepers"!! They just need some help, and time as they learn the language!@
Thankyou!!

VII. Appendices

Appendix A-Agendas

Appendix B-Training Slides

Appendix C-Packet Materials

Appendix D-Detailed Science Results

Appendix A-Agenda

Appendix A presents the summary agendas for Science Alignment Study. The agenda provides a broad detail of the activities over the 2 day study which included an overview session. Detailed training and practice using examples, a consensus building process for assignment of DOK to benchmarks and the individual level scoring of items for DOK and assigning the items to benchmarks.

Ohio Science Assessment Alignment Study Agenda

March 5 & 6, 2007
Pearson Educational Measurement Scoring Center
Schrock Road, Westerville, OH

Monday, March 5, 2007

7:45 AM	Breakfast and registration	
9:00 AM	Welcome and Introductions Large group orientation Presentation of the alignment process General description of the process Training on Science Depths of Knowledge	Assessment Assessment Curriculum
8:30 AM	Small group training Practice Coding DOK to non-Ohio Benchmarks Practice Coding DOK to non-Ohio Items Participants independently code Ohio Benchmarks	Curriculum Curriculum Grade Groups
9:45 AM	Break	
10:00 AM	Preliminary consensus building Practice coding Ohio practice tests Final consensus building	Group Leader Grade Groups Group Leader
12:00 PM	Lunch	
1:00 PM	Log onto the WEB Alignment Tool (WAT) Training on using WAT	Grade Groups Grade Groups
2:30 PM	Break	

2:45 PM Code grade level tests to standards/benchmarks and DOK Grade Groups

4:45 PM Debrief Grade Groups

Tuesday, March 6, 2007

7:30 AM	Breakfast	
8:00 AM	Code grade level tests to standards/benchmarks and DOK	Grade Groups
9:45 AM	Break	
10:00 AM	Code grade level tests to standards/benchmarks and DOK	Grade Grops
12:00 PM	Lunch	
12:45 PM	Code grade level tests to standards/benchmarks and DOK	Grade Groups
2:30 PM	Break	
2:45 PM	Code grade level tests to standards/benchmarks and DOK	Grade Groups
4:45 PM	Debrief/Evaluation	

Appendix B-Training Slides

Slide 1

Web Alignment Tool (WAT) Ohio Assessment Instruments

5 & 6 March 2007
Pearson Educational Measurement
Scoring Site
Westerville, Ohio

Slide 2

Acknowledgements

1. Pearson and site manager Paul L. Brown
2. WCER (Wisconsin Center for Educational Research - Webb, Ely & Vesperman) & National Science Foundation
3. YOU

Cautions

- Pearson is presently scoring so we need to keep our normally gregarious interactions to a level that will not disturb scoring.
- Try to keep to our schedule so as to not interfere with Pearson's schedule and complete on time.

Purpose of study

- Study:
 - WAT method and software
 - evidence that Ohio Assessments are aligned with Ohio Curriculum.
- Independent reviewers
- Independent surveillance

Slide 5

Independent reviewers

- Ohio classroom experts
- Variety of skills and interests
- Work independently on reviewing test items
- But work collaboratively on determining Depth of Knowledge for benchmarks

Slide 6

Independent process reviewer

John Keene - AES

Slide 7

Meeting Objective(s)

- Prepare **Team Leaders** to lead small content area groups through the alignment study
- Cover some alignment basics
- Familiarize **Team Leaders** in the operation of WAT including:
 - What data are required
 - Logging in
 - Entering data

Slide 8

Some conventions

1. Benchmarks \equiv Objectives
2. Standards
 - may mean the book of content standards
 - may mean the statements

Steps in the review process

- Step 1 ~ DOK for benchmarks
 - Train
 - Individual's score benchmarks
 - Consensus on DOK's for benchmarks
 - Group Leader enters DOK's for benchmarks
- Step 2 ~ All reviewers code test items
 - Assign Primary and Secondary Benchmarks
 - Assign DOK's

Performing an Alignment study

- Personnel
- Method
- Means
- Data

Personnel

- Reviewers: Panelists that rate Benchmarks and Test Items
- Group Leaders: Panelist that coordinates group processes and also serve as reviewers
- Facilitators: ODE people that help with technical problems but do not review

Method

Webb Alignment System implemented at the
Web Alignment Tool (WAT)

Means

- Computers
- + Internet
- + Software at WCER

Alignment Process

- Identify Standards and Assessments
- 6-8 Reviewers (Content Experts)
- Train Reviewers on Standards and DOK Levels
- Part I: Code DOK Levels of the *Benchmarks*
- Part II: Code *Assessment Items* with Benchmarks and DOK Levels

Slide 15

Most important Group Leader Task

- Obtaining consensus on the DOK levels for the Benchmarks

Slide 16

Data

- Standards and Benchmarks list
- Descriptions of Depth of Knowledge
- Test Forms
- Test Keys
- Expertise of reviewers
- Shared perceptions from the process

Slide 17

Materials in the Team leader's packet

- Duties of Group Leader
- Names of Participants
- Agenda – Group Leaders
- Agenda – General
- Consensus Principles
- Expense Reports
- List of Standards/benchmarks with Words from Indicators
- DOK Definitions
- Key Word List for Group Leaders
- Key Word List for Participants
- Exemplars of DOK and Standards/benchmarks
- Practice Items for Assigning DOK Levels
- DOK Assignment Individual Form
- DOK Assignment Consensus Form
- WAT Training for Coding Standards/benchmarks with DOK Levels – Group Leaders
- WAT Training for Coding Test Questions
- Meeting Evaluation
- Debriefing Questions

Slide 18

Paper and Pencil Process for Setting DOK to Benchmarks

1. Distribute DOK descriptions
2. Distribute paper forms of Benchmarks
3. Reviewers independently score Benchmarks for DOK
4. Group leader seeks consensus on DOK and records group consensus
5. Group leader records consensus DOK's in WAT as an online process for "Part 1" of analysis.
 - Do not score the standards

Slide 19

Software

Handout instructions

- Group leader version
- Reviewer version

Slide 20

Study subject areas and grades by groups

Grade 5 Science	Grade 8 Science	Grade 10 Science (OGT)
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ODE Group Assignments

<i>Grade 5 Science</i> Terrence Rounds [Jen Stormer] Willa Brown Lauren Monowar-Jones	<i>Grade 8 Science</i> William Webb [Stacy Beck] Don Peasley Esther Hopkins	<i>Grade 10 Science</i> Holly Lavender [Toni Evans] Wendy Stoica Kim Mullen
--	--	--

Floating: **Deb Roshto**, **Judy Feil**, **Terrence Moore**.

ODE has done

Before the alignment seminar	1.	Register your group with the Web Alignment Tool.
	2.	Enter information about the assessment(s) you will be studying with the WAT.
	3.	Enter the state standards into the WAT
	4.	Create studies in the WAT by pairing assessments and standards.

Group Leader Responsibilities

During the alignment seminar	5.	Help train reviewers (Phase I) on your content area's Depth-of-Knowledge (DOK).
	6.	Facilitate the DOK consensus process. Reviewers come to agreement on the DOK level of each objective.
	7.	Enter the consensus DOK values for each objective or benchmark.
	8.	Train your reviewers (Phase II) on how to code assessment items.
	9.	Participate as a reviewer.
	10.	Other duties as required.

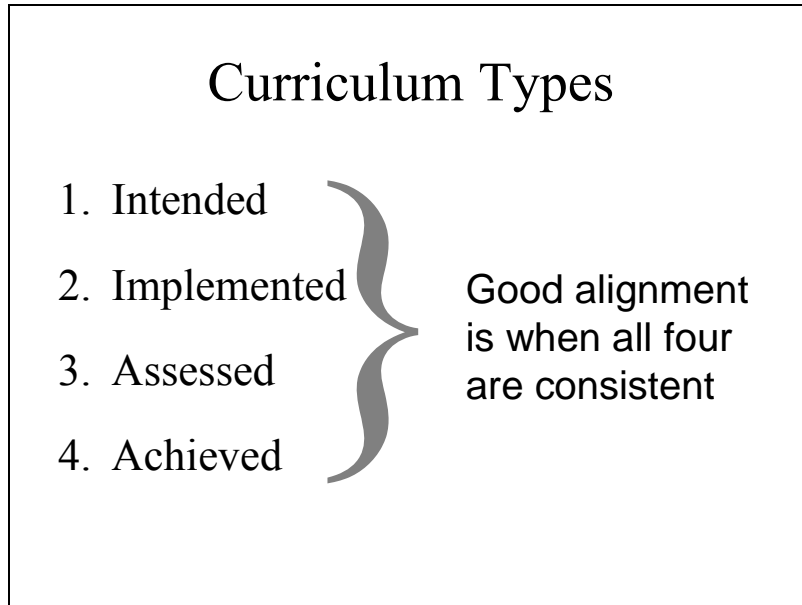
Top Down View Of Alignment

What is alignment?

- Degree to which expectations and assessments are in agreement

Alignment Is Important

- Federal statutes require alignment
- Education systems are easily fragmented



- ### Criteria for Alignment
- Idiosyncratic to a subject area
 - Articulated across grades and ages
 - Issues of equity and fairness: special education or culturally relevant content.
 - Addresses pedagogical implications
 - Considers resources

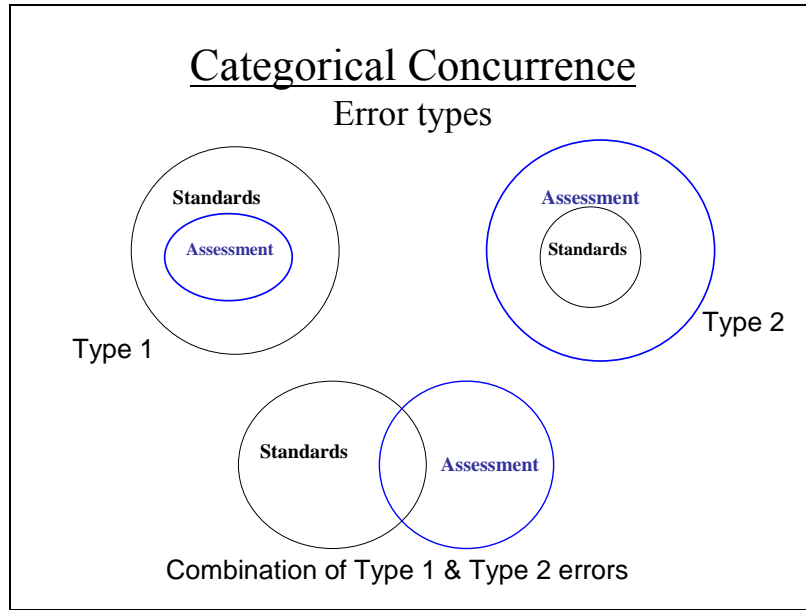
Dimensions of Alignment

- 1) Categorical Concurrence**
- 2) Depth of Knowledge**
- 3) Range of Knowledge**
- 4) Balance of Representation**
- 5) Source of Challenge**

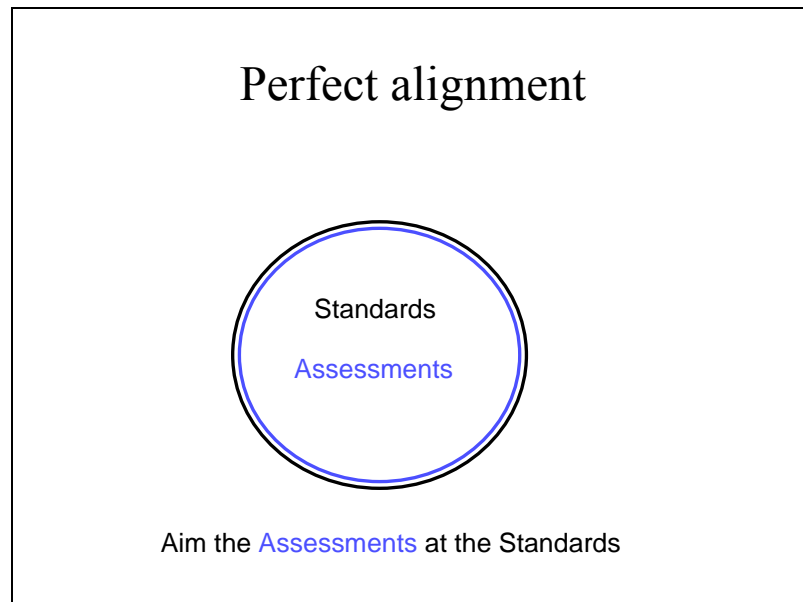
Categorical Concurrence

- Do standards and assessments address the same content categories?
- Objective: At least six test items measuring content from a standard in order for there to be an acceptable level of categorical concurrence between the standard and assessment.

Slide 31

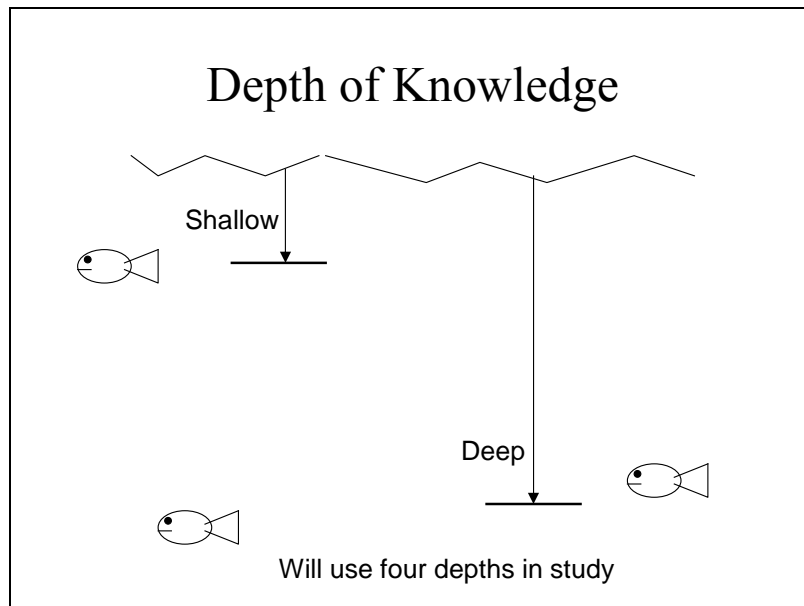


Slide 32



Depth-of-Knowledge Consistency

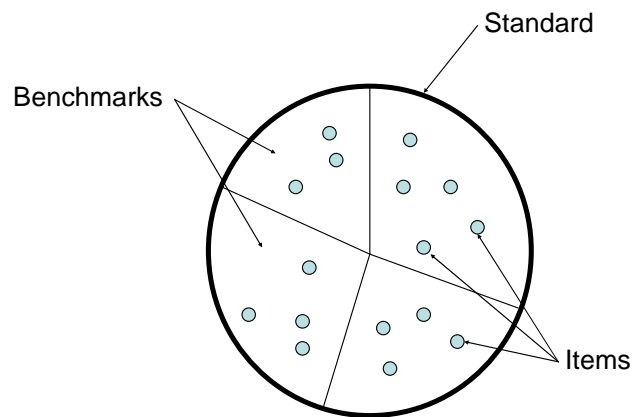
- Is cognitive demand the same as what students are expected to know and do as stated in the content standards?
- Objective: 50% of items at or above the level of knowledge of the objective



Range-of-Knowledge Correspondence

- Are all benchmarks tested?
- Objective: over half of the domain of a standard.

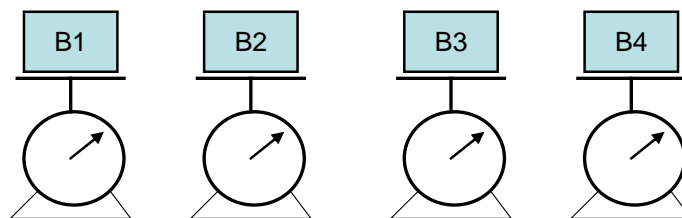
Range of Knowledge



Balance of Representation

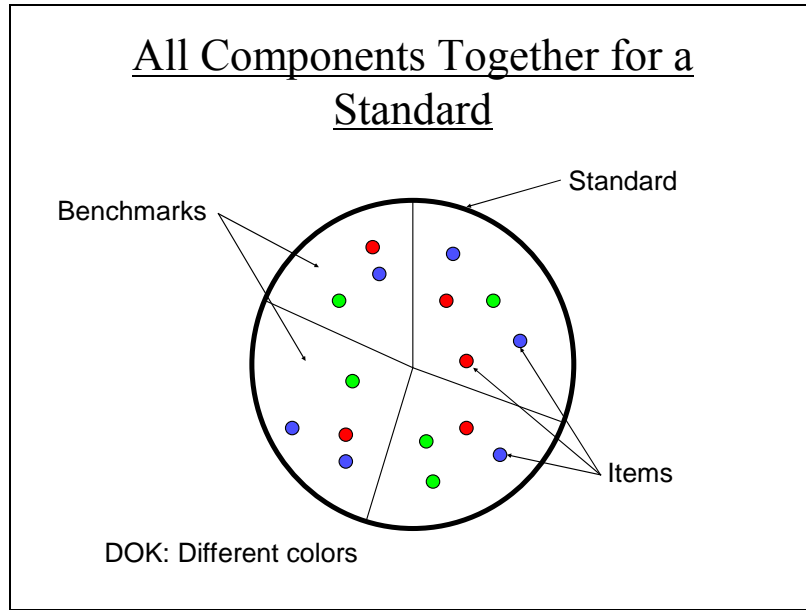
- Are all benchmarks given equal weight?
- Differs from Ohio practice – Ohio uses blueprint for weighting

Equal Weight

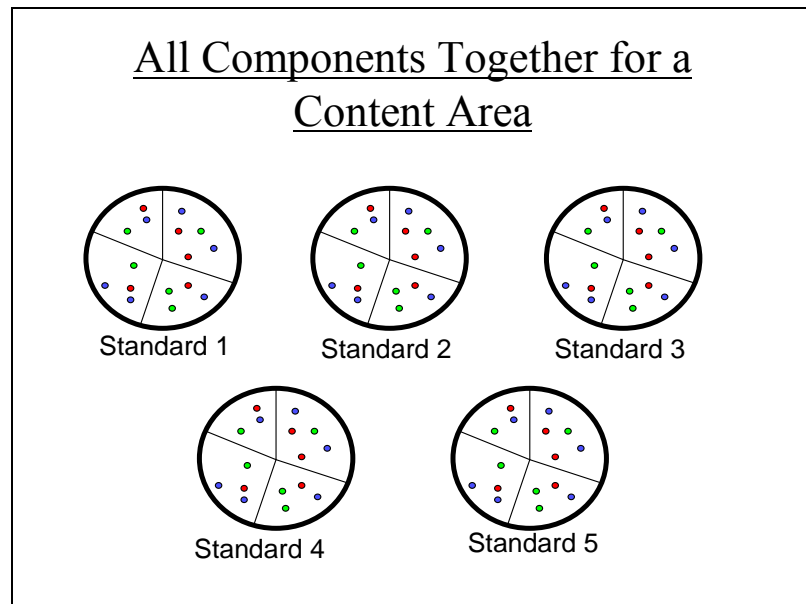


Equal Weight means same number of points

Slide 39



Slide 40



Source of Challenge

- A text field
- Optional
- Use to identify a test item where an examinee would get item right or wrong for the wrong reason.
- Must explain how or why.

Data that must be entered

1. DOK's for benchmarks
2. Primary benchmark for each test item
3. DOK for each test item

Slide 43

Optional data

- Secondary benchmarks for each test item
- Source of challenge for each test item (text field)
- Any notes for each test item (text field)

Slide 44

What alignment is good enough?

Slide 45

Alignment Levels Using the Four Criteria

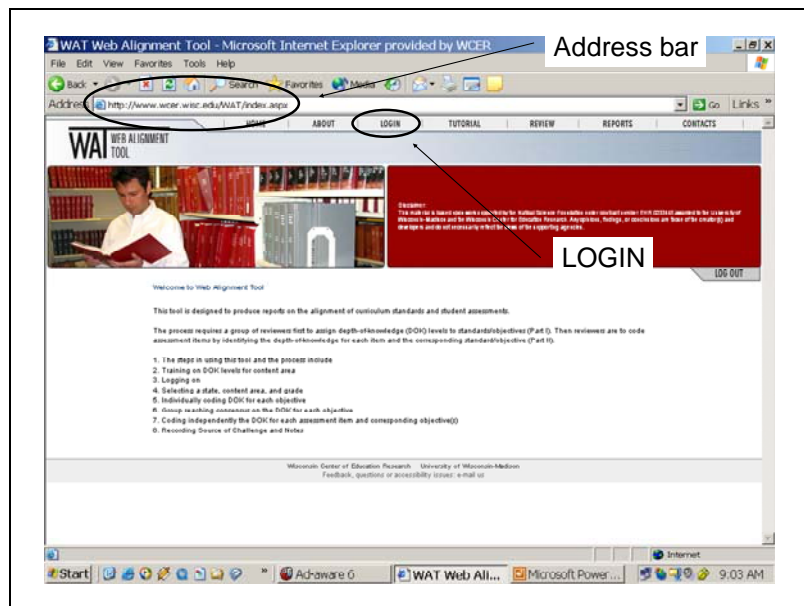
Alignment Level	Categorical Concurrence	Depth of Knowledge	Range of Knowledge	Balance of Representation
<i>Acceptable</i>	6 items per standard	50%	50%	70%
<i>Weak</i>	---	40%-49%	40%-49%	60%-69%
<i>Unacceptable</i>	Less than 6 items per standard	Less than 40%	Less than 40%	Less than 60%

Slide 46

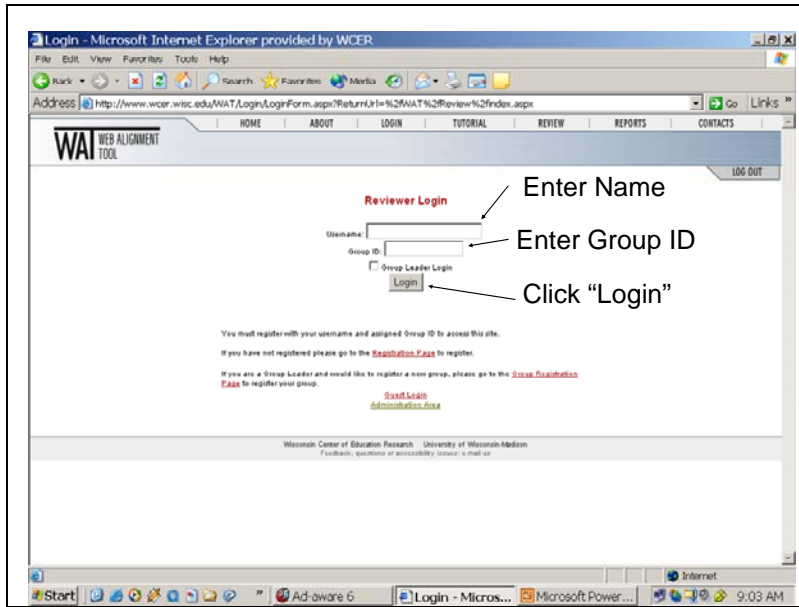
- Using the software**
- Group Leaders enter DOK's for Benchmarks
 - All reviewers enter DOK's and Benchmarks for *Items*
 - ODE help for maneuvering the software but not for making decisions
 - Instructions in your folder for maneuvering software

Reviewer Version

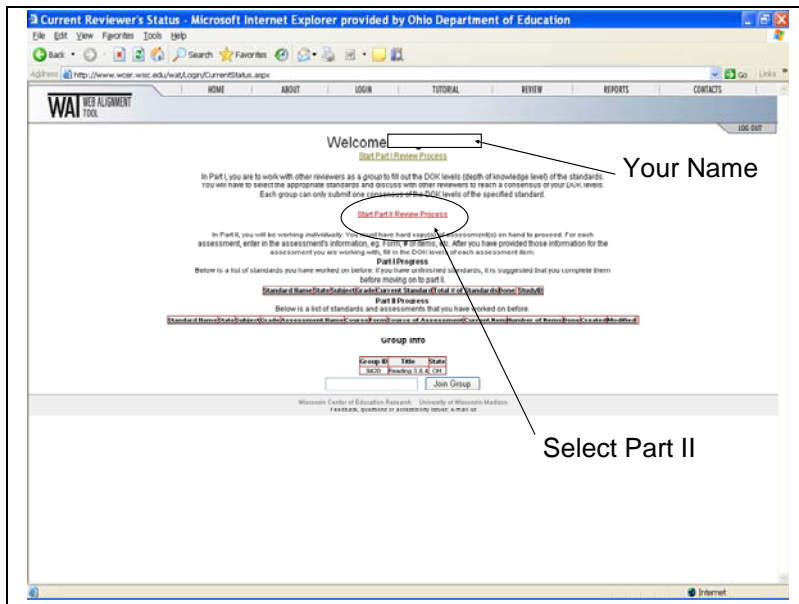
- **Step 1** Open Internet Explorer on your computer
- **Step 2** In the address bar at the top of the browser type in the following address:
- <http://www.wcer.wisc.edu/wat/index.aspx>



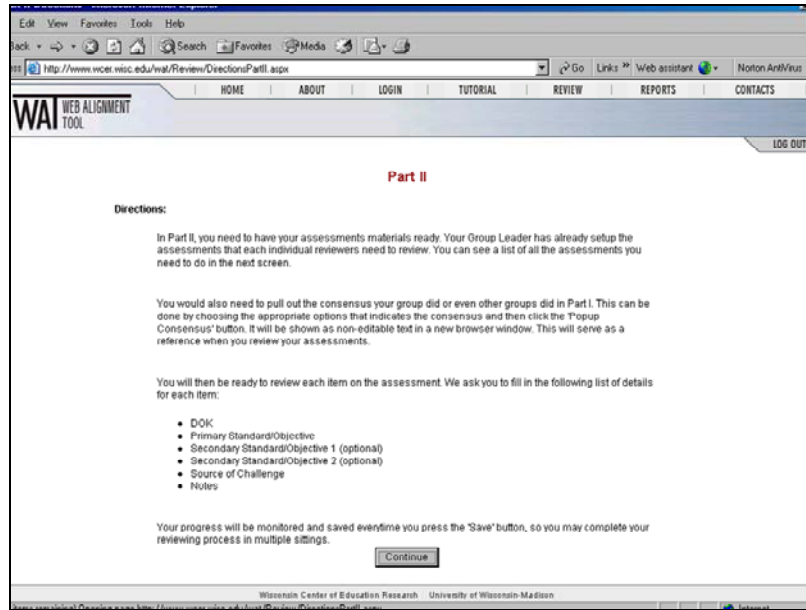
Slide 49



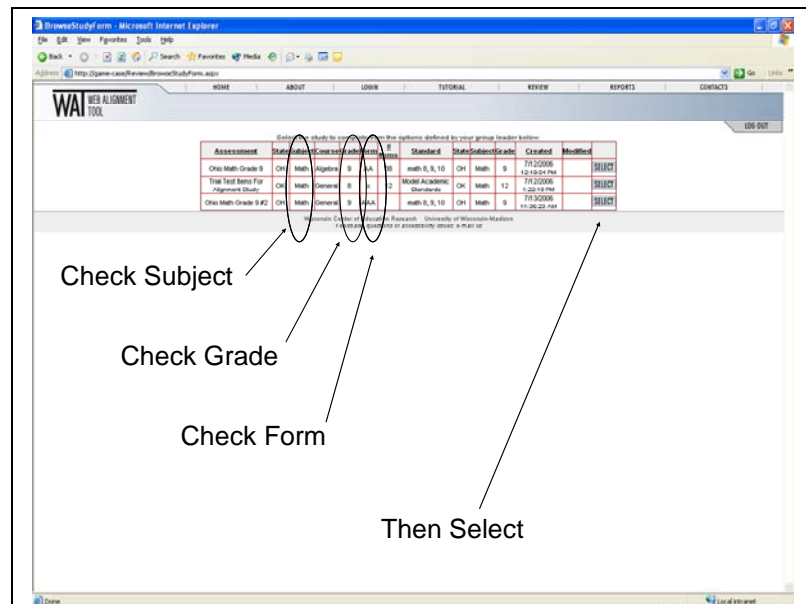
Slide 50



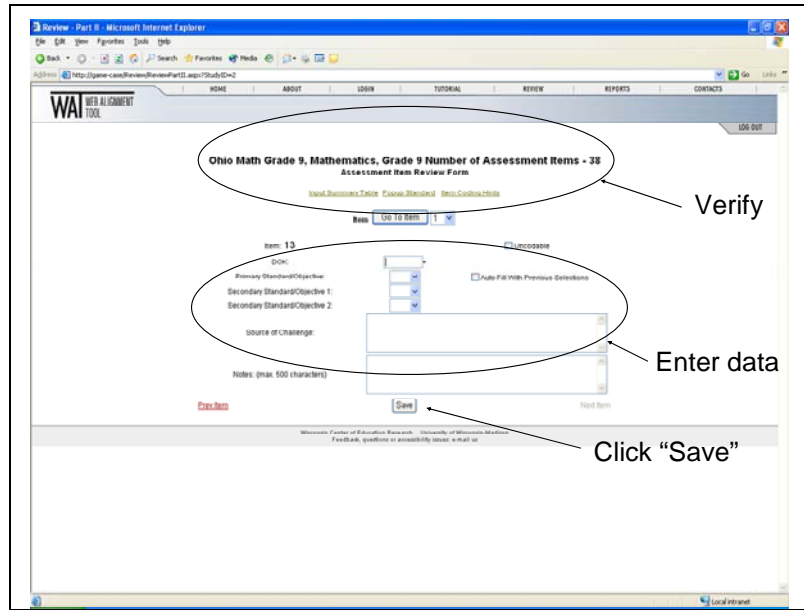
Slide 51



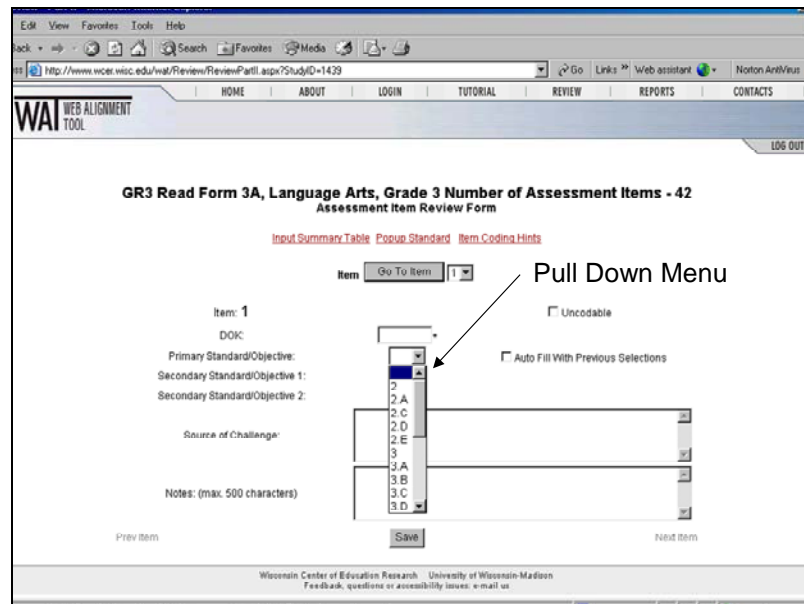
Slide 52



Slide 53



Slide 54



Coding to Benchmarks

- User Standard only when no Benchmark applies
- **Do Not** use a standard when any benchmark applies
- **Do Not** use a standard as a short cut to select all benchmarks in a standard

Coding Process Tips

- One Primary Objective and up to Two Secondary Objectives (if necessary)
- Source of Challenge (a correct/incorrect response for the wrong reason)
- Notes (any insights to share)
- Consider Full Range of Standards
- Use generic objectives sparingly

Slide 57

The end.

Appendix C-Packet Materials

Appendix C contains materials used by panelists to complete the Depth of Knowledge tasks. There are three sets of materials:

1. Depth of Knowledge Definitions
2. Benchmark Examples of Assigning Depth of Knowledge Levels
3. Benchmarks and Indicators for Science

1. Depth of Knowledge Definitions

Depth of Knowledge Levels Alignment Study February & March, 2007

Level 1 (Recall)

This level requires the recall of information, such as a fact, definition, term, or a simple procedure, as well as identifying a simple science process. Level 1 only requires students to demonstrate a rote response, use a well-known formula, follow a set procedure or a clearly defined series of steps. A simple procedure is well defined and typically involves only one step. Verbs such as “identify,” “recall,” “recognize,” “use,” “calculate,” and “measure” generally represent cognitive work at the recall level. Simple problems that can be directly translated into and solved by a formula are considered Level 1. Verbs such as “describe” and “explain” could be classified at different DOK levels, depending on the complexity of what is to be described and explained. A student answering a Level 1 item either knows the answer or does not: that is, the item does not need to be figured out or solved. Some examples that represent, but do not constitute all of, Level 1 performance are:

- Recall or recognize a fact, term, or property.
- Identify words or diagrams representing a scientific concept or relationship.
- Provide or recognize a standard scientific representation for simple phenomenon.
- Outline a routine experimental procedure, such as measuring length.

Level 2 (Skills and Concepts)

This level includes the engagement of some mental processing beyond recalling a response. The content knowledge or process involved is more complex than in Level 1. Items require students to make some decisions as to how to approach the question or problem. Keywords that generally distinguish a Level 2 item include “classify,” “organize,” “make observations,” “collect and display data,” and “compare data.” These actions imply more than one step. For example, to compare data requires first identifying characteristics of the objects or phenomena and then grouping or ordering the objects. Level 2 activities include making observations and collecting data; classifying, organizing, and comparing data; and organizing and displaying data in tables, graphs, and charts. Some action verbs, such as “explain,” “describe,” or “interpret,” could be classified at different DOK levels, depending on the complexity of the action. For example, interpreting information from a simple graph, requiring reading information from the graph, is a Level 2. An item that requires interpretation from a complex graph, such as making decisions regarding features of the graph that need to be considered and how information from the graph can be aggregated, is at Level 3. Some examples that represent, but do not constitute all of, Level 2 performance, are:

- Specify and explain the relationship between facts, terms, properties, or variables.
- Describe and explain examples and non-examples of science concepts.

- Select a procedure according to specified criteria.
- Formulate a routine problem, given data and conditions.
- Organize, represent, and interpret data.

Level 3 (Strategic Thinking)

This level requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. The cognitive work at Level 3 is complex and abstract. The complexity does not result only from the fact that there could be multiple answers, a possibility for both Levels 1 and 2, but because the multi-step task requires more demanding reasoning. In most instances, requiring students to explain their thinking is at Level 3; requiring a very simple explanation or a word or two should be at Level 2. An activity that has more than one possible answer and requires students to justify the response they give would most likely be a Level 3. Experimental designs in Level 3 typically involve more than one dependent variable. Other Level 3 activities include drawing conclusions from observations; citing evidence and developing a logical argument for concepts; explaining phenomena in terms of concepts; and using concepts to solve non-routine problems. Some examples that represent, but do not constitute all of Level 3 performance, are:

- Identify research questions and design investigations for a scientific problem.
- Solve non-routine problems.
- Develop a scientific model for a complex situation.
- Form conclusions from experimental data.

Level 4 (Extended Thinking)

This level involves high complexity. Students are required to make several connections—relate ideas within the standards or between and among standards — and have to select or devise one approach among many alternatives to solve the problem. Standards, goals, and objectives can be stated in such a way as to expect students to perform extended thinking. “Develop generalizations of the results obtained and the strategies used and apply them to new problem situations,” is an example of a grade 8 objective that is a Level 4. Many, but not all, performance assessments and open-ended assessment activities requiring significant thought will be Level 4.

Level 4 requires complex reasoning, experimental design and planning, and probably will require an extended period of time for carrying out the multiple steps of an assessment item. However, the extended time period is not a distinguishing factor if the required work is only repetitive and does not require applying significant conceptual understanding and higher-order thinking. For example, if a student must understand how to take the water temperature from a river each day for a month and then construct a graph, this would be classified as a Level 2 activity. However, if the student must understand a river study that requires taking into consideration a number of variables, this

would be a Level 4. Some examples that represent, but do not constitute all of, a Level 4 performance are:

- Based on data provided from a complex experiment that is novel to the student, deduct the fundamental relationship between several controlled variables.
- Design and describe an investigation, from specifying a problem to designing and an experiment, to analyzing its data and forming conclusions.

Depth of Knowledge Levels for Science

DOK	Performance
<p>Recall</p> <p>Recall or identify terms, facts, simple concepts and processes of science.</p>	<ul style="list-style-type: none"> • recall • identify • describe • verify • recognize • define
<p>Skills and Concepts</p> <p>Use information/data to describe or explain relationships, concepts, or scientific ideas.</p>	<ul style="list-style-type: none"> • interpret data/information • relate • classify/order/sequence • compare/contrast • diagram • model • represent/organize data/information • extract/analyze data/information • generalize • evaluate data/information • explain • infer/conclude from data/information • detect patterns • extrapolate/interpolate from data/information • apply appropriate mathematical reasoning
<p>Strategic Thinking</p> <p>Reason scientifically to develop or support arguments, explain phenomena or solve non-routine problems.</p>	<ul style="list-style-type: none"> • formulate questions • specify methods • propose procedures • predict outcomes • develop models • formulate conclusions • reason • design • systematically evaluate • collect evidence/data/information • devise • plan • hypothesize

Extended Thinking

Make connections and apply information to novel situations using complex reasoning and significant conceptual understanding.

- connect concepts and principles
- discuss issues/problems/solutions
- apply information
- illustrate
- propose solutions
- analyze issues
- interpret problems
- integrate
- synthesize
- evaluate consequences/alternatives/evidence
- recommend
- justify/critique solutions

Depth of Knowledge Levels for Science

DOK	Performance
<p>Recall</p> <p>Recall or identify terms, facts, simple concepts and processes of science.</p>	
<p>Skills and Concepts</p> <p>Use information/data to describe or explain relationships, concepts, or scientific ideas.</p>	
<p>Strategic Thinking</p> <p>Reason scientifically to develop or support arguments, explain phenomena or solve non-routine problems.</p>	
<p>Extended Thinking</p> <p>Make connections and apply information to novel situations using complex reasoning and significant conceptual understanding.</p>	

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2. Benchmark Examples of Assigning Depth of Knowledge Levels

Elementary (3-5)

Life Sciences

Students will identify classification systems to describe groups of living things and to explain the characteristics and functions of observable body parts in a common and familiar animals.

*This benchmark represents the **DOK Level 1, Recall**. Students must explain patterns of structure and function in living things (e.g. body coverings (fur, feathers, scales) in relationship to the types of organisms in which they exist and their purpose in that organism).*

Students will investigate and explain how living things obtain and use energy and develop models of food webs given a variety of organisms that live in a given ecosystem.

*This benchmark represents the **DOK Level 3, Strategic Thinking**. Students must be able to analyze the characteristics of plants and animals in an ecosystem and determine how those living things obtain energy within that system. They must logically develop models for the flow of energy through given systems.*

Physical Sciences

Students will describe how things around us move, explain why things move as they do, and demonstrate and explain how we control the motions of objects. Students will explain how forces (pushes or pulls) are needed to speed up, slow down, stop, or change the direction of a moving object.

*This benchmark represents the **DOK Level 2, Skills and Concepts**. Students can develop models to illustrate how forces affect the motion of objects (e.g., students could change the size of the tires on a toy car and observe the effect that would have on the motion of the car).*

Earth and Space Sciences

Students will describe and explain how natural changes in the Earth's surface occur and how the Earth's surface changes over time.

*This benchmark represents the **DOK Level 2, Skills and Concepts**. Students can demonstrate and explain how natural changes affect the surface of Earth. Students could model stream erosion in a classroom stream table or outside in a natural stream and use this model to explain changes at the macro level.*

Students will identify a non-renewable resource that is used in their school or home life and design a recycling plan to recover that resource or reduce its use.

*This benchmark represents the **DOK Level 4, Extended Thinking**. Students demonstrate*

the ability to design a solution to a problem. The student must be able to identify a non-renewable resource and then design a plan to reduce its use so that what is left in the Earth can be conserved and not exploited.

Middle School (6-8)

Life Sciences

Students will describe the functioning of multicellular organisms, including how cells grow, develop and reproduce. Students explain why and how selected specialized cells are needed by plants and animals.

*This benchmark represents the **DOK Level 1, Recall**. Students explain the function of a cell in a multicellular organism. Students explore specialized cells, such as reproductive cells, leaf cells, and root cells.*

Students will investigate, explain and describe how characteristics of living things are passed on through generations.

*This benchmark represents the **DOK Level 2, Skills and Concepts**. Students will demonstrate understanding of how characteristics are passed on from one generation to the next by observing parents with specific characteristics and predicting the outcome for their offspring.*

Physical Sciences

Students will investigate, describe and analyze ways in which matter changes. Students will describe common physical changes in matter; evaporation, condensation, sublimation thermal expansion and contraction as well as common chemical changes in terms of properties of reactants and products.

*This benchmark represents the **DOK Level 2, Skills and Concepts**. Students can detect patterns in physical and chemical changes in matter. Students will determine if a chemical or physical change has occurred based on observations in an experiment and explain their reasoning.*

Earth and Space Sciences

Students will examine topographic maps and predict where specific rock types can be found based on the surface geology of the area.

*This benchmark represents the **DOK Level 3, Strategic Thinking**. Students demonstrate the ability to interpret complex data to identify what type of rock would be present in a particular area.*

Students will identify a non-renewable resource that is used in their school or home life and design a recycling plan to recover that resource or reduce its use.

*This benchmark represents the **DOK Level 4, Extended Thinking**. Students demonstrate the ability to design a solution to a problem. The student must be able to identify a non-renewable resource and then design a plan to reduce its use so that what is left in the Earth can be conserved and not exploited.*

High School (9-10)

Life Sciences

Students will explain how parts of an ecosystem are related and how they interact and describe common ecological relationships between and among species and their environments.

*This benchmark represents the **DOK Level 2**, Skills and Concepts. Students explain the relationships between abiotic and biotic components of an ecosystem. Students are able to illustrate the relationship between various populations and explain their interdependence.*

Students will illustrate the relationship between various populations within an ecosystem and explain their interdependence. Students will predict what will happen to an ecosystem if a particular population within that ecosystem fluctuates.

*This benchmark represents the **DOK Level 3**, Strategic Thinking. Students must understand how populations of organisms interact within an ecosystem and make predictions of what will happen if there are fluctuations in those populations and provide justification for their explanations..*

Students will explain how new traits can be established by changing or manipulating genes. Students explain how new traits may arise in individuals through changes in genetic material (DNA) and how those changes may influence the environment

*This benchmark represents the **DOK Level 3**, Strategic Thinking. Students explain complex principles of heredity and use that information to illustrate what may happen to an environment as a result of those genetic changes in an organism (e.g., emerging technologies, such as bioengineering to improve agriculture)*

Physical Sciences

Students will explain how visible changes in matter are related to atoms and molecules. Students explain chemical changes in terms of the breaking of bonds and the rearrangement of atoms to form new substances.

*This benchmark represents the **DOK Level 1**, Recall. Students identify patterns in the arrangement of atoms and molecules in relation to changes in matter. Students can identify atomic models that demonstrate the various bonds that occur in given compounds.*

Earth and Space Sciences

Students will describe and explain how the Earth's features change over time. Students use the plate tectonics theory to explain features of the Earth's surface and geological phenomena and describe evidence for the Plate Tectonics Theory.

*This benchmark represents the **DOK Level 2**, Skills and Concepts. Students explore the relationship between features on the surface of Earth and the theory of Plate Tectonics. Students could map the locations of earthquakes and volcanoes and the proximity of defined plate boundaries.*

Students will identify a non-renewable resource that is used in their school or home life and design a recycling plan to recover that resource or reduce its use.

*This benchmark represents the **DOK Level 4**, Extended Thinking. Students demonstrate the ability to design a solution to a problem. The student must be able to identify a non-renewable resource and then design a plan to reduce its use so that what is left in the Earth can be conserved and not exploited.*

3. Benchmarks and Indicators for Science

Grade 3-5

EARTH AND SPACE SCIENCES	
Benchmarks	Notes
<p>I.A. Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four No indicators present for this benchmark.</p> <p>Grade Five</p> <ol style="list-style-type: none"> 1. Describe how night and day are caused by Earth's rotation. 2. Explain that Earth is one of several planets to orbit the sun, and that the moon orbits Earth. 3. Describe the characteristics of Earth and its orbit about the sun (e.g., three-fourths of Earth's surface is covered by a layer of water [some of it frozen], the entire planet surrounded by a thin blanket of air, elliptical orbit, tilted axis and spherical planet). 4. Explain that stars are like the sun, some being smaller and some larger, but so far away that they look like points of light. 	
<p>I.B. Summarize the processes that shape Earth's surface and describe evidence of those processes.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four</p> <ol style="list-style-type: none"> 8. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines). 9. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock. 10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g., volcanic eruptions, earthquakes and landslides). <p>Grade Five No indicators present for this benchmark.</p>	
<p>I.C Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 5. Compare distinct properties of rocks (e.g., color, layering and texture). 6. Observe and investigate that rocks are often found in layers. 7. Describe that smaller rocks come from the breakdown of larger rocks through the actions of plants and weather. 8. Observe and describe the composition of soil (e.g., small pieces of rock and decomposed pieces of plants and animals, and products of plants and animals). 9. Investigate the properties of soil (e.g., color, texture, capacity to retain water, ability to support plant growth). 10. Investigate that soils are often found in layers and can be different from place to place. 	

<p>Grade Four No indicators present for this benchmark.</p> <p>Grade Five</p> <ol style="list-style-type: none"> 5. Explain how the supply of many non-renewable resources is limited and can be extended through reducing, reusing and recycling but cannot be extended indefinitely. 6. Investigate ways Earth's renewable resources (e.g., fresh water, air, wildlife and trees) can be maintained. 	
<p>1.D. Analyze weather and changes that occur over a period of time.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four</p> <ol style="list-style-type: none"> 1. Explain that air surrounds us, takes up space, moves around us as wind, and may be measured using barometric pressure. 2. Identify how water exists in the air in different forms (e.g., in clouds, fog, rain, snow and hail). 3. Investigate how water changes from one state to another (e.g., freezing, melting, condensation and evaporation). 4. Describe weather by measurable quantities such as temperature, wind direction, wind speed, precipitation and barometric pressure. 5. Record local weather information on a calendar or map and describe changes over a period of time (e.g., barometric pressure, temperature, precipitation symbols and cloud conditions). 6. Trace how weather patterns generally move from west to east in the United States. 7. Describe the weather which accompanies cumulus, cumulonimbus, cirrus and stratus clouds. <p>Grade Five No indicators present for this benchmark.</p>	

LIFE SCIENCES

Benchmarks	Notes
<p>2.A. Differentiate between the life cycles of different plants and animals.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 1. Compare the life cycles of different animals including birth to adulthood, reproduction and death (e.g., egg-tadpole-frog, egg-caterpillar-chrysalis-butterfly). <p>Grade Four</p> <ol style="list-style-type: none"> 1. Compare the life cycles of different animals including birth to adulthood, reproduction and death (e.g., egg-tadpole-frog, egg-caterpillar-chrysalis-butterfly). 5. Describe how organisms interact with one another in various ways (e.g., many plants depend on animals for carrying pollen or dispersing seeds). <p>Grade Five</p> <p>No indicators present for this benchmark.</p>	
<p>2.B. Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 2. Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies). 3. Classify animals according to their characteristics (e.g., body coverings and body structure). <p>Grade Four</p> <ol style="list-style-type: none"> 2. Relate plant structures to their specific functions (e.g., growth, survival and reproduction). 3. Classify common plants according to their characteristics (e.g., tree leaves, flowers, seeds, roots and stems). <p>Grade Five</p> <ol style="list-style-type: none"> 1. Describe the role of producers in the transfer of energy entering ecosystems as sunlight to chemical energy through photosynthesis. 2. Explain how almost all kinds of animals' food can be traced back to plants. 3. Trace the organization of simple food chains and food webs (e.g., producers, herbivores, carnivores, omnivores and decomposers). 	
<p>2.C. Compare changes in an organism's ecosystem/habitat that affect its survival.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 4. Use examples to explain that extinct organisms may resemble organisms that are alive today. 5. Observe and explore how fossils provide evidence about animals that lived long ago and the nature of the environment at that time. 6. Describe how changes in an organism's habitat are sometimes beneficial and sometimes harmful. <p>Grade Four</p> <ol style="list-style-type: none"> 4. Observe and explore that fossils provide evidence about plants that lived long ago and the nature of the environment at that time. <p>Grade Five</p> <ol style="list-style-type: none"> 4. Summarize that organisms can survive only in ecosystems in which their needs can be met (e.g., food, water, shelter, air, carrying capacity and waste disposal). The world has different ecosystems and 	

<p>distinct ecosystems support the lives of different types of organisms.</p> <ol style="list-style-type: none">5. Support how an organism's patterns of behavior are related to the nature of that organism's ecosystem, including the kinds and numbers of other organisms present, the availability of food and resources, and the changing physical characteristics of the ecosystem.6. Analyze how all organisms, including humans, cause changes in their ecosystems and how these changes can be beneficial, neutral or detrimental (e.g., beaver ponds, earthworm burrows, grasshoppers eating plants, people planting and cutting trees and people introducing a new species).	
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PHYSICAL SCIENCES	
Benchmarks	Notes
<p>3.A. Compare the characteristics of simple physical and chemical changes.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four</p> <ol style="list-style-type: none"> 1. Identify characteristics of a simple physical change (e.g., heating or cooling can change water from one state to another and the change is reversible). 2. Identify characteristics of a simple chemical change. When a new material is made by combining two or more materials, it has chemical properties that are different from the original materials (e.g., burning paper, vinegar and baking soda). <p>Grade Five No indicators present for this benchmark.</p>	
<p>3.B. Identify and describe the physical properties of matter in its various states.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four</p> <ol style="list-style-type: none"> 3. Describe objects by the properties of the materials from which they are made and that these properties can be used to separate or sort a group of objects (e.g., paper, glass, plastic and metal). 4. Explain that matter has different states (e.g., solid, liquid and gas) and that each state has distinct physical properties. <p>Grade Five No indicators present for this benchmark.</p>	
<p>3.C. Describe the forces that directly affect objects and their motion.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 1. Describe an objects position by locating it relative to another object or the background. 2. Describe an objects motion by tracing and measuring its position over time. 3. Identify contact/noncontact forces that affect motion of an object (e.g., gravity, magnetism and collision) 4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction). <p>Grade Four No indicators present for this benchmark.</p> <p>Grade Five No indicators present for this benchmark.</p>	
<p>3.D. Summarize the way changes in temperature can be produced and thermal energy transferred.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four</p> <ol style="list-style-type: none"> 5. Compare ways the temperature of an object can be changed (e.g., rubbing, heating and bending of metal). <p>Grade Five</p> <ol style="list-style-type: none"> 1. Define temperature as the measure of thermal energy and describe the way it is measured. 2. Trace how thermal energy can transfer from one object to another by conduction. 	
<p>3.E. Trace how electrical energy flows through a simple</p>	

<p>electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic forces.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four No indicators present for this benchmark.</p> <p>Grade Five</p> <ol style="list-style-type: none"> 3. Describe that electrical current in a circuit can produce thermal energy, light, sound and/or magnetic forces. 4. Trace how electrical current travels by creating a simple electric circuit that will light a bulb. 	
<p>3.F. Describe the properties of light and sound energy.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four No indicators present for this benchmark.</p> <p>Grade Five</p> <ol style="list-style-type: none"> 5. Explore and summarize observations of the transmission, bending (refraction) and reflection of light. 6. Describe and summarize observations of the transmission, reflection, and absorption of sound. 7. Describe that changing the rate of vibration can vary the pitch of a sound. 	

SCIENCE AND TECHNOLOGY	
Benchmarks	Notes
<p>4.1.A. Describe how technology affects human life.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 1. Describe how technology can extend human abilities (e.g., to move things and to extend senses). 2. Describe ways that using technology can have helpful and/or harmful results. 3. Investigate ways that the results of technology may affect the individual, family and community. <p>Grade Four</p> <ol style="list-style-type: none"> 1. Explain how technology from different areas (e.g., transportation, communication, nutrition, healthcare, agriculture, entertainment and manufacturing) has improved human lives. 2. Investigate how technology and inventions change to meet peoples' needs and wants. <p>Grade Five</p> <ol style="list-style-type: none"> 1. Investigate positive and negative impacts of human activity and technology on the environment. 	
<p>4.1.B. Describe and illustrate the design process.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 4. Use a simple design process to solve a problem (e.g., identify a problem, identify possible solutions and design a solution). 5. Describe possible solutions to a design problem (e.g., how to hold down paper in the wind). <p>Grade Four</p> <ol style="list-style-type: none"> 3. Describe, illustrate and evaluate the design process used to solve a problem. <p>Grade Five</p> <ol style="list-style-type: none"> 2. Revise an existing design used to solve a problem based on peer review. 3. Explain how the solution to one problem may create other problems. 	

SCIENTIFIC INQUIRY	
Benchmarks	Notes
<p>4.2.A. Use appropriate instruments safely to observe, measure and collect data when conducting a scientific investigation.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 1. Select the appropriate tools and use relevant safety procedures to measure and record length and weight in metric and English units. <p>Grade Four</p> <ol style="list-style-type: none"> 1. Select the appropriate tools and use relevant safety procedures to measure and record length, weight, volume, temperature and area in metric and English units. <p>Grade Five</p> <ol style="list-style-type: none"> 1. Select and safely use the appropriate tools to collect data when conducting investigations and communicating findings to others (e.g., thermometers, timers, balances, spring scales, magnifiers, microscopes and other appropriate tools). 	
<p>4.2.B. Organize and evaluate observations, measurements and other data to formulate inferences and conclusions.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 2. Discuss observations and measurements made by other people. 3. Read and interpret simple tables and graphs produced by self/others. 5. Record and organize observations (e.g., journals, charts and tables). <p>Grade Four</p> <ol style="list-style-type: none"> 2. Analyze a series of events and/or simple daily or seasonal cycles, describe the patterns and infer the next likely occurrence. <p>Grade Five</p> <ol style="list-style-type: none"> 2. Evaluate observations and measurements made by other people and identify reasons for any discrepancies. 3. Use evidence and observations to explain and communicate the results of investigations. 	
<p>4.2.C. Develop, design and safely conduct scientific investigations and communicate the results.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 4. Identify and apply science safety procedures. 6. Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations). <p>Grade Four</p> <ol style="list-style-type: none"> 3. Develop, design and conduct safe, simple investigations or experiments to answer questions. 4. Explain the importance of keeping conditions the same in an experiment. 5. Describe how comparisons may not be fair when some conditions are not kept the same between experiments. 6. Formulate instructions and communicate data in a manner that allows others to understand and repeat an investigation or experiment. <p>Grade Five</p> <ol style="list-style-type: none"> 4. Identify one or two variables in a simple experiment. 5. Identify potential hazards and/or precautions involved in an investigation. 	

<p>6. Explain why results of an experiment are sometimes different (e.g., because of unexpected differences in what is being investigated, unrealized differences in the methods used or in the circumstances in which the investigation was carried out, and because of errors in observations).</p>	
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SCIENTIFIC WAYS OF KNOWING	
Benchmarks	Notes
<p>4.3.A. Distinguish between fact and opinion and explain how ideas and conclusions change as new knowledge is gained.</p> <p>Grade Three No indicators present for this benchmark.</p> <p>Grade Four</p> <ol style="list-style-type: none"> 1. Differentiate fact from opinion and explain that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed. <p>Grade Five</p> <ol style="list-style-type: none"> 1. Summarize how conclusions and ideas change as new knowledge is gained. 	
<p>4.3.B. Describe different types of investigations and use results and data from investigations to provide the evidence to support explanations and conclusions.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 1. Describe different kinds of investigations that scientists use depending on the questions they are trying to answer. <p>Grade Four</p> <ol style="list-style-type: none"> 3. Explain discrepancies in an investigation using evidence to support findings. <p>Grade Five</p> <ol style="list-style-type: none"> 2. Develop descriptions, explanations and models using evidence to defend/support findings. 3. Explain why an experiment must be repeated by different people or at different times or places and yield consistent results before the results are accepted. 4. Identify how scientists use different kinds of ongoing investigations depending on the questions they are trying to answer (e.g., observations of things or events in nature, data collection and controlled experiments). 	
<p>4.3.C. Explain the importance of keeping records of observations and investigations that are accurate and understandable.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 2. Keep records of investigations and observations and do not change the records that are different from someone else's work. <p>Grade Four</p> <ol style="list-style-type: none"> 2. Record the results and data from an investigation and make a reasonable explanation. 4. Explain why keeping records of observations and investigations is important. <p>Grade Five</p> <ol style="list-style-type: none"> 5. Keep records of investigations and observations that are understandable weeks or months later. 	
<p>4.3.D. Explain that men and women of diverse countries and cultures participate in careers in all fields of science.</p> <p>Grade Three</p> <ol style="list-style-type: none"> 3. Explore through stories how men and women have contributed to the development of science. 4. Identify various careers in science. 5. Discuss how both men and women find science rewarding as a career and in their everyday lives. <p>Grade Four No indicators present for this benchmark.</p> <p>Grade Five</p>	

6. Identify a variety of scientific and technological work that people of all ages, backgrounds and groups perform.	
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Grade 6-8

EARTH AND SPACE SCIENCES	
Benchmarks	Notes
<p>1. A Describe how the positions and motions of the objects in the universe cause predictable and cyclic events.</p> <p>Grade Six No indicators present for this benchmark.</p> <p>Grade Seven No indicators present for this benchmark.</p> <p>Grade Eight</p> <ol style="list-style-type: none"> 11. Describe how objects in the solar system are in regular and predictable motions that explain such phenomena as days, years, seasons, eclipses, tides and moon cycles. 12. Explain that gravitational force is the dominant force determining motions in the solar system and in particular keeps the planets in orbit around the sun. 13. Compare the orbits and composition of comets and asteroids with that of Earth. 14. Describe the effect that asteroids or meteoroids have when moving through space and sometimes entering planetary atmospheres (e.g., meteor-"shooting star" and meteorite). 	
<p>1. B Explain that the universe is composed of vast amounts of matter, most of which is at incomprehensible distances and held together by gravitational force. Describe how the universe is studied by the use of equipment such as telescopes, probes, satellites and spacecraft.</p> <p>Grade Six No indicators present for this benchmark.</p> <p>Grade Seven No indicators present for this benchmark.</p> <p>Grade Eight</p> <ol style="list-style-type: none"> i. Explain that the universe consists of billions of galaxies that are classified by shape. ii. Explain interstellar distances are measured in light years (e.g., the nearest star beyond the sun is 4.3 light years away). iii. Examine the life cycle of a star and predict the next likely stage of a star. iv. Name and describe tools used to study the universe (e.g., telescopes, probes, satellites and spacecraft). 	
<p>1. C Describe interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g., water cycle, weather and pollution).</p> <p>Grade Six No indicators present for this benchmark.</p> <p>Grade Seven</p> <ol style="list-style-type: none"> 1. Explain the biogeochemical cycles which move materials between the lithosphere (land), hydrosphere (water) and atmosphere (air). 2. Explain that Earth's capacity to absorb and recycle materials naturally (e.g., smoke, smog and sewage) can change the environmental quality depending on the 	

<p>length of time involved (e.g. global warming).</p> <ol style="list-style-type: none"> 3. Describe the water cycle and explain the transfer of energy between the atmosphere and hydrosphere. 4. Analyze data on the availability of fresh water that is essential for life and for most industrial and agricultural processes. Describe how rivers, lakes and groundwater can be depleted or polluted becoming less hospitable to life and even becoming unavailable or unsuitable for life. 5. Make simple weather predictions based on the changing cloud types associated with frontal systems. 6. Determine how weather observations and measurements are combined to produce weather maps and that data for a specific location at one point in time can be displayed in a station model. 7. Read a weather map to interpret local, regional and national weather. 8. Describe how temperature and precipitation determine climatic zones (biomes) (e.g., desert, grasslands, forests, tundra and alpine). 9. Describe the connection between the water cycle and weather-related phenomenon (e.g., tornadoes, floods, droughts and hurricanes). <p>Grade Eight No indicators present for this benchmark.</p>	
<p>1. D Identify that the lithosphere contains rocks and minerals and that minerals make up rocks. Describe how rocks and minerals are formed and/or classified.</p> <p>Grade Six 10. Describe the rock cycle and explain that there are sedimentary, igneous and metamorphic rocks that have distinct properties (e.g., color, texture) and are formed in different ways. 11. Explain that rocks are made of one or more minerals. 12. Identify minerals by their characteristic properties.</p> <p>Grade Seven No indicators present for this benchmark.</p> <p>Grade Eight No indicators present for this benchmark.</p>	
<p>1. E Describe the processes that contribute to the continuous changing of Earth's surface (e.g., earthquakes, volcanic eruptions, erosion, mountain building and lithospheric plate movements).</p> <p>Grade Six No indicators present for this benchmark.</p> <p>Grade Seven No indicators present for this benchmark.</p> <p>Grade Eight 9. Describe the interior structure of Earth and Earth's crust as divided into tectonic plates riding on top of the slow moving currents of magma in the mantle. 10. Explain that most major geological events (e.g., earthquakes, volcanic eruptions, hot spots and mountain building) result from plate motion. 11. Use models to analyze the size and shape of Earth, its surface and its interior (e.g., globes, topographic maps, satellite images). 12. Explain that some processes involved in the rock cycle are directly related to thermal energy and forces in the mantle that drive plate motions. 13. Describe how landforms are created through a combination of destructive (e.g., weathering and erosion) and constructive processes (e.g., crustal</p>	

<p>deformation, volcanic eruptions and deposition of sediment).</p> <p>14. Explain that folding, faulting and uplifting can rearrange the rock layers so the youngest is not always found on top.</p> <p>15. Illustrate how the three primary types of plate boundaries (transform, divergent and convergent) cause different landforms (e.g., mountains, volcanoes and ocean trenches).</p>	
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LIFE SCIENCES

Benchmarks	Notes
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<p>2. A Explain that the basic functions of organisms are carried out in cells and groups of specialized cells form tissues and organs; the combination of these cells make up multicellular organisms that have a variety of body plans and internal structures.</p> <p>Grade Six</p> <ol style="list-style-type: none"> 2. Explain that many of the basic functions of organisms are carried out by or within cells and are similar in all organisms. 3. Explain that multicellular organisms have a variety of specialized cells, tissues, organs and organ systems that perform specialized functions. 4. Identify how plant cells differ from animal cells (e.g., cell wall and chloroplasts). <p>Grade Seven</p> <ol style="list-style-type: none"> 1. Investigate the great variety of body plans and internal structures found in multicellular organisms. <p>Grade Eight No indicators present for this benchmark.</p>	
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<p>2. B Describe the characteristics of an organism in terms of a combination of inherited traits and recognize reproduction as a characteristic of living organisms essential to the continuation of the species.</p> <p>Grade Six</p> <ol style="list-style-type: none"> 4. Recognize that an individual organism does not live forever; therefore reproduction is necessary for the continuation of every species and traits are passed on to the next generation through reproduction. 5. Describe that in asexual reproduction all the inherited traits come from a single parent. 6. Describe that in sexual reproduction an egg and sperm unite and some traits come from each parent, so the offspring is never identical to either of its parents. 7. Recognize that likenesses between parents and offspring (e.g., eye color, flower color) are inherited. Other likenesses, such as table manners are learned. <p>Grade Seven</p> <ol style="list-style-type: none"> 8. Investigate the great diversity among organisms. <p>Grade Eight</p> <ol style="list-style-type: none"> 1. Describe that asexual reproduction limits the spread of detrimental characteristics through a species and allows for genetic continuity. 2. Recognize that in sexual reproduction new combinations of traits are produced which may increase or decrease an organism's chances for survival. 3. Explain how variations in structure, behavior or physiology allow some organisms to enhance their 	
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<p>reproductive success and survival in a particular environment.</p>	
<p>2. C Explain how energy entering the ecosystems as sunlight supports the life of organisms through photosynthesis and the transfer of energy through the interactions of organisms and the environment.</p> <p>Grade Six 8. Describe how organisms may interact with one another.</p> <p>Grade Seven 2. Investigate how organisms or populations may interact with one another through symbiotic relationships and how some species have become so adapted to each other that neither could survive without the other (e.g., predator-prey, parasitism, mutualism and commensalism). 3. Explain how the number of organisms an ecosystem can support depends on adequate biotic (living) resources (e.g., plants, animals) and abiotic (non-living) resources (e.g., light, water and soil). 6. Summarize the ways that natural occurrences and human activity affect the transfer of energy in Earth's ecosystems (e.g., fire, hurricanes, roads and oil spills). 7. Explain that photosynthetic cells convert solar energy into chemical energy that is used to carry on life functions or is transferred to consumers and used to carry on their life functions.</p> <p>Grade Eight No indicators present for this benchmark.</p>	
<p>2. D Explain how extinction of a species occurs when the environment changes and its adaptive characteristics are insufficient to allow survival (as seen in evidence of the fossil record).</p> <p>Grade Six No indicators present for this benchmark.</p> <p>Grade Seven 4. Investigate how overpopulation impacts an ecosystem. 5. Explain that some environmental changes occur slowly while others occur rapidly (e.g., forest and pond succession, fires and decomposition).</p> <p>Grade Eight 4. Explain that diversity of species is developed through gradual processes over many generations (e.g., fossil record). 5. Investigate how an organism adapted to a particular environment may become extinct if the environment, as shown by the fossil record, changes.</p>	

PHYSICAL SCIENCES	
Benchmarks	Notes
<p>3. A Relate uses, properties and chemical processes to the behavior and/or arrangement of the small particles that compose matter.</p> <p>Grade Six</p> <ol style="list-style-type: none"> 3. Explain that equal volumes of different substances usually have different masses. 4. Describe that in a chemical change new substances are formed with different properties than the original substance (e.g., rusting, burning). 5. Describe that in a physical change (e.g., state, shape and size) the chemical properties of a substance remain unchanged. 6. Describe that chemical and physical changes occur all around us (e.g., in the human body, cooking and industry). <p>Grade Seven</p> <ol style="list-style-type: none"> 1. Investigate how matter can change forms but the total amount of matter remains constant. <p>Grade Eight No indicators present for this benchmark.</p>	
<p>3. B In simple cases, describe the motion of objects and conceptually describe the effects of forces on an object.</p> <p>Grade Six No indicators present for this benchmark.</p> <p>Grade Seven No indicators present for this benchmark.</p> <p>Grade Eight</p> <ol style="list-style-type: none"> 1. Describe how the change in the position (motion) of an object is always judged and described in comparison to a reference point. 2. Explain that motion describes the change in the position of an object (characterized by a speed and direction) as time changes. 3. Explain that an unbalanced force acting on an object changes that object's speed and/or direction. 	
<p>3. C Describe renewable and nonrenewable sources of energy (e.g., solar, wind, fossil fuels, biomass, hydroelectricity, geothermal and nuclear energy) and the management of these sources.</p> <p>Grade Six</p> <ol style="list-style-type: none"> 5. Explain that the energy found in nonrenewable resources such as fossil fuels (e.g., oil, coal and natural gas) originally came from the sun and may renew slowly over millions of years. 6. Explain that energy derived from renewable resources such as wind and water is assumed to be available indefinitely. 7. Describe how electric energy can be produced from a variety of sources (e.g., sun, wind and coal). 8. Describe how renewable and nonrenewable energy resources can be managed (e.g., fossil fuels, trees and water). <p>Grade Seven No indicators present for this benchmark.</p> <p>Grade Eight No indicators present for this benchmark.</p>	
<p>3. D Describe that energy takes many forms, some forms represent kinetic energy and some forms represent potential</p>	

energy; and during energy transformations the total amount of energy remains constant.

Grade Six

No indicators present for this benchmark.

Grade Seven

2. Describe how an object can have potential energy due to its position or chemical composition and can have kinetic energy due to its motion.
3. Identify different forms of energy (e.g., electrical, mechanical, chemical, thermal, nuclear, radiant and acoustic).
4. Explain how energy can change forms but the total amount of energy remains constant.
5. Trace energy transformation in a simple closed system (e.g., a flashlight).

Grade Eight

4. Demonstrate that waves transfer energy.
5. Demonstrate that vibrations in materials may produce waves that spread away from the source in all directions (e.g., earthquake waves and sound waves).

SCIENCE AND TECHNOLOGY

Benchmarks	Notes
<p>4.1. A Give Examples of how technological advances, influenced by scientific knowledge, affect the quality of life.</p> <p>Grade Six</p> <ol style="list-style-type: none"> 4. Explain how technology influences the quality of life. 5. Explain how decisions about the use of products and systems can result in desirable or undesirable consequences (e.g., social and environmental). 6. Describe how automation (e.g., robots) has changed manufacturing including manual labor being replaced by highly-skilled jobs. 7. Explain how the usefulness of manufactured parts of an object depend on how well their properties allow them to fit and interact with other materials. <p>Grade Seven</p> <ol style="list-style-type: none"> i. Explain how needs, attitudes and values influence the direction of technological development in various cultures. ii. Describe how decisions to develop and use technologies often put environmental and economic concerns in direct competition with each other. iii. Recognize that science can only answer some questions and technology can only solve some human problems. <p>Grade Eight</p> <ol style="list-style-type: none"> 1. Examine how science and technology have advanced through the contributions of many different people, cultures and times in history. 2. Examine how choices regarding the use of technology are influenced by constraints caused by various unavoidable factors (e.g., geographic location, limited resources, social, political and economic considerations). 	
<p>4.1. B Design a solution or product taking into account needs and constraints (e.g., cost, time, trade-offs, properties of materials, safety and aesthetics).</p> <p>Grade Six</p> <ol style="list-style-type: none"> 5. Design and build a product or create a solution to a problem given one constraint (e.g., limits of cost and time for design and production, supply of materials and environmental effects). <p>Grade Seven</p> <ol style="list-style-type: none"> 4. Design and build a product or create a solution to a problem given two constraints (e.g., limits of cost and time for design and production or supply of materials and environmental effects). <p>Grade Eight</p> <ol style="list-style-type: none"> 3. Design and build a product or create a solution to a problem given more than two constraints (e.g., limits of cost and time for design and production, supply of materials and environmental effects). 4. Evaluate the overall effectiveness of a product design or solution. 	

SCIENTIFIC INQUIRY	
Benchmarks	Notes
<p>4. 2. A Explain that there are differing sets of procedures for guiding scientific investigations and procedures are determined by the nature of the investigation, safety considerations and appropriate tools.</p> <p>Grade Six</p> <ol style="list-style-type: none"> 2. Explain that there are not fixed procedures for guiding scientific investigations; however, the nature of an investigation determines the procedures needed. 3. Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations. <p>Grade Seven</p> <ol style="list-style-type: none"> 1. Explain that variables and controls can affect the results of an investigation and that ideally one variable should be tested at a time; however it is not always possible to control all variables. 2. Identify simple independent and dependent variables. 3. Formulate and identify questions to guide scientific investigations that connect to science concepts and can be answered through scientific investigations. 4. Choose the appropriate tools and instruments and use relevant safety procedures to complete scientific investigations. <p>Grade Eight</p> <ol style="list-style-type: none"> 1. Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations. 2. Describe the concepts of sample size and control and explain how these affect scientific investigations. 	
<p>4. 2. B Analyze and interpret data from scientific investigations using appropriate mathematical skills in order to draw valid conclusions.</p> <p>Grade Six</p> <ol style="list-style-type: none"> 3. Distinguish between observation and inference. 4. Explain that a single example can never prove that something is always correct, but sometimes a single example can disprove something. <p>Grade Seven</p> <ol style="list-style-type: none"> 5. Analyze alternative scientific explanations and predictions and recognize that there may be more than one good way to interpret a given set of data. 6. Identify faulty reasoning and statements that go beyond the evidence or misinterpret the evidence. 7. Use graphs, tables and charts to study physical phenomena and infer mathematical relationships between variables (e.g., speed and density). <p>Grade Eight</p> <ol style="list-style-type: none"> 3. Read, construct and interpret data in various forms produced by self and others in both written and oral form (e.g., tables, charts, maps, graphs, diagrams and symbols). 4. Apply appropriate math skills to interpret quantitative data (e.g., mean, median and mode). 	

SCIENTIFIC WAYS OF KNOWING	
Benchmarks	Notes
<p>4. 3. A Use skills of scientific inquiry processes (e.g., hypothesis, record keeping, description and explanation).</p> <p>Grade Six</p> <ol style="list-style-type: none"> 1. Identify that hypotheses are valuable even when they are not supported. 2. Describe why it is important to keep clear, thorough and accurate records. <p>Grade Seven No indicators present for this benchmark.</p> <p>Grade Eight</p> <ol style="list-style-type: none"> 1. Identify the difference between description (e.g., observation and summary) and explanation (e.g., inference, prediction, significance and importance). 	
<p>4. 3. B Explain the importance of reproducibility and reduction of bias in scientific methods.</p> <p>Grade Six No indicators present for this benchmark.</p> <p>Grade Seven</p> <ol style="list-style-type: none"> 1. Show that the reproducibility of results is essential to reduce bias in scientific investigations. 2. Describe how repetition of an experiment may reduce bias. <p>Grade Eight</p> <ol style="list-style-type: none"> 2. Explain why it is important to examine data objectively and not let bias affect observations. 	
<p>4. 3. C Give examples of how thinking scientifically is helpful in daily life.</p> <p>Grade Six</p> <ol style="list-style-type: none"> 3. Identify ways scientific thinking is helpful in a variety of everyday settings. 4. Describe how the pursuit of scientific knowledge is beneficial for any career and for daily life. 5. Research how men and women of all countries and cultures have contributed to the development of science <p>Grade Seven</p> <ol style="list-style-type: none"> 3. Describe how the work of science requires a variety of human abilities and qualities that are helpful in daily life (e.g., reasoning, creativity, skepticism and openness). <p>Grade Eight No indicators present for this benchmark.</p>	

Grade 9-12

1. EARTH AND SPACE SCIENCES	
Benchmarks	Notes
<p>1.A Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Describe that stars produce energy from nuclear reactions and that processes in stars have led to the formation of all elements beyond hydrogen and helium. Describe the current scientific evidence that supports the theory of the explosive expansion of the universe, the Big Bang, over 10 billion years ago. <p>Grade Ten No indicators present for this benchmark.</p>	
<p>1.B Explain that many processes occur in patterns within the Earth's systems.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Explain the relationships of the oceans to the lithosphere and atmosphere (e.g., transfer of energy, ocean currents and landforms). <p>Grade Ten</p> <ol style="list-style-type: none"> Summarize the relationship between the climatic zone and the resultant biomes. (This includes explaining the nature of the rainfall and temperature of the mid-latitude climatic zone that supports the deciduous forest.) Explain climate and weather patterns associated with certain geographic locations and features (e.g., tornado alley, tropical hurricanes and lake effect snow). 	
<p>1.C Explain the 4.5 billion-year-history of Earth and the 4 billion-year-history of life on Earth based on observable scientific evidence in the geologic record.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Explain that gravitational forces govern the characteristics and movement patterns of the planets, comets and asteroids in the solar system. <p>Grade Ten</p> <ol style="list-style-type: none"> Explain how geologic time can be estimated by multiple methods (e.g., rock sequences, fossil correlation and radiometric dating). Describe how organisms on Earth contributed to the dramatic change in oxygen content of Earth's early atmosphere. 	
<p>1.D Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <ol style="list-style-type: none"> Explain how the acquisition and use of resources, urban growth and waste disposal can accelerate natural change and impact the quality of life. Describe ways that human activity can alter biogeochemical cycles (e.g., carbon and nitrogen cycles) as well as food webs and energy pyramids (e.g., pest control, legume rotation crops vs. chemical fertilizers). 	
<p>1.E Explain the processes that move and shape Earth's surface.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Explain how the slow movement of material within Earth results from: 	

<ul style="list-style-type: none"> a. thermal energy transfer (conduction and convection) from the deep interior; b. the action of gravitational forces on regions of different density. <ul style="list-style-type: none"> 6. Explain the results of plate tectonic activity (e.g., magma generation, igneous intrusion, metamorphism, volcanic action, earthquakes, faulting and folding). 7. Explain sea-floor spreading and continental drift using scientific evidence (e.g., fossil distributions, magnetic reversals and radiometric dating). <p>Grade Ten No indicators present for this benchmark.</p>	
<p>1.F Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of Earth and space sciences.</p> <p>Grade Nine</p> <ul style="list-style-type: none"> 8. Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., heliocentric theory and plate tectonics theory). <p>Grade Ten</p> <ul style="list-style-type: none"> 7. Describe advances and issues in Earth and space science that have important long-lasting effects on science and society (e.g., geologic time scales, global warming, depletion of resources and exponential population growth). 	

2. LIFE SCIENCES	
Benchmarks	Notes
<p>2.A Explain that cells are the basic unit of structure and function of living organisms, that once life originated all cells come from pre-existing cells, and that there are a variety of cell types.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <ol style="list-style-type: none"> 1. Explain that living cells <ol style="list-style-type: none"> a. are composed of a small number of key chemical elements (carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur) b. are the basic unit of structure and function of all living things c. come from pre-existing cells after life originated, and d. are different from viruses 2. Compare the structure, function and interrelatedness of cell organelles in eukaryotic cells (e.g., nucleus, chromosome, mitochondria, cell membrane, cell wall, chloroplast, cilia, flagella) and prokaryotic cells. 	
<p>2.B Explain the characteristics of life as indicated by cellular processes and describe the process of cell division and development.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <ol style="list-style-type: none"> 8. Explain the characteristics of life as indicated by cellular processes including <ol style="list-style-type: none"> 4. homeostasis 5. energy transfers and transformation 6. transportation of molecules 7. disposal of wastes 8. synthesis of new molecules 4. Summarize the general processes of cell division and differentiation, and explain why specialized cells are useful to organisms and explain that complex multicellular organisms are formed as highly organized arrangements of differentiated cells. 	
<p>2.C Explain the genetic mechanisms and molecular basis of inheritance.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <ol style="list-style-type: none"> 5. Illustrate the relationship of the structure and function of DNA to protein synthesis and the characteristics of an organism. 6. Explain that a unit of hereditary information is called a gene, and genes may occur in different forms called alleles (e.g., gene for pea plant height has two alleles, tall and short). 7. Describe that spontaneous changes in DNA are mutations, which are a source of genetic variation. When mutations occur in sex cells, they may be passed on to future generations; mutations that occur in body cells may affect the functioning of that cell or the organism in which that cell is found. 8. Use the concepts of Mendelian and non-Mendelian genetics (e.g., segregation, independent assortment, dominant and recessive traits, sex-linked traits and 	

<p>jumping genes) to explain inheritance.</p>	
<p>2.D Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological).</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <p>9. Describe how matter cycles and energy flows through different levels of organization in living systems and between living systems and the physical environment. Explain how some energy is stored and much is dissipated into the environment as thermal energy (e.g., food webs and energy pyramids).</p> <p>10. Describe how cells and organisms acquire and release energy (photosynthesis, chemosynthesis, cellular respiration and fermentation)</p> <p>11. Explain that living organisms use matter and energy to synthesize a variety of organic molecules (e.g., proteins, carbohydrates, lipids and nucleic acids) and to drive life processes (e.g., growth, reacting to the environment, reproduction and movement).</p>	
<p>2.E Explain how evolutionary relationships contribute to an understanding of the unity and diversity of life.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <p>12. Describe that biological classification represents how organisms are related with species being the most fundamental unit of the classification system. Relate how biologists arrange organisms into a hierarchy of groups and subgroups based on similarities and differences that reflect their evolutionary relationships.</p> <p>13. Explain that the variation of organisms within a species increases the likelihood that at least some members of a species will survive under gradually changing environmental conditions.</p> <p>14. Relate diversity and adaptation to structures and their functions in living organisms (e.g., adaptive radiation).</p>	
<p>2.F Explain the structure and function of ecosystems and relate how ecosystems change over time.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <p>15. Explain how living things interact with biotic and abiotic components of the environment (e.g., predation, competition, natural disasters and weather).</p> <p>16. Relate how distribution and abundance of organisms and populations in ecosystems are limited by the ability of the ecosystem to recycle materials and the availability of matter, space and energy.</p> <p>17. Conclude that ecosystems tend to have cyclic fluctuations around a state of approximate equilibrium that can change when climate changes, when one or more new species appear as a result of immigration or when one or more species disappear.</p>	
<p>2.G Describe how human activities can impact the status of natural systems.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <p>18. Describe ways that human activities can deliberately or</p>	

<p>inadvertently alter the equilibrium in ecosystems. Explain how changes in technology/biotechnology can cause significant changes, either positive or negative, in environmental quality and carrying capacity.</p> <p>19. Illustrate how uses of resources at local, state, regional, national, and global levels have affected the quality of life (e.g., energy production and sustainable vs. nonsustainable agriculture).</p>	
<p>2.H Describe a foundation of biological evolution as the change in gene frequency of a population over time. Explain the historical and current scientific developments, mechanisms and processes of biological evolution.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <p>20. Recognize that a change in gene frequency (genetic composition) in a population over time is a foundation of biological evolution.</p> <p>21. Explain that natural selection provides the following mechanism for evolution; undirected variation in inherited characteristics exist within every species. These characteristics may give individuals an advantage or disadvantage compared to others in surviving and reproducing. The advantaged offspring are more likely to survive and reproduce. Therefore, the proportion of individuals that have advantageous characteristics will increase. When an environment changes, the survival value of some inherited characteristics may change.</p> <p>22. Describe historical scientific developments that occurred in evolutionary thought (e.g., Lamarck and Darwin, Mendelian Genetics and modern synthesis).</p>	
<p>2.I Explain how natural selection and other evolutionary mechanisms account for the unity and diversity of past and present life forms.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <p>24. Analyze how natural selection and other evolutionary mechanisms (e.g. genetic drift, immigration, emigration, mutation) and their consequences provide a scientific explanation for the diversity and unity of past life forms, as depicted in the fossil record, and present life forms.</p> <p>25. Explain that life on Earth is thought to have begun as simple, one celled organisms approximately 4 billion years ago. During most of the history of Earth only single celled microorganisms existed, but once cells with nuclei developed about a billion years ago, increasingly complex multicellular organisms evolved.</p>	
<p>2.J Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of life sciences.</p> <p>Grade Nine No indicators present for this benchmark.</p> <p>Grade Ten</p> <p>26. Use historical examples to explain how new ideas are limited by the context in which they are conceived. These ideas are often rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g.,</p>	

<p>biological evolution, germ theory, biotechnology and discovering germs).</p> <p>27. Describe advances in life sciences that have important long-lasting effects on science and society (e.g., biological evolution, germ theory, biotechnology and discovering germs).</p> <p>28. Analyze and investigate emerging scientific issues (e.g., genetically modified food, stem cell research, genetic research and cloning).</p>	
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3. PHYSICAL SCIENCES	
Benchmarks	Notes
<p>3.A Describe that matter is made of minute particles called atoms and atoms are comprised of even smaller components. Explain the structure and properties of atoms.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Recognize that all atoms of the same element contain the same number of protons, and elements with the same number of protons may or may not have the same mass. Those with different masses (different numbers of neutrons) are called isotopes. Illustrate that atoms with the same number of positively charged protons and negatively charged electrons are electrically neutral. Show that when elements are listed in order according to the number of protons (called the atomic number), the repeating patterns of physical and chemical properties identify families of elements. Recognize that the periodic table was formed as a result of the repeating pattern of electron configurations. Describe how ions are formed when an atom or a group of atoms acquire an unbalanced charge by gaining or losing one or more electrons. <p>Grade Ten No indicators present for this benchmark.</p>	
<p>3.B Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Explain that the electric force between the nucleus and the electrons hold an atom together. Relate that on a larger scale, electric forces hold solid and liquid materials together (e.g., salt crystals and water). Show how atoms may be bonded together by losing, gaining or sharing electrons and that in a chemical reaction, the number, type of atoms and total mass must be the same before and after the reaction (e.g., writing correct chemical formulas and writing balanced chemical equations). Demonstrate that the pH scale (0-14) is used to measure acidity and classify substances or solutions as acidic, basic, or neutral. <p>Grade Ten No indicators present for this benchmark.</p>	
<p>3.C Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Investigate the properties of pure substances and mixtures (e.g., density, conductivity, hardness, properties of alloys, superconductors and semiconductors). Compare the conductivity of different materials and explain the role of electrons in the ability to conduct electricity. <p>Grade Ten No indicators present for this benchmark.</p>	
<p>3.D Explain the movement of objects by applying Newton's three laws of motion.</p>	

<p>Grade Nine</p> <ol style="list-style-type: none"> 21. Demonstrate that motion is a measurable quantity that depends on the observer's frame of reference and describe the object's motion in terms of position, velocity, acceleration and time. 22. Demonstrate that any object does not accelerate (remains at rest or maintains a constant speed and direction of motion) unless an unbalanced (net) force acts on it. 23. Explain the change in motion (acceleration) of an object. Demonstrate that the acceleration is proportional to the net force acting on the object and inversely proportional to the mass of the object. ($F_{\text{net}} = ma$. Note that weight is the gravitational force on a mass.) 24. Demonstrate that whenever one object exerts a force on another, an equal amount of force is exerted back on the first object. 25. Demonstrate the ways in which frictional forces constrain the motion of objects (e.g., a car traveling around a curve, a block on an inclined plane, a person running, an airplane in flight). <p>Grade Ten No indicators present for this benchmark.</p>	
<p>3.E Demonstrate that energy can be considered to be either kinetic (motion) or potential (stored).</p> <p>Grade Nine</p> <ol style="list-style-type: none"> 1. Explain how an object's kinetic energy depends on its mass and its speed ($KE = \frac{1}{2}mv^2$). 2. Demonstrate that near Earth's surface an object's gravitational potential energy depends upon its weight (mg where m is the object's mass and g is the acceleration due to gravity) and height (h) above a reference surface ($PE = mgh$). <p>Grade Ten No indicators present for this benchmark.</p>	
<p>3.F Explain how energy may change form or be redistributed but the total quantity of energy is conserved.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> 3. Describe radioactive substances as unstable nuclei that undergo random spontaneous nuclear decay emitting particles and/or high energy wavelike radiation. 11. Explain how thermal energy exists in the random motion and vibrations of atoms and molecules. Recognize that the higher the temperature, the greater the average atomic or molecular motion, and during changes of state the temperature remains constant. <ol style="list-style-type: none"> a. Summarize how nuclear reactions convert a small amount of matter into a large amount of energy. (Fission involves the splitting of a large nucleus into smaller nuclei; fusion is the joining of two small nuclei into a larger nucleus at extremely high energies.) b. Trace the transformations of energy within a system (e.g., chemical to electrical to mechanical) and recognize that energy is conserved. Show that these transformations involve the release of some thermal energy. c. Illustrate that chemical reactions are either endothermic or exothermic (e.g., cold packs, hot packs and the burning of fossil fuels). d. Demonstrate that thermal energy can be transferred by 	

<p>conduction, convection or radiation (e.g., through materials by the collision of particles, moving air masses or across empty space by forms of electromagnetic radiation).</p> <p>Grade Ten No indicators present for this benchmark.</p>	
<p>3.G Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.</p> <p>Grade Nine</p> <p>18. Demonstrate that electromagnetic radiation is a form of energy. Recognize that light acts as a wave. Show that visible light is a part of the electromagnetic spectrum (e.g., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays).</p> <p>19. Show how the properties of a wave depend on the properties of the medium through which it travels. Recognize that electromagnetic waves can be propagated without a medium.</p> <p>20. Describe how waves can superimpose on one another when propagated in the same medium. Analyze conditions in which waves can bend around corners, reflect off surfaces, are absorbed by materials they enter, and change direction and speed when entering a different material.</p> <p>Grade Ten No indicators present for this benchmark.</p>	
<p>3.H Trace the historical development of scientific theories and ideas, and describe emerging issues in the study of physical sciences.</p> <p>Grade Nine</p> <p>26. Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., atomic theory, quantum theory and Newtonian mechanics).</p> <p>27. Describe advances and issues in physical science that have important, long-lasting effects on science and society (e.g., atomic theory, quantum theory, Newtonian mechanics, nuclear energy, nanotechnology, plastics, ceramics and communication technology).</p> <p>Grade Ten No indicators present for this benchmark.</p>	

4. SCIENTIFIC METHODS AND APPLICATIONS	
4.1 SCIENCE AND TECHNOLOGY	
Benchmarks	Notes
<p>4.1.A Explain the ways in which the processes of technological design respond to the needs of society.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Identify a problem or need, propose designs and choose among alternative solutions for the problem. Explain why a design should be continually assessed and the ideas of the design should be tested, adapted and refined. <p>Grade Ten</p> <ol style="list-style-type: none"> Explain that when evaluating a design for a device or process, thought should be given to how it will be manufactured, operated, maintained, replaced and disposed of in addition to who will sell, operate and take care of it. Explain how the costs associated with these considerations may introduce additional constraints on the design. 	
<p>4.1.B Explain that science and technology are independent; each drives the other.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> Describe means of comparing the benefits with the risks of technology and how science can inform public policy. <p>Grade Ten</p> <ol style="list-style-type: none"> Cite examples of ways that scientific inquiry is driven by the desire to understand the natural world and how technology is driven by the need to meet human needs and solve human problems. Describe examples of scientific advances and emerging technologies and how they may impact society. 	

4.2 SCIENTIFIC INQUIRY	
Benchmarks	Notes
<p>4.2.A Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> 4. Distinguish between observations and inferences given a scientific situation. 5. Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g., OSHA, Material Safety Data Sheets [MSDS], eyewash, goggles and ventilation). 6. Construct, interpret and apply physical and conceptual models that represent or explain systems, objects, events or concepts. 7. Decide what degree of precision based on the data is adequate and round off the results of calculator operations to the proper number of significant figures to reasonably reflect those of the inputs. 8. Develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology. 9. Draw logical conclusions based on scientific knowledge and evidence from investigations. <p>Grade Ten</p> <ol style="list-style-type: none"> 1. Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g. OSHA, MSDS, eyewash, goggles and ventilation). 2. Present scientific findings using clear language, accurate data, appropriate graphs, tables, maps and available technology. 3. Use mathematical models to predict and analyze natural phenomena. 4. Draw conclusions from inquiries based on scientific knowledge and principles, the use of logic and evidence (data) from investigations. 5. Explain how new scientific data can cause any existing scientific explanation to be supported, revised or rejected. 	

4.3 SCIENTIFIC WAYS OF KNOWING	
Benchmarks	Notes
<p>4.3.A Explain that scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> 1. Comprehend that many scientific investigations require the contributions of women and men from different disciplines in and out of science. These people study different topics, use different techniques and have different standards of evidence but share a common purpose - to better understand a portion of our universe. 3. Demonstrate that reliable scientific evidence improves the ability of scientists to offer accurate predictions. <p>Grade Ten</p> <ol style="list-style-type: none"> 1. Discuss science as a dynamic body of knowledge that can lead to the development of entirely new disciplines. 2. Describe that scientists may disagree about explanations of phenomena, about interpretation of data or about the value of rival theories, but they do agree that questioning, response to criticism and open communication are integral to the process of science. 3. Recognize that science is a systematic method of continuing investigation, based on observation, hypothesis testing, measurement, experimentation, and theory building, which leads to more adequate explanations of natural phenomena. 	
<p>4.3.B Explain how scientific inquiry is guided by knowledge, observations, ideas and questions.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> 5. Justify that scientific theories are explanations of large bodies of information and/or observations that withstand repeated testing. 6. Explain that inquiry fuels observation and experimentation that produce data that are the foundation of scientific disciplines. Theories are explanations of these data. 7. Recognize that scientific knowledge and explanations have changed over time, almost always building on earlier knowledge. <p>Grade Ten</p> <p>No indicators present for this benchmark.</p>	
<p>4.3.C Describe the ethical practices and guidelines in which science operates.</p> <p>Grade Nine</p> <ol style="list-style-type: none"> 2. Illustrate that the methods and procedures used to obtain evidence must be clearly reported to enhance opportunities for further investigations. 4. Explain how support of ethical practices in science (e.g., individual observations and confirmations, accurate reporting, peer review and publication) are required to reduce bias. <p>Grade Ten</p> <ol style="list-style-type: none"> 4. Recognize that ethical considerations limit what scientists can do. 5. Recognize that research involving voluntary human subjects should be conducted only with the informed 	

<p>consent of the subjects and follow rigid guidelines and/or laws.</p> <p>6. Recognize that animal-based research must be conducted according to currently accepted professional standards and laws.</p>	
<p>4.3.D Recognize that scientific literacy is part of being a knowledgeable citizen.</p> <p>Grade Nine</p> <p>8. Illustrate that much can be learned about the internal workings of science and the nature of science from the study of scientists, their daily work and their efforts to advance scientific knowledge in their area of study.</p> <p>9. Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.</p> <p>Grade Ten</p> <p>7. Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.</p>	

Appendix D-Detailed Science Results

Grade 5 Form A Tables

Table 5.1

Categorical Concurrence Between Standards and Assessment as Rated by Six Reviewers

GR5 Science M07 Form 5A

Number of Assessment Items - 38

Standards			Level by Objective			Hits		Cat. Concurr.
Title	Goals #	Objs #	Level	# of objs by Level	% w/in std by Level	Mean	S.D.	
1 - Earth and Space Sciences	4	4	1 2	1 3	25 75	16.83	3.89	YES
2 - Life Sciences	3	3	1 2	1 2	33 66	9	1.91	YES
3 - Physical Sciences	6	6	1 2	5 1	83 16	11.67	1.25	YES
4 - Scientific Methods and Applications	3	9.17	1 2 3	3 2 4	33 22 44	18.33	4.03	YES
Total	16	22.17	1 2 3	10 8 4	45 36 18	55.83	5.70	

Table 5.2

Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Assumes Each Objective Should Have Equal Representation)
GR5 Science M07 Form 5A
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	4	4	16.83	3.89	34	38	55	40	11	22	YES
2 - Life Sciences	3	3	9	1.91	46	44	51	44	2	7	YES
3 - Physical Sciences	6	6	11.67	1.25	0	0	86	24	14	24	YES
4 - Scientific Methods and Applications	3	9.17	18.33	4.03	72	45	14	34	14	34	NO
Total	16	22.17	55.83	5.70	40	46	48	45	12	26	

Table 5.2a

Alternate Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Does Not Assume Each Objective Should Have Equal Representation)
GR5 Science M07 Form 5A
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	4	4	16.83	3.89	29	207	59	40	12	22	YES
2 - Life Sciences	3	3	9	1.91	53	194	44	44	3	7	WEAK
3 - Physical Sciences	6	6	11.67	1.25	0	0	73	24	27	24	YES
4 - Scientific Methods and Applications	3	9.17	18.33	4.03	60	259	17	34	23	34	NO
Total	16	22.17	55.83	5.70	40	46	48	45	12	26	

This Table Is In Development And The Results May Be Invalid

Table 5.3

*Range-of-Knowledge Correspondence and Balance of Representation Between Standards and Assessment as Rated by Six Reviewers
GR5 Science M07 Form 5A*

Number of Assessment Items - 38

Standards			Hits		Range of Objectives				Rng. of Know.	Balance Index				Bal. of Represent.
					# Objs Hit		% of Total			% Hits in Std/Ttl Hits		Index		
Title	Goals #	Objs #	Mean	S.D.	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.	
1 - Earth and Space Sciences	4	4	16.83	3.89	4	0	100	0	YES	30	7	0.84	0.10	YES
2 - Life Sciences	3	3	9	1.91	3	0	100	0	YES	16	3	0.84	0.07	YES
3 - Physical Sciences	6	6	11.67	1.25	4.83	0.37	81	6	YES	21	1	0.74	0.05	YES
4 - Scientific Methods and Applications	3	9.17	18.33	4.03	6.5	0.96	71	10	YES	33	6	0.72	0.08	YES
Total	16	22.17	55.83	5.70	4.58	1.38	88	14		25	8	0.79	0.09	

Table 5.4

Summary of Attainment of Acceptable Alignment Level on Four Content Focus Criteria as Rated by Six Reviewers
GR5 Science M07 Form 5A
Number of Assessment Items - 38

Standards	Alignment Criteria			
	Categorical Concurrence	Depth-of-Knowledge Consistency	Range of Knowledge	Balance of Representation
1 - Earth and Space Sciences	YES	YES	YES	YES
2 - Life Sciences	YES	YES	YES	YES
3 - Physical Sciences	YES	YES	YES	YES
4 - Scientific Methods and Applications	YES	NO	YES	YES

Table 5.5
Source-of-Challenge Issues by Reviewer
GR5 Science M07 Form 5A

Item Number	Comments by Reviewer
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Table 5.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR5 Science M07 Form 5A

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
1	1	1	1	1	1	1
2	1	1	1	1	1	1
3	1	1	1	1	1	1
4	1	1	1	1	1	1
5	1	1	1	1	1	1
6	2	2	2	3	2	2
7	1	1	1	1	2	2
8	1	1	1	1	1	1
9	1	1	1	1	1	1
10	1	1	1	1	1	1
11	1	3	2	2	2	2
12	1	1	1	1	1	1
13	1	1	1	2	1	1
14	1	1	1	1	1	1
15	1	2	1	1	2	1
16	1	3	2	2	2	2
17	1	1	1	1	1	1
18	1	1	1	1	1	1
19	1	1	1	1	1	1
20	1	1	1	2	1	1
21	2	3	2	2	2	2
22	1	1	1	1	1	1
23	1	2	1	2	1	1
24	1	2	1	2	1	1
25	1	1	1	1	1	1
26	1	3	2	1	1	1
27	1	2	1	1	2	2
28	1	1	1	1	1	1
29	1	1	1	1	1	1
30	2	1	2	1	1	1
31	1	3	1	1	3	1
32	2	2	1	2	2	2
33	1	1	1	1	1	1
34	1	1	1	1	1	1
35	1	2	1	1	2	1
36	2	1	2	1	1	2
37	2	1	1	1	1	1
38	2	3	1	1	2	2

Table 5.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR5 Science M07 Form 5A

Intraclass Correlation: 0.809

Pairwise Comparison: 0.7509

Table 5.7
Notes by Reviewer
GR5 Science M07 Form 5A

Item Number Comments by Reviewer

Table 5.8
DOK Levels and Objectives Coded by Each Reviewer
GR5 Science M07 Form 5A

Item	DO K0	PObj0	S1Obj0	DOK1	PObj1	S1Obj1	DOK2	PObj2	S1Obj2	DOK3	PObj3	S1Obj3	DOK4	PObj4	S1Obj4	DOK5	PObj5	S1Obj5
1	1	3.6		1	3.6		1	3.6		1	3.6		1	3.6		1	3.6	
2	1	2.3		1	2.2		1	2.2		1	1.3		1	2.2		1	2.2	2.3
3	1	2.3		1	2.3		1	2.3		1	1.3		1	2.3		1	2.3	
4	1	2.2		1	2.2		1	2.2		1	1.3		1	2.2		1	2.2	
5	1	2.1		1	2.1		1	2.1		1	1.3		1	2.2		1	2.1	
6	2	1.2		2	1.2		2	1.2		3	1.2		2	1.2		2	1.2	
7	1	1.3		1	1.1		1	1.1		1	1.1		2	1.1		2	1.1	
8	1	4.1.2		1	4.1.2		1	4.1.2		1	4.1.2		1	4.1.2		1	4.1.2	
9	1	3.1		1	3.1		1	3.1		1	3.1		1	3.1		1	3.1	
10	1	4.3.1		1	4.3.1		1	4.3.1		1	4.3.1		1	4.3.1		1	4.3.1	
11	1	4.2.1	1.4	3	4.2.1	1.4	2	1.4	4.2.1	2	1.4		2	4.2.1		2	4.2.1	
12	1	3.3		1	3.3		1	3.3		1	3.3		1	3.3		1	3.3	
13	1	3.4		1	3.4		1	3.4		2	3.4		1	3.4		1	3.4	
14	1	2.1		1	2.2	2.1	1	2.1		1	2.2		1	2.2		1	2.2	
15	1	1.1		2	1.1		1	1.1		1	1.1		2	1.1		1	1.1	
16	1	4.3.3		3	4.3.3		2	4.2.2	3.4	2	4.2.2		2	4.2.2		2	4.3.3	
17	1	3.3		1	3.3		1	3.3		1	3.3		1	3.3		1	3.3	
18	1	2.2		1	2.2		1	2.2		1	2.2		1	2.2		1	2.2	
19	1	3.2		1	1.4	3.2	1	3.2	4.2.1	1	3.4	3.2	1	3.2		1	3.1	
20	1	3.4		1	3.4		1	3.4		2	3.4		1	3.4		1	3.4	
21	2	3.6		3	3.6		2	3.6	4.2.2	2	3.6		2	3.6	4.2.2	2	3.6	
22	1	3.6		1	3.6		1	3.6		1	3.6		1	3.6		1	3.6	
23	1	4.2.3		2	4.3.2	4.3.3	1	4.2.3		2	4.1.2	4.2.3	1	4.2.3		1	4.2.3	
24	1	3.6	4.2.2	2	3.6		1	3.6	4.2.2	2	4.2.2	3.6	1	3.6		1	4.2.2	
25	1	4.2.3		1	4.2.3		1	4.2.3	4.3.2	1	4.2.3		1	4.2.3		1	4.2.3	
26	1	4.2.2		3	4.2.2		2	4.3.2	3.6	1	4.1.1		1	3.6	4.2.2	1	4.1.2	
27	1	4.2.3		2	4.1.1		1	4.2.1		1	4.2.1		2	4.2.1	4.2.3	2	4.2.1	
28	1	1.1		1	1.1		1	1.1		1	1.1		1	1.1		1	1.1	
29	1	1.1		1	1.1		1	1.1		1	1.3		1	1.1		1	1.1	
30	2	4.2.2		1	2.1		2	2.1	4.2.2	1	2.1		1	2.1	4.2.2	1	4.2.2	
31	1	4.3.2		3	4.2.2		1	4.2.2	2.1	1	4.2.3		3	4.2.2	2.2	1	4.3.1	
32	2	2.3		2	2.3		1	2.3		2	2.3		2	2.3	4.2.2	2	2.3	
33	1	1.4		1	1.4		1	1.4		1	1.4		1	1.4		1	1.4	
34	1	1.1		1	1.1		1	1.1		1	1.1		1	1.1		1	1.1	
35	1	4.2.2	1.3	2	1.3		1	1.3	4.2.2	1	1.3		2	1.3	4.2.2	1	4.2.2	
36	2	4.2.2		1	1.3		2	1.3	4.2.2	1	1.3		1	1.3	4.2.2	2	4.2.2	
37	2	1.2		1	1.2		1	1.3	1.2	1	1.2		1	1.2		1	4.2	
38	2	2.3		3	1.3		1	1.3	1.4	1	1.3		2	2.3	4.2.2	2	1.3	

Objective Pairwise Comparison: 0.6469

Standard Pairwise Comparison: 0.7956

Table 5.9
 Objectives Coded to Each Item by Reviewers
 GR5 Science M07 Form 5A

Low		Medium		High						
6		8.815789		36						
1	3.6	3.6	3.6	3.6	3.6	3.6				
2	1.3	2.2	2.2	2.2	2.2	2.3	2.3			
3	1.3	2.3	2.3	2.3	2.3	2.3				
4	1.3	2.2	2.2	2.2	2.2	2.2				
5	1.3	2.1	2.1	2.1	2.1	2.2				
6	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
	1.2	1.2	1.2	1.2	1.2					
7	1.1	1.1	1.1	1.1	1.1	1.3				
8	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2				
9	3.1	3.1	3.1	3.1	3.1	3.1				
10	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1				
11	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	1.4	1.4	1.4	1.4	1.4	1.4	4.2.1	4.2.1	4.2.1	
	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	
	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1		
12	3.3	3.3	3.3	3.3	3.3	3.3				
13	3.4	3.4	3.4	3.4	3.4	3.4				
14	2.1	2.1	2.1	2.2	2.2	2.2	2.2			
15	1.1	1.1	1.1	1.1	1.1	1.1				
16	3.4	3.4	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.3.3	4.3.3
	4.3.3	4.3.3	4.3.3	4.3.3						
17	3.3	3.3	3.3	3.3	3.3	3.3				
18	2.2	2.2	2.2	2.2	2.2	2.2				
19	1.4	3.1	3.2	3.2	3.2	3.2	3.2	3.4	4.2.1	
20	3.4	3.4	3.4	3.4	3.4	3.4				
21	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
	3.6	3.6	4.2.2	4.2.2	4.2.2	4.2.2				
22	3.6	3.6	3.6	3.6	3.6	3.6				
23	4.1.2	4.2.3	4.2.3	4.2.3	4.2.3	4.2.3	4.3.2	4.3.3		
24	3.6	3.6	3.6	3.6	3.6	4.2.2	4.2.2	4.2.2	4.2.2	
25	4.2.3	4.2.3	4.2.3	4.2.3	4.2.3	4.2.3	4.3.2			
26	3.6	3.6	4.1.1	4.1.2	4.2.2	4.2.2	4.2.2	4.3.2		
27	4.1.1	4.1.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1
	4.2.3	4.2.3	4.2.3	4.2.3						
28	1.1	1.1	1.1	1.1	1.1	1.1				
29	1.1	1.1	1.1	1.1	1.1	1.3				
30	2.1	2.1	2.1	2.1	4.2.2	4.2.2	4.2.2	4.2.2		

Table 5.9
Objectives Coded to Each Item by Reviewers
GR5 Science M07 Form 5A

31	2.1	2.2	4.2.2	4.2.2	4.2.2	4.2.3	4.3.1	4.3.2		
32	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	2.3	2.3	4.2.2	4.2.2						
33	1.4	1.4	1.4	1.4	1.4	1.4				
34	1.1	1.1	1.1	1.1	1.1	1.1				
35	1.3	1.3	1.3	1.3	1.3	4.2.2	4.2.2	4.2.2	4.2.2	
36	1.3	1.3	1.3	1.3	4.2.2	4.2.2	4.2.2	4.2.2		
37	1.2	1.2	1.2	1.2	1.2	1.3	4.2			
38	1.3	1.3	1.3	1.3	1.4	2.3	2.3	4.2.2		

Table 5.10
 Items Coded by Reviewers to Each Objective
 GR5 Science M07 Form 5A

Low		Medium		High
0		11.16667		35

1																					
1.1	7	7	7	7	7	15	15	15	15	15	15	28	28	28	28	28	28	29	29	29	
	29	29	34	34	34	34	34	34	34												
1.2	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
	6	6	6	6	37	37	37	37	37												
1.3	2	3	4	5	7	29	35	35	35	35	35	36	36	36	36	37	38	38	38	38	
1.4	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	19	33	33	33
	33	33	33	38																	
2																					
2.1	5	5	5	5	14	14	14	30	30	30	30	31									
2.2	2	2	2	2	4	4	4	4	4	5	14	14	14	14	18	18	18	18	18	18	
	31																				
2.3	2	2	3	3	3	3	3	32	32	32	32	32	32	32	32	32	32	32	32	38	
	38																				
3																					
3.1	9	9	9	9	9	9	19														
3.2	19	19	19	19	19																
3.3	12	12	12	12	12	12	17	17	17	17	17	17									
3.4	13	13	13	13	13	13	16	16	19	20	20	20	20	20	20						
3.5																					
3.6	1	1	1	1	1	1	21	21	21	21	21	21	21	21	21	21	21	21	22	22	
	22	22	22	22	24	24	24	24	24	24	26	26									
4																					
4.1																					
4.1.1	26	27	27																		
4.1.2	8	8	8	8	8	8	23	26													
4.2	37																				
4.2.1	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
	19	27	27	27	27	27	27	27	27												
4.2.2	16	16	16	16	16	16	21	21	21	21	24	24	24	24	26	26	26	30	30	30	
	30	31	31	31	32	32	35	35	35	35	36	36	36	36	38						
4.2.3	23	23	23	23	23	25	25	25	25	25	25	27	27	27	27	31					
4.3																					
4.3.1	10	10	10	10	10	10	31														
4.3.2	23	25	26	31																	
4.3.3	16	16	16	16	16	16	23														
4.3.4																					

Table 5.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR5 Science M07 Form 5A

Low		Medium		High
1		3		6

1	3.6: 6					
2	1.3: 1	2.2: 4	2.3: 2			
3	1.3: 1	2.3: 5				
4	1.3: 1	2.2: 5				
5	1.3: 1	2.1: 4	2.2: 1			
6	1.2: 6					
7	1.1: 5	1.3: 1				
8	4.1.2 :6					
9	3.1: 6					
10	4.3.1 :6					
11	1.4: 4	4.2.1 :5				
12	3.3: 6					
13	3.4: 6					
14	2.1: 3	2.2: 4				
15	1.1: 6					
16	3.4: 1	4.2.2 :3	4.3.3 :3			
17	3.3: 6					
18	2.2: 6					
19	1.4: 1	3.1: 1	3.2: 5	3.4: 1	4.2.1 :1	
20	3.4: 6					

Table 5.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR5 Science M07 Form 5A

	6					
21	3.6: 6	4.2.2 :2				
22	3.6: 6					
23	4.1.2 :1	4.2.3 :5	4.3.2 :1	4.3.3 :1		
24	3.6: 5	4.2.2 :4				
25	4.2.3 :6	4.3.2 :1				
26	3.6: 2	4.1.1 :1	4.1.2 :1	4.2.2 :3	4.3.2 :1	
27	4.1.1 :1	4.2.1 :4	4.2.3 :2			
28	1.1: 6					
29	1.1: 5	1.3: 1				
30	2.1: 4	4.2.2 :4				
31	2.1: 1	2.2: 1	4.2.2 :3	4.2.3 :1	4.3.1 :1	4.3.2 :1
32	2.3: 6	4.2.2 :1				
33	1.4: 6					
34	1.1: 6					
35	1.3: 5	4.2.2 :4				
36	1.3: 4	4.2.2 :4				
37	1.2: 5	1.3: 1	4.2: 1			
38	1.3: 4	1.4: 1	2.3: 2	4.2.2 :1		

Table 5.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR5 Science M07 Form 5A

Low DOK		Matched DOK		High DOK
1		3		6

1 [2]:										
1.1 [1]:	7:5[1.4]	15:6[1.33]	28:6[1]	29:5[1]	34:6[1]					
1.2 [2]:	6:6[2.17]	37:5[1.2]								
1.3 [2]:	2:1[1]	3:1[1]	4:1[1]	5:1[1]	7:1[1]	29:1[1]	35:5[1.4]	36:4[1.25]	37:1[1]	38:4[1.75]
1.4 [2]:	11:4[2]	19:1[1]	33:6[1]	38:1[1]						
2 [2]:										
2.1 [1]:	5:4[1]	14:3[1]	30:4[1.25]	31:1[1]						
2.2 [2]:	2:4[1]	4:5[1]	5:1[1]	14:4[1]	18:6[1]	31:1[3]				
2.3 [2]:	2:2[1]	3:5[1]	32:6[1.83]	38:2[2]						
3 [1]:										
3.1 [1]:	9:6[1]	19:1[1]								
3.2 [1]:	19:5[1]									
3.3 [1]:	12:6[1]	17:6[1]								
3.4 [1]:	13:6[1.17]	16:1[2]	19:1[1]	20:6[1.17]						
3.5 [2]:										
3.6 [1]:	1:6[1]	21:6[2.1]	22:6[1]	24:5[1.4]	26:2[1.5]					

Table 5.14
Group Consensus
Gr 5 Science Combined, Science, Grade 5

Level	Description	DOK
1	Earth and Space Sciences	2
1.1	Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.	1
1.2	Summarize the processes that shape Earth's surface and describe evidence of those processes.	2
1.3	Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.	2
1.4	Analyze weather and changes that occur over a period of time.	2
2	Life Sciences	2
2.1	Differentiate between the life cycles of different plants and animals.	1
2.2	Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.	2
2.3	Compare changes in an organism's ecosystem/ habitat that affect its survival.	2
3	Physical Sciences	1
3.1	Compare the characteristics of simple physical and chemical changes.	1
3.2	Identify and describe the physical properties of matter in its various states.	1
3.3	Describe the forces that directly affect objects and their motion.	1
3.4	Summarize the way changes in temperature can be produced and thermal energy transferred.	1
3.5	Trace how electrical energy flows through a simple electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic forces.	2
3.6	Describe the properties of light and sound energy	1
4	Scientific Methods and Applications	2
4.1	Science and Technology	3
4.1.1	Describe how technology affects human life.	2
4.1.2	Describe and illustrate the design process.	3
4.2	Scientific Inquiry	3
4.2.1	Use appropriate instruments safely to observe, measure and collect data when conducting a scientific investigation.	1
4.2.2	Organize and evaluate observations, measurements and other data to formulate inferences and conclusions.	3
4.2.3	Develop, design and safely conduct scientific investigations and communicate the results.	3
4.3	Scientific Ways of Knowing	2
4.3.1	Distinguish between fact and opinion and explain how ideas and conclusions change as new knowledge is gained.	2
4.3.2	Describe different types of investigations and use results and data from investigations to provide the evidence to support explanations and conclusions.	3
4.3.3	Explain the importance of keeping records of observations and investigations that are accurate and understandable.	1
4.3.4	Explain that men and women of diverse countries and cultures participate in careers in all fields of science	1

Table 5.15
Debriefing Summary
GR5 Science M07 Form 5A

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- The most important topics were covered.
- yes
- I was surprised that the students were not required to construct an experiment. Overall I felt that it was an appropriate level of knowledge required.
- Yes. I thought concepts were worded well and written at the level of the student taking the test.
- I was expecting more of Standard 4.2.3 to be touched on more. There was not a question in there at all where the kids had to develop an investigation to solve a problem. They did talk about keeping conditions the same, but I was actually expecting the kids to have to design an experiment.
- Yes, I believe so. I did expect to see a question or 2 on electricity since 5th Grade is the only one that contains this in the Standards.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- I thought that food chains and webs could be addressed at a level 3
- yes, although level 4 was not met.
- Overall I am surprised at the amount of Level 1's on the DOK. Although, at the grade band of 3-5 it should be at the lower level. I feel, as an educator, I keep hearing that we need to have the students ready to think at higher problem solving levels. They need to have a strong working knowledge of the basic facts that the standards require.
- I did not see the higher level application and reasoning levels. I observed most of these questions as rote memorization.
- Unless I scored them wrong, I felt that there were a lot of level 1s and 2s, and not so much 3s.
- I think so.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- Yes
- yes
- I feel the vocabulary is in line with the standards but the vocabulary is still difficult for fifth graders.
- yes
- Yes, this was written appropriately and I feel the students would be able to read the questions and understand what is being asked of them.
- I think so.

Table 5.15
Debriefing Summary
GR5 Science M07 Form 5A

D. What is your general opinion of the alignment between the standards and assessment:

ii. Acceptable Alignment (6) : 100%

E. Comments

· I would like the opportunity to go back and look at the questions and tally the division of the questions to the standards. It was difficult for me to judge the level of difficulty and the standard and try and keep a realistic judgement of the variety. I would have liked to have more time and not have it squeezed in at the end of a important but long day. I look forward to doing the next form with a fresh start of the day.

Table 5.15
Debriefing Summary
GR5 Science M07 Form 5A

Table 5.1

Categorical Concurrence Between Standards and Assessment as Rated by Six Reviewers

GR5 Science M07 Form 5B

Number of Assessment Items - 38

Standards			Level by Objective			Hits		Cat. Concurr.
Title	Goals #	Objs #	Level	# of objs by Level	% w/in std by Level	Mean	S.D.	
1 - Earth and Space Sciences	4	4	1 2	1 3	25 75	18.83	1.95	YES
2 - Life Sciences	3	3	1 2	1 2	33 66	16.5	3.86	YES
3 - Physical Sciences	6	6.17	1 2	5 1	83 16	11.67	1.49	YES
4 - Scientific Methods and Applications	3	9	1 2 3	3 2 4	33 22 44	13.83	3.80	YES
Total	16	22.17	1 2 3	10 8 4	45 36 18	60.83	6.89	

Table 5.2

Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Assumes Each Objective Should Have Equal Representation)
GR5 Science M07 Form 5B
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	4	4	18.83	1.95	53	40	28	26	18	32	WEAK
2 - Life Sciences	3	3	16.5	3.86	35	37	30	26	35	40	YES
3 - Physical Sciences	6	6.17	11.67	1.49	11	30	80	36	9	25	YES
4 - Scientific Methods and Applications	3	9	13.83	3.80	77	38	22	36	2	9	NO
Total	16	22.17	60.83	6.89	42	45	45	42	13	29	

Table 5.2a

*Alternate Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Does Not Assume Each Objective Should Have Equal Representation)
GR5 Science M07 Form 5B
Number of Assessment Items - 38*

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	4	4	18.83	1.95	54	377	27	26	19	32	WEAK
2 - Life Sciences	3	3	16.5	3.86	33	263	39	26	27	40	YES
3 - Physical Sciences	6	6.17	11.67	1.49	8	52	74	36	17	25	YES
4 - Scientific Methods and Applications	3	9	13.83	3.80	74	381	24	36	2	9	NO
Total	16	22.17	60.83	6.89	42	45	45	42	13	29	

This Table Is In Development And The Results May Be Invalid

Table 5.3

Range-of-Knowledge Correspondence and Balance of Representation Between Standards and Assessment as Rated by Six Reviewers

GR5 Science M07 Form 5B

Number of Assessment Items - 38

Standards			Hits		Range of Objectives				Rng. of Know.	Balance Index				Bal. of Represent.
					# Objs Hit		% of Total			% Hits in Std/Ttl Hits		Index		
Title	Goals #	Objs #	Mean	S.D.	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.	
1 - Earth and Space Sciences	4	4	18.83	1.95	3.33	0.47	83	12	YES	31	4	0.86	0.07	YES
2 - Life Sciences	3	3	16.5	3.86	2.67	0.47	89	16	YES	27	5	0.74	0.04	YES
3 - Physical Sciences	6	6.17	11.67	1.49	5.67	0.47	92	8	YES	19	2	0.74	0.05	YES
4 - Scientific Methods and Applications	3	9	13.83	3.80	4.67	0.47	52	5	YES	23	5	0.63	0.10	WEAK
Total	16	22.17	60.83	6.89	4.08	1.26	79	19		25	6	0.74	0.11	

Table 5.4

Summary of Attainment of Acceptable Alignment Level on Four Content Focus Criteria as Rated by Six Reviewers
GR5 Science M07 Form 5B
Number of Assessment Items - 38

Standards	Alignment Criteria			
	Categorical Concurrence	Depth-of-Knowledge Consistency	Range of Knowledge	Balance of Representation
1 - Earth and Space Sciences	YES	WEAK	YES	YES
2 - Life Sciences	YES	YES	YES	YES
3 - Physical Sciences	YES	YES	YES	YES
4 - Scientific Methods and Applications	YES	NO	YES	WEAK

Table 5.5
Source-of-Challenge Issues by Reviewer
GR5 Science M07 Form 5B

Item Number	Comments by Reviewer
1	I do not think that the students will see this clearly. Most students if they do not have an eraser, just cross the word out, therefore cleaner (A) would be a realistic choice. They would not see paper being saved by the space of a crossed out word or two.
15	I am not so sure that this matches the benchmark very well. I felt like I was stretchng just to match it to this. I don't feel the students are really reading or interpreting a "table" or "chart" like the benchmark says. It's just a picture.
21	I could not find an indicator that addressed bouyancy or density or surface area. Therefore, I do not believe that this item is truly aligned to any indicator even though I put one on this form.
21	Boat shaped clay
21	I think this relates to density, sinking or floating, or surface area. This is not really mentioned 3 - 5
21	I couldn't really find a particular benchmark that this question addressed. I classified it as "properties of matter," however, I think it deals more with density/ bouyancy.

Table 5.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR5 Science M07 Form 5B

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
1	1	1	1	1	2	1
2	1	1	1	1	1	1
3	1	2	2	1	1	2
4	1	2	1	1	2	1
5	1	1	1	1	1	1
6	1	1	1	1	1	1
7	1	1	1	1	2	1
8	1	1	1	1	1	1
9	1	1	1	1	1	1
10	2	1	2	1	1	2
11	3	4	2	2	2	2
12	1	1	1	1	1	1
13	2	2	1	2	2	2
14	1	2	1	1	1	1
15	2	1	1	1	1	1
16	1	2	1	1	1	1
17	2	1	1	2	1	2
18	1	1	1	1	1	1
19	1	1	1	1	1	1
20	1	1	1	1	1	1
21	1	2	1	1	1	1
22	2	2	2	2	2	1
23	1	1	1	1	1	1
24	2	1	1	1	1	1
25	2	2	1	2	2	1
26	2	1	1	1	1	1
27	2	1	1	1	1	1
28	1	2	2	1	1	1
29	2	2	1	1	2	1
30	2	1	1	1	1	1
31	2	2	1	1	1	1
32	2	3	3	2	2	2
33	1	1	1	1	1	1
34	2	2	1	1	1	1
35	2	2	2	1	2	1
36	2	2	1	1	1	1
37	2	1	1	2	1	2
38	1	1	1	1	1	1

Table 5.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR5 Science M07 Form 5B

Intraclass Correlation: 0.8109
Pairwise Comparison: 0.6877

Table 5.7
Notes by Reviewer
GR5 Science M07 Form 5B

Item Number	Comments by Reviewer
11	I think this question hits 4.2.2, 2.2, 1.1 and 2.3
13	I think the key is not clear enough for a fifth grader to make sense of. the size of the rocks are much smaller than the rocks in the picture. It would be easy for them to mix it up with the sand bar.
13	The symbols in the key for the sandbar and the plants look very similar. They don't look exactly like the symbols that are drawn in the diagram. They should be changed to be more clearer and more like what is in the diagram.
15	This question on first glance looks like it is dealing with force. There is so much information that is not relavent, my concern is that the student will spend time trying to comprehend the information and miss the the gist of the question.
18	It is difficult to pick out the cattail that is suppose to look broken. It looks as if it is growing sideways out of the side of the pond.
18	The cattail that is broken in the picture is hard to see. It may need to be enlarged or made more obvious for the kids.
21	Students will choose the boat because boats float!
21	I cann see the students picking the boat because of proir knowledge, boats float on water, not the science behind it. I had a difficult time matching this to a standard
21	I cannot link this to a specific benchmark. No benchmark focuses on identifying shapes that will float.
28	I think this will be a difficult choice for the students. They will need to see the difference between find and capture.
34	Having the grass growing in the stream makes it look like (C) could be correct also.
36	Would it be any value to put this with questions 18 & 19. It already has the picture. Is the picture really necessary for this question.

Table 5.8
DOK Levels and Objectives Coded by Each Reviewer
GR5 Science M07 Form 5B

Item	DO K0	PObj0	S1Obj0	DO K1	PObj1	S1Obj1	S2Obj1	DO K2	PObj2	S1Obj2	S2Obj2	DO K3	PObj3	S1Obj3	DO K4	PObj4	S1Obj4	S2Obj4	DO K5	PObj5	S1Obj5
1	1	4.1.1		1	4.1.1			1	1.3			1	4.1.1		2	4.1.1			1	4.1.1	
2	1	1.4		1	1.4			1	1.4			1	1.4		1	1.4			1	1.4	
3	1	1.4		2	1.4			2	1.4			1	1.4		1	1.4			2	1.4	
4	1	1.4		2	1.4			1	1.4			1	1.4		2	1.4			1	1.4	
5	1	1.4		1	1.4			1	1.4			1	1.4		1	1.4			1	1.4	
6	1	4.2.1	1.4	1	1.4			1	1.4	4.2.1		1	1.4		1	1.4			1	1.4	
7	1	1.1		1	1.1			1	1.1			1	1.1		2	1.1			1	1.1	
8	1	4.3.1		1	4.3.1			1	4.3.1	2.3		1	4.3.1		1	4.3.1			1	4.3.1	
9	1	3.6		1	3.6			1	3.6			1	3.6		1	3.6			1	3.6	
10	2	3.5		1	3.5			2	3.5			1	3.5		1	3.5			2	3.5	
11	3	2.3	4.2.2	4	1.1	2.2		2	4.2.2	2.2	1.1	2	4.2.2	1.1	2	2.3	1.1	4.2.2	2	4.2.2	1.1
12	1	3.3		1	3.3			1	3.5	3.3		1	3.5		1	3.3			1	3.3	
13	2	1.2		2	1.2			1	1.2	4.2.2		2	1.2		2	1.2			2	1.2	
14	1	1.1		2	1.1			1	1.1	4.2.2		1	1.1		1	1.1			1	1.1	
15	2	4.2.2	3.3	1	4.2.1			1	4.2.2	3.3		1	3.3		1	4.2.2			1	3.3	
16	1	2.2		2	2.2			1	2.2	4.2.2		1	2.2		1	2.2			1	2.2	
17	2	3.3		1	3.3			1	3.3			2	3.3		1	3.3			2	3.3	
18	1	3.6		1	3.6			1	3.6			1	3.6		1	3.6			1	3.6	
19	1	1.2		1	1.2			1	1.2			1	2.2		1	1.2			1	1.2	
20	1	2.2		1	2.1			1	2.2			1	2.2		1	2.2			1	2.2	
21	1	3.2		2	3.3			1	3.2			1	3.2		1	3			1	3.2	
22	2	4.1.1		2	4.1.1			2	4.2.2			2	4.1.1		2	4.1.1			1	4.1.1	
23	1	1.4		1	1.4			1	1.4			1	1.4		1	1.4			1	1.4	
24	2	1.2		1	1.2			1	1.2			1	1.2		1	1.2			1	1.2	
25	2	4.2.3		2	4.2.3	4.2.2	4.2.1	1	4.2.3	3.5		2	4.3.2		2	4.1.2			1	4.2.3	
26	2	3.3		1	3.3			1	3.3			1	3.3		1	3.3			1	3.2	
27	2	1.2		1	1.2			1	1.2			1	1.2		1	1.2			1	1.2	
28	1	2.2		2	2.2			2	2.2	4.2.2		1	2.2	4.2.2	1	2.2	4.2.2		1	2.2	
29	2	4.2.2	2.2	2	2.3			1	2.3	4.2.2		1	4.2.2	2.3	2	2.3	4.2.2		1	2.3	
30	2	3.4		1	3.4			1	3.4	2.2		1	2.3		1	3.4			1	3.4	
31	2	2.3		2	2.3			1	2.3			1	2.3		1	2.3			1	2.3	
32	2	2.3	2.2	3	2.2	2.3		3	2.1	2.2		2	2.2		2	2.2	4.2.2		2	2.2	
33	1	2.2		1	1.3			1	2.2			1	2.2		1	2.3			1	2.2	
34	2	2.3		2	1.2			1	2.3			1	2.3		1	1.2	4.2.2		1	1.2	
35	2	4.2.2	2.1	2	2.1			2	4.2.2	2.1		1	4.2.2		2	4.2.2	2.1		1	4.2.2	2.2
36	2	1.4		2	1.4			1	1.4			1	1.4		1	1.4			1	3.1	
37	2	3.3		1	3.2			1	3.3			2	4.2.3		1	4.2.3			2	3.3	4.2.2
38	1	3.1		1	3.1			1	3.2			1	3.1		1	3.1			1	3.1	

Objective Pairwise Comparison: 0.6583

Standard Pairwise Comparison: 0.7948

Table 5.9
Objectives Coded to Each Item by Reviewers
GR5 Science M07 Form 5B

Low		Medium		High						
6		9.605263		56						
1	1.3	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1				
2	1.4	1.4	1.4	1.4	1.4	1.4				
3	1.4	1.4	1.4	1.4	1.4	1.4				
4	1.4	1.4	1.4	1.4	1.4	1.4				
5	1.4	1.4	1.4	1.4	1.4	1.4				
6	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	1.4	1.4	4.2.1	4.2.1	4.2.1	4.2.1				
7	1.1	1.1	1.1	1.1	1.1	1.1				
8	2.3	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1			
9	3.6	3.6	3.6	3.6	3.6	3.6				
10	3.5	3.5	3.5	3.5	3.5	3.5				
11	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	
	1.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	4.2.2	
	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	
	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	
	4.2.2									
12	3.3	3.3	3.3	3.3	3.3	3.5	3.5			
13	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	1.2	1.2	4.2.2	4.2.2						
14	1.1	1.1	1.1	1.1	1.1	1.1	4.2.2			
15	3.3	3.3	3.3	3.3	4.2.1	4.2.2	4.2.2	4.2.2		
16	2.2	2.2	2.2	2.2	2.2	2.2	4.2.2			
17	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
	3.3	3.3								
18	3.6	3.6	3.6	3.6	3.6	3.6				
19	1.2	1.2	1.2	1.2	1.2	2.2				
20	2.1	2.2	2.2	2.2	2.2	2.2				
21	3	3.2	3.2	3.2	3.2	3.3				
22	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1
	4.2.2	4.2.2								
23	1.4	1.4	1.4	1.4	1.4	1.4				
24	1.2	1.2	1.2	1.2	1.2	1.2				
25	3.5	4.1.2	4.2.1	4.2.2	4.2.3	4.2.3	4.2.3	4.2.3	4.3.2	
26	3.2	3.3	3.3	3.3	3.3	3.3				
27	1.2	1.2	1.2	1.2	1.2	1.2				
28	2.2	2.2	2.2	2.2	2.2	2.2	4.2.2	4.2.2	4.2.2	

Table 5.9
Objectives Coded to Each Item by Reviewers
GR5 Science M07 Form 5B

29	2.2	2.3	2.3	2.3	2.3	2.3	4.2.2	4.2.2	4.2.2	4.2.2
30	2.2	2.3	3.4	3.4	3.4	3.4	3.4			
31	2.3	2.3	2.3	2.3	2.3	2.3				
32	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2
	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	4.2.2	
	4.2.2	4.2.2	4.2.2							
33	1.3	2.2	2.2	2.2	2.2	2.3				
34	1.2	1.2	1.2	2.3	2.3	2.3	4.2.2			
35	2.1	2.1	2.1	2.1	2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2
36	1.4	1.4	1.4	1.4	1.4	3.1				
37	3.2	3.3	3.3	3.3	4.2.2	4.2.3	4.2.3			
38	3.1	3.1	3.1	3.1	3.1	3.2				

Table 5.10
 Items Coded by Reviewers to Each Objective
 GR5 Science M07 Form 5B

Low		Medium		High
0		12.16667		57

1																				
1.1	7	7	7	7	7	7	11	11	11	11	11	11	11	11	11	11	11	11	11	
	11	11	11	11	11	11	14	14	14	14	14	14								
1.2	13	13	13	13	13	13	13	13	13	13	13	13	19	19	19	19	19	24	24	24
	24	24	24	27	27	27	27	27	27	27	34	34	34							
1.3	1	33																		
1.4	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5
	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	23	23	23	
	23	23	23	36	36	36	36	36												
2																				
2.1	20	32	32	32	32	35	35	35	35											
2.2	11	11	11	11	11	11	11	11	16	16	16	16	16	16	19	20	20	20	20	20
	28	28	28	28	28	28	29	30	32	32	32	32	32	32	32	32	32	32	32	32
	32	32	32	32	32	32	32	32	32	32	32	32	32	32	33	33	33	33	35	
2.3	8	11	11	11	11	11	11	11	11	29	29	29	29	29	30	31	31	31	31	31
	31	32	32	32	32	32	32	32	32	33	34	34	34							
3	21																			
3.1	36	38	38	38	38	38														
3.2	21	21	21	21	26	37	38													
3.3	12	12	12	12	12	15	15	15	15	17	17	17	17	17	17	17	17	17	17	17
	17	21	26	26	26	26	26	37	37	37										
3.4	30	30	30	30	30															
3.5	10	10	10	10	10	10	12	12	25											
3.6	9	9	9	9	9	9	18	18	18	18	18	18								
4																				
4.1																				
4.1.1	1	1	1	1	1	22	22	22	22	22	22	22	22	22	22	22	22	22	22	
4.1.2	25																			
4.2																				
4.2.1	6	6	6	6	15	25														
4.2.2	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	13	13	14	15	15	15	16	22	22	25	28	28	28	29	29	29	29	32	32	
	32	32	34	35	35	35	35	35	37											
4.2.3	25	25	25	25	37	37														
4.3																				
4.3.1	8	8	8	8	8	8														
4.3.2	25																			
4.3.3																				

Table 5.10
Items Coded by Reviewers to Each Objective
GR5 Science M07 Form 5B

4.3.4

Table 5.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR5 Science M07 Form 5B

Low		Medium		High
1		3		6

1	1.3: 1	4.1.1 :5		
2	1.4: 6			
3	1.4: 6			
4	1.4: 6			
5	1.4: 6			
6	1.4: 6	4.2.1 :2		
7	1.1: 6			
8	2.3: 1	4.3.1 :6		
9	3.6: 6			
10	3.5: 6			
11	1.1: 5	2.2: 2	2.3: 2	4.2.2 :5
12	3.3: 5	3.5: 2		
13	1.2: 6	4.2.2 :1		
14	1.1: 6	4.2.2 :1		
15	3.3: 4	4.2.1 :1	4.2.2 :3	
16	2.2: 6	4.2.2 :1		
17	3.3: 6			
18	3.6: 6			
19	1.2: 5	2.2: 1		
20	2.1: 1	2.2: 1		

Table 5.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)
GR5 Science M07 Form 5B

	1	5				
21	3:1	3.2: 4	3.3: 1			
22	4.1.1 :5	4.2.2 :1				
23	1.4: 6					
24	1.2: 6					
25	3.5: 1	4.1.2 :1	4.2.1 :1	4.2.2 :1	4.2.3 :4	4.3.2 :1
26	3.2: 1	3.3: 5				
27	1.2: 6					
28	2.2: 6	4.2.2 :3				
29	2.2: 1	2.3: 5	4.2.2 :4			
30	2.2: 1	2.3: 1	3.4: 5			
31	2.3: 6					
32	2.1: 1	2.2: 6	2.3: 2	4.2.2 :1		
33	1.3: 1	2.2: 4	2.3: 1			
34	1.2: 3	2.3: 3	4.2.2 :1			
35	2.1: 4	2.2: 1	4.2.2 :5			
36	1.4: 5	3.1: 1				
37	3.2: 1	3.3: 3	4.2.2 :1	4.2.3 :2		
38	3.1: 5	3.2: 1				

Table 5.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR5 Science M07 Form 5B

Low DOK		Matched DOK		High DOK
1		3		6

1										
[2]:										
1.1	7:6[	11:5	14:6							
[1]:	1.17	[2.4]	[1.1							
	]		7]							
1.2	13:6	19:5	24:6	27:6	34:3					
[2]:	[1.8	[1]	[1.1	[1.1	[1.3					
	3]		7]	7]	3]					
1.3	1:1[	33:1								
[2]:	1]	[1]								
1.4	2:6[	3:6[	4:6[	5:6[	6:6[	23:6	36:5			
[2]:	1]	1.5]	1.33	1]	1]	[1]	[1.4]			
]							
2										
[2]:										
2.1	20:1	32:1	35:4							
[1]:	[1]	[3]	[2]							
2.2	11:2	16:6	19:1	20:5	28:6	29:1	30:1	32:6	33:4	35:1
[2]:	[3]	[1.1	[1]	[1]	[1.3	[2]	[1]	[2.3	[1]	[1]
		7]			3]			3]		
2.3	8:1[	11:2	29:5	30:1	31:6	32:2	33:1	34:3		
[2]:	1]	[2.5]	[1.4]	[1]	[1.3	[2.5]	[1]	[1.3		
					3]			3]		
3										
[1]:										
3.1	21:1									
[1]:	[1]									
3.1	36:1	38:5								
[1]:	[1]	[1]								
3.2	21:4	26:1	37:1	38:1						
[1]:	[1]	[1]	[1]	[1]						
3.3	12:5	15:4	17:6	21:1	26:5	37:3				
[1]:	[1]	[1.2	[1.5]	[2]	[1.2]	[1.6				
		5]				7]				
3.4	30:5									
[1]:	[1.2]									
3.5	10:6	12:2	25:1							
[2]:	[1.5]	[1]	[1]							
3.6	9:6[	18:6								
[1]:	1]	[1]								

Table 5.14
Group Consensus
Gr 5 Science Combined, Science, Grade 5

Level	Description	DOK
1	Earth and Space Sciences	2
1.1	Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.	1
1.2	Summarize the processes that shape Earth's surface and describe evidence of those processes.	2
1.3	Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.	2
1.4	Analyze weather and changes that occur over a period of time.	2
2	Life Sciences	2
2.1	Differentiate between the life cycles of different plants and animals.	1
2.2	Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.	2
2.3	Compare changes in an organism's ecosystem/ habitat that affect its survival.	2
3	Physical Sciences	1
3.1	Compare the characteristics of simple physical and chemical changes.	1
3.2	Identify and describe the physical properties of matter in its various states.	1
3.3	Describe the forces that directly affect objects and their motion.	1
3.4	Summarize the way changes in temperature can be produced and thermal energy transferred.	1
3.5	Trace how electrical energy flows through a simple electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic forces.	2
3.6	Describe the properties of light and sound energy	1
4	Scientific Methods and Applications	2
4.1	Science and Technology	3
4.1.1	Describe how technology affects human life.	2
4.1.2	Describe and illustrate the design process.	3
4.2	Scientific Inquiry	3
4.2.1	Use appropriate instruments safely to observe, measure and collect data when conducting a scientific investigation.	1
4.2.2	Organize and evaluate observations, measurements and other data to formulate inferences and conclusions.	3
4.2.3	Develop, design and safely conduct scientific investigations and communicate the results.	3
4.3	Scientific Ways of Knowing	2
4.3.1	Distinguish between fact and opinion and explain how ideas and conclusions change as new knowledge is gained.	2
4.3.2	Describe different types of investigations and use results and data from investigations to provide the evidence to support explanations and conclusions.	3
4.3.3	Explain the importance of keeping records of observations and investigations that are accurate and understandable.	1
4.3.4	Explain that men and women of diverse countries and cultures participate in careers in all fields of science	1

Table 5.15

Debriefing Summary

GR5 Science M07 Form 5B

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- I felt that rocks and soils could have been covered more in depth. I would have liked to have seen a question or two on renewable vs. nonrenewable resources.
- Physical and chemical changes were only addressed once. I also feel there was an over abundance of benchmark 1, especially 1.4. There could have been a few more benchmarks 4 covered.
- The Science and Technology, Scientific and Scientific Ways of Knowing were not tested as much as I thought they would have been. I am not sure that they should be 3 different standards to begin with. with the exception of reading and interpreting graphs and tables. Reading graphs and tables was covered a lot.
- yes, concepts were covered
- I felt that in the Physical Sciences standard there was little attention paid to physical and chemical changes and the physical properties of matter. In the Science Inquiry I felt again that the scientific process was left out. I was expecting more questions to be on there about creating and designing an experiment to solve a problem. I also felt on this test not enough was done about keeping experiments fair and how results can be affected by variables and testing conditions. Everything else was tested and covered pretty well.
- I think so.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- I felt that this form had higher DOK levels than Form A. This was what I expected.
- all levels were addressed, most at DOK1.
- I thought that the students would have to perform at a higher level of performance. Although, I feel this is a much more realistic expectation for 5th graders to perform at this level. It still is an amazing amount of reading and information for them to process in one sitting. I think the more mature student will fair better than the student with more knowledge of science. The average fifth grade student does not have the attention span to work diligently at each question.
- I did not identify any DOK 3 or 4 level questions
- Since most of our benchmarks were level 1s or 2s, I felt the questions did a pretty good jbb covering this. I would have liked to have seen one or two level 3 questions. Unless I scored them wrong I had none. They might be harder to score, but the students should be challenged on atleast a couple of the questions. This could have been done in the science inquiry section.
- I believe it did a pretty good job for this grade ban. I did expect to see some DOK 3 questions, and I didn't feel any of the items on this particular assessment reached the level 3.

Table 5.15
Debriefing Summary
GR5 Science M07 Form 5B

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- I think that everything was written appropriately.
- yes
- I feel the vocabulary in the test mirrors the vocabulary in the standards, but the vocabulary is still demanding for the typical let alone struggling students.
- Yes
- I feel that an average fifth grader should be able to take this test. What I am not so sure about are the special education students and the ESL students. These students, even with their discrepancies, have to take the same test and their scores count for/against their teacher. This is not a fair test to those students who have some learning discrepancies beyond anyone's control. If these tests are going to be administered to those students this must be taken into consideration.
- Yes.

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (5) : 83%
- iii. Needs slight improvement (1) : 17%

E. Comments

- The test itself seemed aligned to the benchmarks and indicators, but there was an overabundance of the Earth/Space benchmarks. Motion benchmarks were also covered more than the other Physical science benchmarks.

Table 8.1
Categorical Concurrence Between Standards and Assessment as Rated by Five Reviewers
GR8 Science M07 Form 8A
Number of Assessment Items - 38

Standards			Level by Objective			Hits		Cat. Concurr.
Title	Goals #	Objs #	Level	# of objs by Level	% w/in std by Level	Mean	S.D.	
1 - Earth and Space Sciences	5	5	1 2	3 2	60 40	14.8	3.87	YES
2 - Life Sciences	4	4	1 2	1 3	25 75	12.2	1.47	YES
3 - Physical Sciences	4	4.2	1 2	2 2	50 50	12.8	1.94	YES
4 - Scientific Methods and Applications	3	7.2	2 3	4 3	57 42	18.6	11.83	YES
Total	16	20.4	1 2 3	6 11 3	30 55 15	58.4	13.34	

Table 8.2

Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Five Reviewers (Assumes Each Objective Should Have Equal Representation)
GR8 Science M07 Form 8A
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	5	5	14.8	3.87	21	39	56	41	24	31	YES
2 - Life Sciences	4	4	12.2	1.47	14	24	64	33	22	31	YES
3 - Physical Sciences	4	4.2	12.8	1.94	14	26	53	35	33	37	YES
4 - Scientific Methods and Applications	3	7.2	18.6	11.83	41	38	43	35	16	31	YES
Total	16	20.4	58.4	13.34	22	35	54	37	23	33	

Table 8.2a

Alternate Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Five Reviewers (Does Not Assume Each Objective Should Have Equal Representation)

GR8 Science M07 Form 8A

Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	5	5	14.8	3.87	14	83	50	41	36	31	YES
2 - Life Sciences	4	4	12.2	1.47	16	101	59	33	25	31	YES
3 - Physical Sciences	4	4.2	12.8	1.94	10	66	51	35	39	37	YES
4 - Scientific Methods and Applications	3	7.2	18.6	11.83	49	383	38	35	13	31	YES
Total	16	20.4	58.4	13.34	22	35	54	37	23	33	

This Table Is In Development And The Results May Be Invalid

Table 8.3

*Range-of-Knowledge Correspondence and Balance of Representation Between Standards and Assessment as Rated by Five Reviewers
GR8 Science M07 Form 8A
Number of Assessment Items - 38*

Standards			Hits		Range of Objectives				Rng. of Know.	Balance Index				Bal. of Represent.
					# Objs Hit		% of Total			% Hits in Std/Ttl Hits		Index		
Title	Goals #	Objs #	Mean	S.D.	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.	
1 - Earth and Space Sciences	5	5	14.8	3.87	4.6	0.8	92	16	YES	26	6	0.72	0.11	YES
2 - Life Sciences	4	4	12.2	1.47	3.8	0.4	95	10	YES	21	3	0.85	0.10	YES
3 - Physical Sciences	4	4.2	12.8	1.94	3.6	0.49	86	12	YES	23	7	0.77	0.04	YES
4 - Scientific Methods and Applications	3	7.2	18.6	11.83	3.8	1.17	53	18	YES	29	13	0.74	0.07	YES
Total	16	20.4	58.4	13.34	3.95	0.86	82	22		25	9	0.77	0.10	

Table 8.4

Summary of Attainment of Acceptable Alignment Level on Four Content Focus Criteria as Rated by Five Reviewers
GR8 Science M07 Form 8A
Number of Assessment Items - 38

Standards	Alignment Criteria			
	Categorical Concurrence	Depth-of-Knowledge Consistency	Range of Knowledge	Balance of Representation
1 - Earth and Space Sciences	YES	YES	YES	YES
2 - Life Sciences	YES	YES	YES	YES
3 - Physical Sciences	YES	YES	YES	YES
4 - Scientific Methods and Applications	YES	YES	YES	YES

Table 8.5
Source-of-Challenge Issues by Reviewer
GR8 Science M07 Form 8A

Item Number	Comments by Reviewer
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Table 8.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR8 Science M07 Form 8A

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5
1	2	2	2	2	1
2	1	1	1	2	1
3	1	1	1	1	1
4	2	2	2	2	1
5	2	1	2	2	2
6	2	2	2	3	2
7	2	2	2	2	2
8	2	2	1	2	2
9	2	3	2	2	2
10	2	2	2	2	2
11	3	3	3	3	3
12	1	1	1	1	1
13	2	2	1	2	1
14	1	2	2	2	1
15	1	2	1	1	2
16	1	2	1	2	1
17	2	3	2	3	3
18	1	1	1	1	1
19	1	1	1	2	1
20	1	1	1	1	1
21	1	1	2	2	1
22	2	2	2	2	2
23	3	3	3	3	2
24	1	2	1	2	1
25	2	1	2	2	1
26	2	2	2	2	1
27	2	2	1	2	2
28	2	2	2	3	3
29	2	3	2	2	2
30	1	2	2	2	1
31	1	1	1	1	1
32	3	3	3	3	3
33	2	2	2	2	1
34	1	1	1	2	1
35	1	1	1	1	1
36	1	1	1	1	1
37	2	2	1	2	1
38	2	1	1	2	1

Table 8.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR8 Science M07 Form 8A

Intraclass Correlation: 0.9098
Pairwise Comparison: 0.6632

Table 8.7
Notes by Reviewer
GR8 Science M07 Form 8A

Item Number Comments by Reviewer

Table 8.8
DOK Levels and Objectives Coded by Each Reviewer
GR8 Science M07 Form 8A

Item	DOK0	PObj0	S1Obj 0	DOK1	PObj1	S1Obj 1	S2Obj 1	DOK2	PObj2	S1Obj 2	DOK3	PObj3	DOK4	PObj4
1	2	4.2.1		2	3.1	4.2.2		2	3		2	3.1	1	3.1
2	1	2.3		1	2.3			1	2.4		2	2.3	1	2.3
3	1	4.2.1		1	4.2.1			1	4.2.1		1	4.2.1	1	4.2.1
4	2	4.2.2		2	4.2.1	4.2.2	4.3.1	2	4.3.1		2	4.2.2	1	4.3.1
5	2	4.2.2		1	4.2.2			2	4.3.1		2	4.2.2	2	4.2.2
6	2	4.2.2		2	4.2.1	4.3.2	4.2.2	2	4.3.1		3	4.2.2	2	3.1
7	2	1.3		2	4.2.2			2	4.2.2		2	1.3	2	1.3
8	2	1.3	4.2.2	2	1.3			1	4.2.2		2	1.3	2	1.3
9	2	1.3	4.2.2	3	1.3			2	4.3.1		2	1.3	2	1.3
10	2	1.3	4.2.2	2	4.2.2			2	4.2.2		2	1.3	2	1.3
11	3	1.3	4.2.2	3	1.3	4.2.2		3	4.2.2		3	1.3	3	1.3
12	1	1.4		1	1.4			1	1.4		1	1.4	1	1.4
13	2	4.1.1		2	3.3	4.1.1		1	3.3		2	3.3	1	3.3
14	1	1.3		2	2.3			2	2.4		2	2.3	1	2.3
15	1	3.1		2	3.1	4.2.2		1	4.2.2		1	3.1	2	3.1
16	1	2.3		2	2.4	2.2		1	2.4		2	2.1	1	2.2
17	2	4.3.2		3	4.3.2	4.3.1	4.2.2	2	4.2.1		3	4.3	3	4.2.2
18	1	1.5		1	1.4	1.5		1	1.4		1	1.5	1	1.4
19	1	2.1		1	2.1			1	2.1		2	2.1	1	2.1
20	1	3.3		1	3.3			1	3.3		1	1.4	1	3.3
21	1	2.1		1	2.1			2	2.2		2	2.1	1	2.1
22	2	2.2		2	2.4	2.2		2	2.2		2	2.2	2	2.2
23	3	2.4		3	2.3			3	2.3		3	2.3	2	2.3
24	1	1.1		2	1.1			1	1.1		2	1.1	1	1.1
25	2	4.2.2		1	3.2			2	3.2		2	3.2	1	3.2
26	2	3.2		2	3.2	4.2.2		2	3.4	3.2	2	3.2	1	3.2
27	2	3.2	4.2.2	2	3.2			1	1.2		2	3.2	2	3.2
28	2	3.2	4.2.2	2	3.2	4.2.2		2	3.2	4.2.2	3	3.2	3	3.2
29	2	2.4		3	2.4	4.2.2	1.4	2	2.4		2	2.4	2	1.5
30	1	2.1		2	2.1			2	2.1		2	2.1	1	2.2
31	1	3.2		1	1.2	1.1		1	1.2		1	1.2	1	1.2
32	3	3.3	4.2.1	3	4.1.2	1.3	4.1.1	3	3.3		3	3.3	3	3.3
33	2	2.3		2	2.2	2.4		2	2.4		2	2.3	1	2.2
34	1	1.2		1	1.2			1	1.2		2	1.2	1	4.2.1
35	1	2.1		1	2.1			1	2.1		1	2.1	1	2.1
36	1	1.1		1	1.1			1	1.1		1	1.1	1	1.1
37	2	3.3		2	3.4			1	3.4		2	3.3	1	3.4
38	2	1.1		1	1.1			1	1.1		2	1.1	1	1.1

Objective Pairwise Comparison: 0.4785
Standard Pairwise Comparison: 0.7291

Table 8.9
 Objectives Coded to Each Item by Reviewers
 GR8 Science M07 Form 8A

Low		Medium		High
5		7.68421		32

1	3	3.1	3.1	3.1	4.2.1	4.2.2					
2	2.3	2.3	2.3	2.3	2.4						
3	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1						
4	4.2.1	4.2.2	4.2.2	4.2.2	4.3.1	4.3.1	4.3.1				
5	4.2.2	4.2.2	4.2.2	4.2.2	4.3.1						
6	3.1	3.1	4.2.1	4.2.1	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2
	4.3.1	4.3.1	4.3.2	4.3.2							
7	1.3	1.3	1.3	4.2.2	4.2.2						
8	1.3	1.3	1.3	1.3	4.2.2	4.2.2					
9	1.3	1.3	1.3	1.3	4.2.2	4.3.1					
10	1.3	1.3	1.3	4.2.2	4.2.2	4.2.2					
11	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
	1.3	1.3	1.3	1.3	1.3	1.3	4.2.2	4.2.2	4.2.2		
	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2		
12	1.4	1.4	1.4	1.4	1.4						
13	3.3	3.3	3.3	3.3	4.1.1	4.1.1					
14	1.3	2.3	2.3	2.3	2.4						
15	3.1	3.1	3.1	3.1	4.2.2	4.2.2					
16	2.1	2.2	2.2	2.3	2.4	2.4					
17	4.2.1	4.2.1	4.2.2	4.2.2	4.2.2	4.2.2	4.3	4.3	4.3.1	4.3.1	
	4.3.2	4.3.2	4.3.2	4.3.2							
18	1.4	1.4	1.4	1.5	1.5	1.5					
19	2.1	2.1	2.1	2.1	2.1						
20	1.4	3.3	3.3	3.3	3.3						
21	2.1	2.1	2.1	2.1	2.2						
22	2.2	2.2	2.2	2.2	2.2	2.4					
23	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.4	
24	1.1	1.1	1.1	1.1	1.1						
25	3.2	3.2	3.2	3.2	4.2.2						
26	3.2	3.2	3.2	3.2	3.2	3.4	4.2.2				
27	1.2	3.2	3.2	3.2	3.2	4.2.2					
28	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2					
29	1.4	1.5	2.4	2.4	2.4	2.4	4.2.2				
30	2.1	2.1	2.1	2.1	2.2						
31	1.1	1.2	1.2	1.2	1.2	3.2					

Table 8.9
Objectives Coded to Each Item by Reviewers
GR8 Science M07 Form 8A

32	1.3	1.3	1.3	1.3	3.3	3.3	3.3	3.3	3.3	3.3
	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	
	3.3	4.1.1	4.1.1	4.1.1	4.1.1	4.1.2	4.1.2	4.1.2	4.1.2	
	4.2.1	4.2.1	4.2.1	4.2.1						
33	2.2	2.2	2.3	2.3	2.4	2.4				
34	1.2	1.2	1.2	1.2	4.2.1					
35	2.1	2.1	2.1	2.1	2.1					
36	1.1	1.1	1.1	1.1	1.1					
37	3.3	3.3	3.4	3.4	3.4					
38	1.1	1.1	1.1	1.1	1.1					

Table 8.10
 Items Coded by Reviewers to Each Objective
 GR8 Science M07 Form 8A

Low		Medium		High
0		10.42857		50

1																			
1.1	24	24	24	24	24	31	36	36	36	36	36	38	38	38	38	38			
1.2	27	31	31	31	31	34	34	34	34										
1.3	7	7	7	8	8	8	8	9	9	9	9	10	10	10	11	11	11	11	11
	11	11	11	11	11	11	11	11	11	11	14	32	32	32	32				
1.4	12	12	12	12	12	18	18	18	20	29									
1.5	18	18	18	29															
2																			
2.1	16	19	19	19	19	19	21	21	21	21	30	30	30	30	35	35	35	35	35
2.2	16	16	21	22	22	22	22	22	30	33	33								
2.3	2	2	2	2	14	14	14	16	23	23	23	23	23	23	23	33	33		
2.4	2	14	16	16	22	23	23	29	29	29	29	33	33						
3	1																		
3.1	1	1	1	6	6	15	15	15	15										
3.2	25	25	25	25	26	26	26	26	26	27	27	27	27	28	28	28	28	28	28
	28	28	28	31															
3.3	13	13	13	13	20	20	20	20	32	32	32	32	32	32	32	32	32	32	32
	32	32	32	32	37	37													
3.4	26	37	37	37															
4																			
4.1																			
4.1.1	13	13	32	32	32	32													
4.1.2	32	32	32	32															
4.2																			
4.2.1	1	3	3	3	3	3	4	6	6	17	17	32	32	32	32	34			
4.2.2	1	4	4	4	5	5	5	5	6	6	6	6	6	6	7	7	8	8	9
	10	10	11	11	11	11	11	11	11	11	11	11	11	11	15	15	17	17	17
	17	25	26	27	28	28	28	28	28	28	29								
4.3	17	17																	
4.3.1	4	4	4	5	6	6	9	17	17										
4.3.2	6	6	17	17	17	17													
4.3.3																			

Table 8.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)
 GR8 Science M07 Form 8A

Low		Medium		High
1		2		5

1	3:1 :	3.1: 3	4.2.1 :1	4.2.2 :1	
2	2.3: 4	2.4: 1			
3	4.2.1 :5				
4	4.2.1 :1	4.2.2 :3	4.3.1 :3		
5	4.2.2 :4	4.3.1 :1			
6	3.1: 1	4.2.1 :1	4.2.2 :3	4.3.1 :1	4.3.2 :1
7	1.3: 3	4.2.2 :2			
8	1.3: 4	4.2.2 :2			
9	1.3: 4	4.2.2 :1	4.3.1 :1		
10	1.3: 3	4.2.2 :3			
11	1.3: 4	4.2.2 :3			
12	1.4: 5				
13	3.3: 4	4.1.1 :2			
14	1.3: 1	2.3: 3	2.4: 1		
15	3.1: 4	4.2.2 :2			
16	2.1: 1	2.2: 2	2.3: 1	2.4: 2	
17	4.2.1 :1	4.2.2 :2	4.3: 1	4.3.1 :1	4.3.2 :2
18	1.4: 3	1.5: 3			
19	2.1: 5				
20	1.4: :	3.3: :			

Table 8.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)
 GR8 Science M07 Form 8A

	1	4			
21	2.1: 4	2.2: 1			
22	2.2: 5	2.4: 1			
23	2.3: 4	2.4: 1			
24	1.1: 5				
25	3.2: 4	4.2.2 :1			
26	3.2: 5	3.4: 1	4.2.2 :1		
27	1.2: 1	3.2: 4	4.2.2 :1		
28	3.2: 5	4.2.2 :3			
29	1.4: 1	1.5: 1	2.4: 4	4.2.2 :1	
30	2.1: 4	2.2: 1			
31	1.1: 1	1.2: 4	3.2: 1		
32	1.3: 1	3.3: 4	4.1.1 :1	4.1.2 :1	4.2.1 :1
33	2.2: 2	2.3: 2	2.4: 2		
34	1.2: 4	4.2.1 :1			
35	2.1: 5				
36	1.1: 5				
37	3.3: 2	3.4: 3			
38	1.1: 5				

Table 8.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR8 Science M07 Form 8A

Low DOK		Matched DOK		High DOK
1		2		5

1							
[1]:							
1.1	24:5	31:1	36:5	38:5			
[1]:	[1.4]	[1]	[1]	[1.4]			
1.2	27:1	31:4	34:4				
[1]:	[1]	[1]	[1.25]				
1.3	7:3	8:4	9:4	10:3	11:4	14:1	32:1
[2]:	[2]	[2]	[2.25]	[2]	[3]	[1]	[3]
1.4	12:5	18:3	20:1	29:1			
[2]:	[1]	[1]	[1]	[3]			
1.5	18:3	29:1					
[1]:	[1]	[2]					
2							
[2]:							
2.1	16:1	19:5	21:4	30:4	35:5		
[1]:	[2]	[1.2]	[1.25]	[1.75]	[1]		
2.2	16:2	21:1	22:5	30:1	33:2		
[2]:	[1.5]	[2]	[2]	[1]	[1.5]		
2.3	2:4	14:3	16:1	23:4	33:2		
[2]:	[1.25]	[1.67]	[1]	[2.75]	[2]		
2.4	2:1	14:1	16:2	22:1	23:1	29:4	33:2
[2]:	[1]	[2]	[1.5]	[2]	[3]	[2.25]	[2]
3							
[2]:							
3.1	1:3	6:1	15:4				
[2]:	[1.67]	[2]	[1.5]				
3.2	25:4	26:5	27:4	28:5	31:1		
[2]:	[1.5]	[1.8]	[2]	[2.4]	[1]		
3.3	13:4	20:4	32:4	37:2			
[1]:	[1.5]	[1]	[3]	[2]			
3.4	26:1	37:3					
[1]:	[2]	[1.3]					

Table 8.14
Group Consensus
Gr 8 Science Combined, Science, Grade 8

Level	Description	DOK
1	Earth and Space Sciences	1
1.1	Describe how the positions and motions of the objects in the universe cause predictable and cyclic events.	1
1.2	Explain that the universe is composed of vast amounts of matter, most of which is at incomprehensible distances and held together by gravitational force. Describe how the universe is studied by the use of equipment such as telescopes, probes, satellites and spacecraft.	1
1.3	Describe interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g., water cycle, weather and pollution).	2
1.4	Identify that the lithosphere contains rocks and minerals and that minerals make up rocks. Describe how rocks and minerals are formed and/or classified.	2
1.5	Describe the processes that contribute to the continuous changing of Earth's surface (e.g., earthquakes, volcanic eruptions, erosion, mountain building and lithospheric plate movements).	1
2	Life Sciences	2
2.1	Differentiate between the life cycles of different plants and animals.	1
2.2	Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.	2
2.3	Compare changes in an organism's ecosystem/ habitat that affect its survival.	2
2.4	Explain how the extinction	2
3	Physical Sciences	2
3.1	Relate uses, properties and chemical processes to the behavior and/or arrangement of the small particles that compose matter.	2
3.2	In simple cases, describe the motion of objects and conceptually describe the effects of forces on an object.	2
3.3	Describe renewable and nonrenewable sources of energy (e.g., solar, wind, fossil fuels, biomass, hydroelectricity, geothermal and nuclear energy) and the management of these sources.	1
3.4	Describe that energy takes many forms, some forms represent kinetic energy and some forms represent potential energy; and during energy transformations the total amount of energy remains constant	1
4	Scientific Methods and Applications	2
4.1	Science and Technology	3
4.1.1	Give examples of how technological advances, influenced by scientific knowledge, affect the quality of life.	2
4.1.2	Design a solution or product taking into account needs and constraints (e.g., cost, time, trade-offs, properties of materials, safety and aesthetics).	3
4.2	Scientific Inquiry	3
4.2.1	Explain that there are differing sets of procedures for guiding scientific investigations and procedures are determined by the nature of the investigation, safety considerations and appropriate tools.	2
4.2.2	Analyze and interpret data from scientific investigations using appropriate mathematical	3

Table 8.14
Group Consensus
Gr 8 Science Combined, Science, Grade 8

Level	Description	DOK
	skills in order to draw valid conclusions.	
4.3	Scientific Ways of Knowing	2
4.3.1	Use skills of scientific inquiry processes (e.g., hypothesis, record keeping, description and explanation).	3
4.3.2	Explain the importance of reproducibility and reduction of bias in scientific methods.	2
4.3.3	Give examples of how thinking scientifically is helpful in daily life.	2

Table 8.15
Debriefing Summary
GR8 Science M07 Form 8A

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- yes
- Yes, most of the topics were covered.
- Yes
- Yes
- I expected there to be more plate tectonics. (1.5) This unifying concept should be covered more heavily.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- yes
- I scored very few items at level 3 and none at level 4. It would be vrey difficult to have a level 4 paper & pencil item. I would have prefered to see fewer recall items.
- Yes

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- yes
- Yes.
- yes
- No,it assumes that the students taking this test are within the average to above average range in IQ and have no disabilities or other handicapping conditions. Many students who are not identified within the special education category have low-average or below average IQ's. They would have difficulty relaying what they know with this test format. Most in your special education population would find the design of this test impossible to show what they know. They will not pass this test.
- yes

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (5) : 100%

E. Comments

Table 8.1
Categorical Concurrence Between Standards and Assessment as Rated by Five Reviewers
GR8 Science M07 Form 8B
Number of Assessment Items - 38

Standards			Level by Objective			Hits		Cat. Concurr.
Title	Goals #	Objs #	Level	# of objs by Level	% w/in std by Level	Mean	S.D.	
1 - Earth and Space Sciences	5	5	1 2	3 2	60 40	12.4	1.36	YES
2 - Life Sciences	4	4	1 2	1 3	25 75	13.2	0.98	YES
3 - Physical Sciences	4	4	1 2	2 2	50 50	11.8	2.71	YES
4 - Scientific Methods and Applications	3	7	2 3	4 3	57 42	18	7.56	YES
Total	16	20	1 2 3	6 11 3	30 55 15	55.4	7.89	

Table 8.2

Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Five Reviewers (Assumes Each Objective Should Have Equal Representation)

GR8 Science M07 Form 8B

Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	5	5	12.4	1.36	16	32	68	34	16	26	YES
2 - Life Sciences	4	4	13.2	0.98	20	28	75	29	5	12	YES
3 - Physical Sciences	4	4	11.8	2.71	12	26	54	36	33	37	YES
4 - Scientific Methods and Applications	3	7	18	7.56	36	35	46	34	18	28	YES
Total	16	20	55.4	7.89	20	31	63	35	18	29	

Table 8.2a

Alternate Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Five Reviewers (Does Not Assume Each Objective Should Have Equal Representation)

GR8 Science M07 Form 8B

Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	5	5	12.4	1.36	9	56	61	34	30	26	YES
2 - Life Sciences	4	4	13.2	0.98	21	112	68	29	11	12	YES
3 - Physical Sciences	4	4	11.8	2.71	9	47	51	36	40	37	YES
4 - Scientific Methods and Applications	3	7	18	7.56	30	350	54	34	16	28	YES
Total	16	20	55.4	7.89	20	31	63	35	18	29	

This Table Is In Development And The Results May Be Invalid

Table 8.3

*Range-of-Knowledge Correspondence and Balance of Representation Between Standards and Assessment as Rated by Five Reviewers
GR8 Science M07 Form 8B*

Number of Assessment Items - 38

Standards			Hits		Range of Objectives				Rng. of Know.	Balance Index				Bal. of Represent.
					# Objs Hit		% of Total			% Hits in Std/Ttl Hits		Index		
Title	Goals #	Objs #	Mean	S.D.	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.	
1 - Earth and Space Sciences	5	5	12.4	1.36	4.6	0.8	92	16	YES	23	3	0.73	0.08	YES
2 - Life Sciences	4	4	13.2	0.98	4	0	100	0	YES	24	4	0.68	0.05	WEAK
3 - Physical Sciences	4	4	11.8	2.71	3.8	0.4	95	10	YES	22	6	0.74	0.10	YES
4 - Scientific Methods and Applications	3	7	18	7.56	2.6	1.36	37	19	NO	31	10	0.84	0.11	YES
Total	16	20	55.4	7.89	3.75	1.09	81	29		25	7	0.75	0.10	

Table 8.4

Summary of Attainment of Acceptable Alignment Level on Four Content Focus Criteria as Rated by Five Reviewers
GR8 Science M07 Form 8B
Number of Assessment Items - 38

Standards	Alignment Criteria			
	Categorical Concurrence	Depth-of-Knowledge Consistency	Range of Knowledge	Balance of Representation
1 - Earth and Space Sciences	YES	YES	YES	YES
2 - Life Sciences	YES	YES	YES	WEAK
3 - Physical Sciences	YES	YES	YES	YES
4 - Scientific Methods and Applications	YES	YES	NO	YES

Table 8.5
Source-of-Challenge Issues by Reviewer
GR8 Science M07 Form 8B

Item Number Comments by Reviewer

Table 8.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR8 Science M07 Form 8B

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5
1	2	2	1	1	1
2	1	1	1	1	1
3	1	2	1	2	1
4	1	1	1	2	1
5	1	2	1	1	2
6	2	2	2	2	2
7	2	1	1	1	1
8	2	2	2	2	2
9	2	2	2	2	1
10	2	2	1	2	1
11	3	3	2	3	2
12	2	2	1	2	1
13	1	1	1	1	1
14	2	2	2	1	2
15	2	2	2	1	1
16	3	3	2	2	3
17	3	2	2	2	1
18	1	1	2	1	1
19	2	2	1	2	2
20	2	2	1	2	1
21	3	3	3	3	4
22	2	2	2	2	1
23	2	2	2	2	2
24	2	2	2	1	2
25	1	1	1	1	1
26	3	3	2	2	1
27	2	2	2	2	1
28	2	2	2	2	1
29	1	2	1	2	1
30	2	2	2	2	2
31	1	2	1	1	1
32	2	3	2	2	2
33	2	1	2	2	1
34	2	2	2	2	2
35	1	1	1	2	1
36	2	2	2	2	1
37	1	1	1	1	1
38	1	1	2	2	2

Table 8.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR8 Science M07 Form 8B

Intraclass Correlation: 0.8445
Pairwise Comparison: 0.6132

Table 8.7
Notes by Reviewer
GR8 Science M07 Form 8B

Item Number Comments by Reviewer

Table 8.8
DOK Levels and Objectives Coded by Each Reviewer
GR8 Science M07 Form 8B

Item	DOK0	PObj0	S1Obj 0	DOK1	PObj1	S1Obj 1	DOK2	PObj2	S1Obj 2	DOK3	PObj3	DOK4	PObj4
1	2	1.4		2	1.5	1.4	1	1.4		1	1.5	1	1.5
2	1	2.1		1	2.1		1	2.1		1	2.1	1	2.1
3	1	1.1		2	1.1		1	1.1		2	1.1	1	1.1
4	1	1.1		1	1.2	1.1	1	1.2		2	1.1	1	1.1
5	1	1.1		2	1.1		1	1.1		1	1.1	2	1.1
6	2	1.1		2	1.1		2	1.1		2	1.1	2	1.1
7	2	3.2		1	3.4	3.3	1	3.4		1	3.4	1	3.3
8	2	1.3		2	1.3		2	4.3.1		2	1.3	2	1.3
9	2	4.2.1	4.2.2	2	4.2.2	4.3.1	2	4.3.1		2	4.2.1	1	4.2.2
10	2	4.2.2		2	4.3.1	4.2.2	1	4.3.1		2	4.2.2	1	4.2.2
11	3	4.2.2	4.2.1	3	4.3.1	4.2.2	2	4.3.1		3	4.3.1	2	4.2.2
12	2	2.4		2	2.4		1	2.4		2	2.4	1	2.4
13	1	1.5	1.4	1	1.4		1	1.4		1	1.4	1	1.4
14	2	2.3		2	2.3	4.2.2	2	2.4		1	2.3	2	2.3
15	2	2.3		2	2.3		2	2.3		1	2.3	1	2.3
16	3	2.3		3	2.3		2	2.3	2.4	2	2.3	3	2.3
17	3	2.3		2	2.3		2	2.3		2	2.3	1	2.3
18	1	1.1		1	1.5	1.2	2	1.2	1.4	1	1.1	1	1.1
19	2	2.4		2	2.2	2.4	1	2.4		2	2.4	2	2.4
20	2	2.3		2	2.3		1	2.1		2	2.3	1	2.3
21	3	4.2.2	4.2.1	3	3.1	4.2.2	3	4.3.1		3	3.1	4	4.2.2
22	2	2.2		2	2.2		2	2.2		2	2.2	1	2.2
23	2	4.2.1		2	4.1.1		2	2.4		2	2.3	2	2.3
24	2	2.3	4.2.1	2	2.3		2	2.4		1	2.3	2	2.3
25	1	1.2		1	1.2		1	1.2		1	1.2	1	1.2
26	3	4.2.1		3	4.1.2	4.2.1	2	4.3.1		2	4.2.1	1	4.2.1
27	2	3.4	4.2.1	2	4.1.2	4.2.1	2	4.3.1		2	4.2.1	1	4.2.1
28	2	4.2.1		2	3.1		2	3.1		2	3.1	1	3.4
29	1	4.2.1		2	3.1		1	3.1		2	3.1	1	3.4
30	2	4.2.2		2	3.1		2	3.1		2	3.1	2	3.4
31	1	2.2		2	2.2		1	2.2		1	2.2	1	2.2
32	2	3.3		3	4.1.1		2	3.3		2	3.3	2	3.3
33	2	3.4		1	3.4		2	3.4		2	3.2	1	3.4
34	2	3.4		2	3.2		2	1.2		2	3.2	2	3.4
35	1	3.4		1	3.2		1	3.4		2	3.2	1	3.2
36	2	3.1	4.2.2	2	3.1	3.4	2	3.1		2	3.1	1	3.4
37	1	1.2		1	1.2		1	1.1	1.2	1	1.2	1	1.2
38	1	3.1		1	3.1		2	1.2		2	3.1	2	3.1

Objective Pairwise Comparison: 0.5227
Standard Pairwise Comparison: 0.8575

Table 8.9
 Objectives Coded to Each Item by Reviewers
 GR8 Science M07 Form 8B

Low		Medium		High						
5		7.289474		28						
1	1.4	1.4	1.4	1.5	1.5	1.5				
2	2.1	2.1	2.1	2.1	2.1					
3	1.1	1.1	1.1	1.1	1.1					
4	1.1	1.1	1.1	1.1	1.2	1.2				
5	1.1	1.1	1.1	1.1	1.1					
6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
7	3.2	3.3	3.3	3.4	3.4	3.4				
8	1.3	1.3	1.3	1.3	4.3.1					
9	4.2.1	4.2.1	4.2.2	4.2.2	4.2.2	4.3.1	4.3.1			
10	4.2.2	4.2.2	4.2.2	4.2.2	4.3.1	4.3.1				
11	4.2.1	4.2.1	4.2.1	4.2.1	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2
	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.3.1	4.3.1	4.3.1	
	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	
12	2.4	2.4	2.4	2.4	2.4					
13	1.4	1.4	1.4	1.4	1.4	1.5				
14	2.3	2.3	2.3	2.3	2.4	4.2.2				
15	2.3	2.3	2.3	2.3	2.3					
16	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	2.4	2.4								
17	2.3	2.3	2.3	2.3	2.3					
18	1.1	1.1	1.1	1.2	1.2	1.4	1.5			
19	2.2	2.4	2.4	2.4	2.4	2.4				
20	2.1	2.3	2.3	2.3	2.3					
21	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	4.2.1	4.2.1
	4.2.1	4.2.1	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	
	4.2.2	4.2.2	4.2.2	4.2.2	4.2.2	4.3.1	4.3.1	4.3.1	4.3.1	
22	2.2	2.2	2.2	2.2	2.2					
23	2.3	2.3	2.4	4.1.1	4.2.1					
24	2.3	2.3	2.3	2.3	2.4	4.2.1				
25	1.2	1.2	1.2	1.2	1.2					
26	4.1.2	4.1.2	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1
	4.3.1	4.3.1								
27	3.4	4.1.2	4.2.1	4.2.1	4.2.1	4.2.1	4.3.1			
28	3.1	3.1	3.1	3.4	4.2.1					
29	3.1	3.1	3.1	3.4	4.2.1					

Table 8.9
Objectives Coded to Each Item by Reviewers
GR8 Science M07 Form 8B

30	3.1	3.1	3.1	3.4	4.2.2					
31	2.2	2.2	2.2	2.2	2.2					
32	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	4.1.1	4.1.1
33	3.2	3.4	3.4	3.4	3.4					
34	1.2	3.2	3.2	3.4	3.4					
35	3.2	3.2	3.2	3.4	3.4					
36	3.1	3.1	3.1	3.1	3.4	3.4	4.2.2			
37	1.1	1.2	1.2	1.2	1.2	1.2				
38	1.2	3.1	3.1	3.1	3.1					

Table 8.10
 Items Coded by Reviewers to Each Objective
 GR8 Science M07 Form 8B

Low		Medium		High
0		9.892858		34

1																				
1.1	3	3	3	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6	6
	6	6	6	6	18	18	18	37												
1.2	4	4	18	18	25	25	25	25	25	34	37	37	37	37	37	37	38			
1.3	8	8	8	8																
1.4	1	1	1	13	13	13	13	13	18											
1.5	1	1	1	13	18															
2																				
2.1	2	2	2	2	2	20														
2.2	19	22	22	22	22	22	31	31	31	31	31									
2.3	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16	16	16	17
	17	17	17	17	20	20	20	20	23	23	24	24	24	24						
2.4	12	12	12	12	12	14	16	16	19	19	19	19	19	23	24					
3																				
3.1	21	21	21	21	21	21	21	21	28	28	28	29	29	29	30	30	30	36	36	36
	36	38	38	38	38															
3.2	7	33	34	34	35	35	35													
3.3	7	7	32	32	32	32	32	32	32	32										
3.4	7	7	7	27	28	29	30	33	33	33	33	34	34	35	35	36	36			
4																				
4.1																				
4.1.1	23	32	32																	
4.1.2	26	26	27																	
4.2																				
4.2.1	9	9	11	11	11	11	21	21	21	21	23	24	26	26	26	26	26	26	26	26
	27	27	27	27	28	29														
4.2.2	9	9	9	10	10	10	10	11	11	11	11	11	11	11	11	11	11	11	11	14
	21	21	21	21	21	21	21	21	21	21	21	21	30	36						
4.3																				
4.3.1	8	9	9	10	10	11	11	11	11	11	11	11	11	11	11	11	11	11	21	21
	21	26	26	27																
4.3.2																				
4.3.3																				

Table 8.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)
 GR8 Science M07 Form 8B

Low		Medium		High
1		2		5

1	1.4: 3	1.5: 3		
2	2.1: 5			
3	1.1: 5			
4	1.1: 4	1.2: 2		
5	1.1: 5			
6	1.1: 5			
7	3.2: 1	3.3: 2	3.4: 3	
8	1.3: 4	4.3.1 :1		
9	4.2.1 :2	4.2.2 :3	4.3.1 :2	
10	4.2.2 :4	4.3.1 :2		
11	4.2.1 :1	4.2.2 :3	4.3.1 :3	
12	2.4: 5			
13	1.4: 5	1.5: 1		
14	2.3: 4	2.4: 1	4.2.2 :1	
15	2.3: 5			
16	2.3: 5	2.4: 1		
17	2.3: 5			
18	1.1: 3	1.2: 2	1.4: 1	1.5: 1
19	2.2: 1	2.4: 5		
20	2.1: 5	2.3: 5		

Table 8.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)
GR8 Science M07 Form 8B

	1	4		
21	3.1: 2	4.2.1 :1	4.2.2 :3	4.3.1 :1
22	2.2: 5			
23	2.3: 2	2.4: 1	4.1.1 :1	4.2.1 :1
24	2.3: 4	2.4: 1	4.2.1 :1	
25	1.2: 5			
26	4.1.2 :1	4.2.1 :4	4.3.1 :1	
27	3.4: 1	4.1.2 :1	4.2.1 :4	4.3.1 :1
28	3.1: 3	3.4: 1	4.2.1 :1	
29	3.1: 3	3.4: 1	4.2.1 :1	
30	3.1: 3	3.4: 1	4.2.2 :1	
31	2.2: 5			
32	3.3: 4	4.1.1 :1		
33	3.2: 1	3.4: 4		
34	1.2: 1	3.2: 2	3.4: 2	
35	3.2: 3	3.4: 2		
36	3.1: 4	3.4: 2	4.2.2 :1	
37	1.1: 1	1.2: 5		
38	1.2: 1	3.1: 4		

Table 8.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR8 Science M07 Form 8B

Low DOK		Matched DOK		High DOK
1		2		5

1 [1]:									
1.1 [1]:	3:5[1.4]	4:4[1.25]	5:5[1.4]	6:5[2]	18:3 [1]	37:1 [1]			
1.2 [1]:	4:2[1]	18:2 [1.5]	25:5 [1]	34:1 [2]	37:5 [1]	38:1 [2]			
1.3 [2]:	8:4[2]								
1.4 [2]:	1:3[1.67]	13:5 [1]	18:1 [2]						
1.5 [1]:	1:3[1.33]	13:1 [1]	18:1 [1]						
2 [2]:									
2.1 [1]:	2:5[1]	20:1 [1]							
2.2 [2]:	19:1 [2]	22:5 [1.8]	31:5 [1.2]						
2.3 [2]:	14:4 [1.7 5]	15:5 [1.6]	16:5 [2.6]	17:5 [2]	20:4 [1.7 5]	23:2 [2]	24:4 [1.7 5]		
2.4 [2]:	12:5 [1.6]	14:1 [2]	16:1 [2]	19:5 [1.8]	23:1 [2]	24:1 [2]			
3 [2]:									
3.1 [2]:	21:2 [3]	28:3 [2]	29:3 [1.6 7]	30:3 [2]	36:4 [2]	38:4 [1.5]			
3.2 [2]:	7:1[2]	33:1 [2]	34:2 [2]	35:3 [1.3 3]					
3.3 [1]:	7:2[1]	32:4 [2]							
3.4 [1]:	7:3[1]	27:1 [2]	28:1 [1]	29:1 [1]	30:1 [2]	33:4 [1.5]	34:2 [2]	35:2 [1]	36:2 [1.5]

Table 8.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR8 Science M07 Form 8B

4										
[2]:										
4.1										
[3]:										
4.1.1	23:1	32:1								
[2]:	[2]	[3]								
4.1.2	26:1	27:1								
[3]:	[3]	[2]								
4.2										
[3]:										
4.2.1	9:2[	11:1	21:1	23:1	24:1	26:4	27:4	28:1	29:1	
[2]:	2]	[3]	[3]	[2]	[2]	[2.2 5]	[1.7 5]	[2]	[1]	
4.2.2	9:3[	10:4	11:3	14:1	21:3	30:1	36:1			
[3]:	1.67]	[1.7 5]	[2.6 7]	[2]	[3.3 3]	[2]	[2]			
4.3										
[2]:										
4.3.1	8:1[	9:2[	10:2	11:3	21:1	26:1	27:1			
[3]:	2]	2]	[1.5]	[2.6 7]	[3]	[2]	[2]			
4.3.2										
[2]:										
4.3.3										
[2]:										

Table 8.14
Group Consensus
Gr 8 Science Combined, Science, Grade 8

Level	Description	DOK
1	Earth and Space Sciences	1
1.1	Describe how the positions and motions of the objects in the universe cause predictable and cyclic events.	1
1.2	Explain that the universe is composed of vast amounts of matter, most of which is at incomprehensible distances and held together by gravitational force. Describe how the universe is studied by the use of equipment such as telescopes, probes, satellites and spacecraft.	1
1.3	Describe interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g., water cycle, weather and pollution).	2
1.4	Identify that the lithosphere contains rocks and minerals and that minerals make up rocks. Describe how rocks and minerals are formed and/or classified.	2
1.5	Describe the processes that contribute to the continuous changing of Earth's surface (e.g., earthquakes, volcanic eruptions, erosion, mountain building and lithospheric plate movements).	1
2	Life Sciences	2
2.1	Differentiate between the life cycles of different plants and animals.	1
2.2	Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.	2
2.3	Compare changes in an organism's ecosystem/ habitat that affect its survival.	2
2.4	Explain how the extinction	2
3	Physical Sciences	2
3.1	Relate uses, properties and chemical processes to the behavior and/or arrangement of the small particles that compose matter.	2
3.2	In simple cases, describe the motion of objects and conceptually describe the effects of forces on an object.	2
3.3	Describe renewable and nonrenewable sources of energy (e.g., solar, wind, fossil fuels, biomass, hydroelectricity, geothermal and nuclear energy) and the management of these sources.	1
3.4	Describe that energy takes many forms, some forms represent kinetic energy and some forms represent potential energy; and during energy transformations the total amount of energy remains constant	1
4	Scientific Methods and Applications	2
4.1	Science and Technology	3
4.1.1	Give examples of how technological advances, influenced by scientific knowledge, affect the quality of life.	2
4.1.2	Design a solution or product taking into account needs and constraints (e.g., cost, time, trade-offs, properties of materials, safety and aesthetics).	3
4.2	Scientific Inquiry	3
4.2.1	Explain that there are differing sets of procedures for guiding scientific investigations and procedures are determined by the nature of the investigation, safety considerations and appropriate tools.	2
4.2.2	Analyze and interpret data from scientific investigations using appropriate mathematical	3

Table 8.14
Group Consensus
Gr 8 Science Combined, Science, Grade 8

Level	Description	DOK
	skills in order to draw valid conclusions.	
4.3	Scientific Ways of Knowing	2
4.3.1	Use skills of scientific inquiry processes (e.g., hypothesis, record keeping, description and explanation).	3
4.3.2	Explain the importance of reproducibility and reduction of bias in scientific methods.	2
4.3.3	Give examples of how thinking scientifically is helpful in daily life.	2

Table 8.15
Debriefing Summary
GR8 Science M07 Form 8B

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- yes
- Scientific ways of knowing was under-represented. 3.3 another area not covered.
- yes
- Science and Technology had the least amount of test items. There were no questions on 4.2.1
- I feel plate tectonics was not sufficiently addressed on this test.(1.5)

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- yes
- There were no level 4 items.
- not enough 3 DOK
- There were no questions that gave examples of how thinking scientifically is helpful in daily life.
- yes

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- yes
- Yes.
- yes
- There were more questions on Life Science topic than I thought appropriate for an 8th grade test where the focus is Earth and Space and Physical Science. There were not enough questions on the Scientific Methods and Applications. This test only tests average to above average students. It does not address the needs of special education students or general education students who have below level abilities.
- yes

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (4) : 80%
- iii. Needs slight improvement (1) : 20%

E. Comments

Table 10.1
Categorical Concurrence Between Standards and Assessment as Rated by Six Reviewers
GR10 Science M07 Form 10A
Number of Assessment Items - 38

Standards			Level by Objective			Hits		Cat. Concurr.
Title	Goals #	Objs #	Level	# of objs by Level	% w/in std by Level	Mean	S.D.	
1 - Earth and Space Sciences	6	6.33	1 2	3 3	50 50	12.5	3.5	YES
2 - Life Sciences	10	10.33	1 2 3	2 4 4	20 40 40	18.33	3.09	YES
3 - Physical Sciences	8	8	1 2	2 6	25 75	17.83	5.58	YES
4 - Scientific Methods and Applications	3	7.33	1 2 3	2 3 2	28 42 28	11.67	4.96	YES
Total	27	32	1 2 3	9 16 6	29 51 19	60.33	13.44	

Table 10.2

Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Assumes Each Objective Should Have Equal Representation)
GR10 Science M07 Form 10A
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	6	6.33	12.5	3.5	38	48	42	43	21	33	YES
2 - Life Sciences	10	10.33	18.33	3.09	45	45	43	43	12	30	YES
3 - Physical Sciences	8	8	17.83	5.58	34	36	46	39	20	38	YES
4 - Scientific Methods and Applications	3	7.33	11.67	4.96	36	38	48	40	15	35	YES
Total	27	32	60.33	13.44	39	43	44	42	17	34	

Table 10.2a

Alternate Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Does Not Assume Each Objective Should Have Equal Representation)
GR10 Science M07 Form 10A
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	6	6.33	12.5	3.5	22	76	45	43	33	33	YES
2 - Life Sciences	10	10.33	18.33	3.09	42	157	43	43	15	30	YES
3 - Physical Sciences	8	8	17.83	5.58	40	133	49	39	12	38	YES
4 - Scientific Methods and Applications	3	7.33	11.67	4.96	33	120	51	40	16	35	YES
Total	27	32	60.33	13.44	39	43	44	42	17	34	

This Table Is In Development And The Results May Be Invalid

Table 10.3

Range-of-Knowledge Correspondence and Balance of Representation Between Standards and Assessment as Rated by Six Reviewers

GR10 Science M07 Form 10A

Number of Assessment Items - 38

Standards			Hits		Range of Objectives				Rng. of Know.	Balance Index				Bal. of Represent.
					# Objs Hit		% of Total			% Hits in Std/Ttl Hits		Index		
Title	Goals #	Objs #	Mean	S.D.	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.	
1 - Earth and Space Sciences	6	6.33	12.5	3.5	5.33	1.37	84	19	YES	21	5	0.70	0.07	YES
2 - Life Sciences	10	10.33	18.33	3.09	6.83	1.57	66	14	YES	31	6	0.65	0.03	WEAK
3 - Physical Sciences	8	8	17.83	5.58	6.83	0.37	85	5	YES	29	3	0.74	0.06	YES
4 - Scientific Methods and Applications	3	7.33	11.67	4.96	3.67	1.25	49	14	WEAK	19	5	0.80	0.14	YES
Total	27	32	60.33	13.44	5.67	1.80	71	20		25	7	0.72	0.10	

Table 10.4

Summary of Attainment of Acceptable Alignment Level on Four Content Focus Criteria as Rated by Six Reviewers
GR10 Science M07 Form 10A
Number of Assessment Items - 38

Standards	Alignment Criteria			
	Categorical Concurrence	Depth-of-Knowledge Consistency	Range of Knowledge	Balance of Representation
1 - Earth and Space Sciences	YES	YES	YES	YES
2 - Life Sciences	YES	YES	YES	WEAK
3 - Physical Sciences	YES	YES	YES	YES
4 - Scientific Methods and Applications	YES	YES	WEAK	YES

Table 10.5
Source-of-Challenge Issues by Reviewer
GR10 Science M07 Form 10A

Item Number	Comments by Reviewer
7	
9	I do not see a specific benchmark or indicator(s) that address this item.
15	Biomes, earth science ??
20	There are very broad connections in this benchmark.
25	It is not clear to me from the question if the time period in the graph is just supposed to cover the time when it is accelerating, or if the time period also includes AFTER it has stopped accelerating but is still moving upward. A student familiar with model rockets might assume the second case and lean toward B, since it would be slowing down after the fuel runs out (even though the curvature isn't quite right...)
35	I see no place in the curriculum that actually explains how one adds elements to the periodic table, however 3.1 does address a lot regarding it. Not sure this is a valid question.

Table 10.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR10 Science M07 Form 10A

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
1	1	1	1	1	1	1
2	2	1	2	1	1	1
3	1	1	1	1	2	2
4	2	1	1	1	1	2
5	1	1	2	2	1	1
6	2	2	3	3	2	2
7	2	2	2	1	2	1
8	1	2	1	1	1	2
9	2	2	2	2	2	2
10	1	1	2	1	1	2
11	3	2	2	2	2	2
12	2	3	2	2	2	1
13	1	1	1	1	2	2
14	1	2	1	2	2	1
15	2	2	2	1	2	1
16	3	2	2	2	2	1
17	3	2	2	2	2	2
18	2	2	1	2	2	1
19	1	2	1	1	1	2
20	1	1	1	1	1	1
21	1	1	1	1	1	2
22	2	2	2	1	2	2
23	2	1	1	1	1	2
24	3	2	3	2	2	2
25	2	1	2	2	1	2
26	2	1	1	1	1	1
27	1	2	2	1	1	2
28	2	2	2	2	1	2
29						
30						
31						
32						
33						
34						
35	2	2	2	2	1	2
36	3	3	2	3	3	3
37	2	2	1	1	1	2
38	1	1	1	1	1	2
39	1	1	1	1	2	2
40	1	1	1	1	1	2

Table 10.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR10 Science M07 Form 10A

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
41	2	2	2	1	2	2
42	3	3	3	2	3	3
43	2	2	2	2	2	1
44	1	1	1	1	1	2

Intraclass Correlation: 0.8341

Pairwise Comparison: 0.5737

Table 10.7
Notes by Reviewer
GR10 Science M07 Form 10A

Item Number	Comments by Reviewer
6	Predict -- explain = formulate/justify
7	Although there is a graph it is simple reading.
7	Please check the physics equation to calculate the speed of sound of a material. Speed of sound depends on bulk modulus and density. If the bulk modulus is the same, increasing the density will decrease the speed of sound.
10	Had to make some decisions in regards to approach
12	Interpret data
36	This is a multi-part question. I am having a hard time finding the secondary coding that may be used for life science.

Table 10.8
DOK Levels and Objectives Coded by Each Reviewer
GR10 Science M07 Form 10A

Item	DOK0	PObj0	S1Obj0	S2Obj0	DOK1	PObj1	S1Obj1	DOK2	PObj2	S1Obj2	DOK3	PObj3	S1Obj3	DOK4	PObj4	S1Obj4	DOK5	PObj5	S1Obj5
1	1	1.5	1.2		1	1.5		1	1.5		1	1.5		1	1.5	1.6	1	1.5	
2	2	3.5	3.6	3.4	1	3.4		2	3.5		1	3.4		1	3.5		1	3.6	3.5
3	1	3.6	3.4	3.5	1	3.4		1	3.6		1	3.6		2	3.5		2	3.6	
4	2	3.5	3.6	3.4	1	3.4	3.5	1	3.5		1	3.5		1	3.5		2	3.5	3.6
5	1	3.4			1	3.4		2	3.4		2	3.4		1	3.3		1	3.4	
6	2	3.4	3.5	3.6	2	3.4		3	3.4		3	4.2.1		2	3.4		2	3.4	
7	2	3.7	3.3		2	3.7		2	3.7		1	3.3		2	3.7	3.3	1	3.7	
8	1	1.6	1.5		2	4.3	1.5	1	1.6		1	1.5		1	1.5		2	1.3	
9	2	2.4	2.6		2	2		2	2.6		2	2.4		2	2.4		2	2.6	
10	1	4.2.1			1	4.2.1		2	4.2.1		1	4.2.1		1	4.2.1		2	4.2.1	
11	3	2.3			2	2.3		2	2.3	2.8	2	2.3		2	2.3		2	2.3	
12	2	2.3			3	2.3		2	2.3		2	2.3		2	2.3		1	2.3	
13	1	2.3			1	2.3		1	2.3		1	2.3		2	2.3		2	2.8	
14	1	2.3			2	2.6		1	2.3		2	2.3		2	2.3		1	2.3	
15	2	1.2			2	2.6		2	1.2	4.3.2	1	1.2		2	2.6		1	1.2	
16	3	1.2			2	2.6		2	1.2	4.3.2	2	1.2		2	2.6	4.2.1	1	1.2	
17	3	1.2			2	2.6		2	1.2		2	1.2		2	2.6	4.2.1	2	1.2	
18	2	1.2			2	2.7		1	1.2		2	1.2		2	2.6		1	1.2	
19	1	1.2			2	2.6		1	1.2	2.6	1	1.2		1	2.6		2	1.2	2.5
20	1	1.2	1.5	3.6	1	3.6		1	1.2		1	1.2		1	1.2	3.6	1	1.2	
21	1	3.4			1	3.4		1	3.4		1	3.4		1	3.4		2	3.4	
22	2	1.5			2	1.5		2	2.5	2.2	1	1.5		2	1.5		2	1.5	
23	2	1.1	3.6	3.4	1	1.1		1	1.1		1	1.1		1	1.1		2	1.1	1.6
24	3	4.1.1	4.1.2		2	4.1.1	4.1.2	3	4.1.1	3.7	2	4.1.2	3.8	2	4.1.1		2	4.1.1	
25	2	3.4	3.5	3.6	1	3.4	3.5	2	3.4	3.5	2	3.5		1	3.5		2	3.5	
26	2	1.1	1.3		1	1.1		1	1.1	1.3	1	1.1		1	1.3		1	1	
27	1	3.2			2	3.2		2	3.2		1	3.2		1	3.2		2	3.2	
28	2	3.3			2	3.3		2	3.3		2	3.3		1	3.3		2	3.3	
29																			
30																			
31																			
32																			
33																			
34																			
35	2	3.1			2	3.1		2	3.2		2	3.1		1	3.1	3.2	2	3.1	
36	3	4.1.1	4.3.3	2.7	3	2.9		2	2.10	4.1.2	3	4.2.1		3	1		3	2.2	
37	2	2.1	2.2		2			1	2.10		1	2.1		1	2.1		2	2	
38	1	2.4	2.2	3.2	1	2.4		1	2.4		1	2.4		1	2.2		2	2.4	
39	1	2.5			1	2.5		1	4.3.2	2.10	1	2.5		2	2.5		2	2.10	
40	1	1.4	1.6	4.1	1	3.6		1	1.4	4.1.2	1	1.4		1	1.4		2	4.1.1	
41	2	2.7			2	1.4		2	2.7	4.1.1	1	4.1.1		2	4.1.2		2	2.7	
42	3	4.2.1	4.3.1	4.3.3	3	4.2.1		3	4.2.1	4.3.2	2	4.2.1		3	4.2.1		3	4.2.1	

Table 10.8
DOK Levels and Objectives Coded by Each Reviewer
GR10 Science M07 Form 10A

Item	DOK0	PObj0	S1Obj 0	S2Obj 0	DOK1	PObj1	S1Obj 1	DOK2	PObj2	S1Obj 2	DOK3	PObj3	S1Obj 3	DOK4	PObj4	S1Obj 4	DOK5	PObj5	S1Obj 5
43	2	2.5			2	2.3		2	2.5		2	2.5		2	2.5		1	2	
44	1	3.3			1	3.3		1	3.3		1	3.3		1	3.3		2	3.3	

Objective Pairwise Comparison: 0.4616

Standard Pairwise Comparison: 0.763

Table 10.9
Objectives Coded to Each Item by Reviewers
GR10 Science M07 Form 10A

Low		Medium		High						
0		8.227273		36						
1	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.6		
2	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.6	3.6	
3	3.4	3.4	3.5	3.5	3.6	3.6	3.6	3.6		
4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.6	3.6
5	3.3	3.4	3.4	3.4	3.4	3.4				
6	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
	3.5	3.5	3.6	3.6	4.2.1	4.2.1				
7	3.3	3.3	3.3	3.7	3.7	3.7	3.7	3.7		
8	1.3	1.5	1.5	1.5	1.5	1.6	1.6	4.3		
9	2	2.4	2.4	2.4	2.6	2.6	2.6			
10	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1				
11	2.3	2.3	2.3	2.3	2.3	2.3	2.8			
12	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	
	2.3	2.3	2.3	2.3	2.3					
13	2.3	2.3	2.3	2.3	2.3	2.8				
14	2.3	2.3	2.3	2.3	2.3	2.6				
15	1.2	1.2	1.2	1.2	2.6	2.6	4.3.2			
16	1.2	1.2	1.2	1.2	2.6	2.6	4.2.1	4.3.2		
17	1.2	1.2	1.2	1.2	2.6	2.6	4.2.1			
18	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.6	2.6
	2.7	2.7								
19	1.2	1.2	1.2	1.2	2.5	2.6	2.6	2.6		
20	1.2	1.2	1.2	1.2	1.2	1.5	3.6	3.6	3.6	
21	3.4	3.4	3.4	3.4	3.4	3.4				
22	1.5	1.5	1.5	1.5	1.5	2.2	2.5			
23	1.1	1.1	1.1	1.1	1.1	1.1	1.6	3.4	3.6	
24	3.7	3.7	3.8	3.8	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1
	4.1.1	4.1.1	4.1.1	4.1.1	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2	
	4.1.2									
25	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.6
26	1	1.1	1.1	1.1	1.1	1.3	1.3	1.3		
27	3.2	3.2	3.2	3.2	3.2	3.2				
28	3.3	3.3	3.3	3.3	3.3	3.3				
29	Fi									

Table 10.9
Objectives Coded to Each Item by Reviewers
GR10 Science M07 Form 10A

el d Te st											
30 Fi el d Te st											
31 Fi el d Te st											
32 Fi el d Te st											
33 Fi el d Te st											
34 Fi el d Te st											
35	3.1	3.1	3.1	3.1	3.1	3.2	3.2				
36	1	1	1	1	2.2	2.2	2.2	2.2	2.7	2.7	
	2.7	2.7	2.9	2.9	2.9	2.9	2.10	2.10	2.10		
	2.10	4.1.1	4.1.1	4.1.1	4.1.1	4.1.2	4.1.2	4.1.2	4.1.2		
	4.2.1	4.2.1	4.2.1	4.2.1	4.3.3	4.3.3	4.3.3	4.3.3			
37	2	2.1	2.1	2.1	2.2	2.10					
38	2.2	2.2	2.4	2.4	2.4	2.4	2.4	3.2			
39	2.5	2.5	2.5	2.5	2.10	2.10	4.3.2				
40	1.4	1.4	1.4	1.4	1.6	3.6	4.1	4.1.1	4.1.2		
41	1.4	2.7	2.7	2.7	4.1.1	4.1.1	4.1.2				

Table 10.9
Objectives Coded to Each Item by Reviewers
GR10 Science M07 Form 10A

42	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1
	4.2.1	4.2.1	4.3.1	4.3.1	4.3.2	4.3.2	4.3.3	4.3.3			
43	2	2.3	2.5	2.5	2.5	2.5					
44	3.3	3.3	3.3	3.3	3.3	3.3					

Table 10.10
Items Coded by Reviewers to Each Objective
GR10 Science M07 Form 10A

	42	42	42	42	42	42
4.3	8					
4.3.1	42	42				
4.3.2	15	16	39	42	42	
4.3.3	36	36	36	36	42	42
4.3.4						

Table 10.11

Number of Reviewers Coding an Item by Objective (Item Number: Number of Reviewers)

GR10 Science M07 Form 10A

Table 10.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR10 Science M07 Form 10A

Low		Medium		High
1		3		6

1	1.2: 1	1.5: 6	1.6: 1	
2	3.4: 3	3.5: 4	3.6: 2	
3	3.4: 2	3.5: 2	3.6: 4	
4	3.4: 2	3.5: 6	3.6: 2	
5	3.3: 1	3.4: 5		
6	3.4: 5	3.5: 1	3.6: 1	4.2.1 :1
7	3.3: 3	3.7: 5		
8	1.3: 1	1.5: 4	1.6: 2	4.3: 1
9	2.1	2.4: 3	2.6: 3	
10	4.2.1 :6			
11	2.3: 6	2.8: 1		
12	2.3: 6			
13	2.3: 5	2.8: 1		
14	2.3: 5	2.6: 1		
15	1.2: 4	2.6: 2	4.3.2 :1	
16	1.2: 4	2.6: 2	4.2.1 :1	4.3.2 :1
17	1.2: 4	2.6: 2	4.2.1 :1	
18	1.2: 4	2.6: 1	2.7: 1	
19	1.2: 4	2.5: 1	2.6: 3	
20	1.2: 4	1.5: 1	3.6: 3	

Table 10.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR10 Science M07 Form 10A

	5	1	3						
21	3.4: 6								
22	1.5: 5	2.2: 1	2.5: 1						
23	1.1: 6	1.6: 1	3.4: 1	3.6: 1					
24	3.7: 1	3.8: 1	4.1.1: 5	4.1.2: 3					
25	3.4: 3	3.5: 6	3.6: 1						
26	1:1	1.1: 4	1.3: 3						
27	3.2: 6								
28	3.3: 6								
29									
Field Test									
30									
Field Test									
31									
Field Test									
32									
Field Test									
33									
Field Test									
34									
Field Test									
35	3.1: 5	3.2: 2							
36	1:1	2.2:	2.7:	2.9:	2.10	4.1.1	4.1.2	4.2.1	4.3.3

Table 10.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR10 Science M07 Form 10A

Low DOK		Matched DOK		High DOK
1		3		6

1	26:1 [2]: [1]	36:1 [3]					
1.1	23:6 [2]: [1.3 3]	26:4 [1.2 5]					
1.2	1:1[[1]: 1]	15:4 [1.5]	16:4 [2]	17:4 [2.2 5]	18:4 [1.5]	19:4 [1.2 5]	20:5 [1]
1.3	8:1[[1]: 2]	26:3 [1.3 3]					
1.4	40:4 [2]: [1]	41:1 [2]					
1.5	1:6[[1]: 1]	8:4[1.25]	20:1 [1]	22:5 [1.8]			
1.6	1:1[[2]: 1]	8:2[1]	23:1 [2]	40:1 [1]			
2	9:1[[2]: 2]	37:1 [2]	43:1 [1]				
2.1	37:3 [1]: [1.3 3]						
2.2	22:1 [1]: [2]	36:1 [3]	37:1 [2]	38:2 [1]			
2.3	11:6 [2]: [2.1 7]	12:6 [2]	13:5 [1.2]	14:5 [1.4]	43:1 [2]		
2.4	9:3[[2]: 2]	38:5 [1.2]					
2.5	19:1 [3]: [2]	22:1 [2]	39:4 [1.2 5]	43:4 [2]			
2.6	9:3[[3]: 2]	14:1 [2]	15:2 [2]	16:2 [2]	17:2 [2]	18:1 [2]	19:3 [1.3 3]
2.7	18:1 [2]: [2]	36:1 [3]	41:3 [2]				

Table 10.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR10 Science M07 Form 10A

[2]:	2]			
4.3.1	42:1			
[2]:	[3]			
4.3.2	15:1	16:1	39:1	42:1
[2]:	[2]	[2]	[1]	[3]
4.3.3	36:1	42:1		
[1]:	[3]	[3]		
4.3.4				
[1]:				

Table 10.14
Group Consensus
Gr 10 Science Combined, Science, Grade 10

Level	Description	DOK
1	Earth and Space Sciences	2
1.1	Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe.	2
1.2	Explain that many processes occur in patterns within the Earth's systems.	1
1.3	Explain the 4.5 billion-year-history of Earth and the 4 billion-year-history of life on Earth based on observable scientific evidence in the geologic record.	1
1.4	Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources.	2
1.5	Explain the processes that move and shape Earth's surface.	1
1.6	Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of Earth and space sciences.	2
2	Life Sciences	2
2.1	Explain that cells are the basic unit of structure and function of living organisms, that once life originated all cells come from pre-existing cells, and that there are a variety of cell types.	1
2.2	Explain the characteristics of life as indicated by cellular processes and describe the process of cell division and development.	1
2.3	Explain the genetic mechanisms and molecular basis of inheritance.	2
2.4	Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological).	2
2.5	Explain how evolutionary relationships contribute to an understanding of the unity and diversity of life.	3
2.6	Explain the structure and function of ecosystems and relate how ecosystems change over time.	3
2.7	Describe how human activities can impact the status of natural systems.	2
2.8	Describe a foundation of biological evolution as the change in gene frequency of a population over time. Explain the historical and current scientific developments, mechanisms and processes of biological evolution.	3
2.9	Explain how natural selection and other evolutionary mechanisms account for the unity and diversity of past and present life forms.	3
2.10	Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of life sciences.	2
3	Physical Sciences	2
3.1	Describe that matter is made of minute particles called atoms and atoms are comprised of even smaller components. Explain the structure and properties of atoms.	1
3.2	Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances.	1
3.3	Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance.	2
3.4	Explain the movement of objects by applying Newton's three laws of motion.	2
3.5	Demonstrate that energy can be considered to be either kinetic (motion) or potential	2

Table 10.14
Group Consensus
Gr 10 Science Combined, Science, Grade 10

Level	Description	DOK
	(stored).	
3.6	Explain how energy may change form or be redistributed but the total quantity of energy is conserved.	2
3.7	Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.	2
3.8	Trace the historical development of scientific theories and ideas, and describe emerging issues in the study of physical sciences.	2
4	Scientific Methods and Applications	2
4.1	Science and Technology	3
4.1.1	Explain the ways in which the processes of technological design respond to the needs of society.	3
4.1.2	Explain that science and technology are interdependent; each drives the other.	2
4.2	Scientific Inquiry	3
4.2.1	Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations	3
4.3	Scientific Ways of Knowing	2
4.3.1	Explain that scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world.	2
4.3.2	Explain how scientific inquiry is guided by knowledge, observations, ideas and questions.	2
4.3.3	Describe the ethical practices and guidelines in which science operates.	1
4.3.4	Recognize that scientific literacy is part of being a knowledgeable citizen.	1

Table 10.15

Debriefing Summary

GR10 Science M07 Form 10A

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- I expected a broader coverage of topics in physical science, there was a lack of coverage of chemistry. The biology lacked the coverage of evolution.
- For the most part, the test covered the important aspects of each standard.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- Yes, for the most part. There were only a couple of threes, and I didn't see any fours (I didn't expect to see fours).
- I had very few DOK 3 questions. I guess I expected a few more.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- Yes, they were clear and concise.
- Yes

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (4) : 80%
- iii. Needs slight improvement (1) : 20%

E. Comments

Table 10.1
Categorical Concurrence Between Standards and Assessment as Rated by Six Reviewers
GR10 Science M07 Form 10B
Number of Assessment Items - 38

Standards			Level by Objective			Hits		Cat. Concurr.
Title	Goals #	Objs #	Level	# of objs by Level	% w/in std by Level	Mean	S.D.	
1 - Earth and Space Sciences	6	6	1 2	3 3	50 50	12.33	2.81	YES
2 - Life Sciences	10	10.5	1 2 3	2 4 4	20 40 40	19	5.07	YES
3 - Physical Sciences	8	8	1 2	2 6	25 75	20.33	6.65	YES
4 - Scientific Methods and Applications	3	7.17	1 2 3	2 3 2	28 42 28	14.67	3.09	YES
Total	27	31.67	1 2 3	9 16 6	29 51 19	66.33	12.92	

Table 10.2

Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Assumes Each Objective Should Have Equal Representation)
GR10 Science M07 Form 10B
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	6	6	12.33	2.81	21	41	45	42	34	39	YES
2 - Life Sciences	10	10.5	19	5.07	49	47	35	42	16	33	YES
3 - Physical Sciences	8	8	20.33	6.65	29	31	58	36	13	20	YES
4 - Scientific Methods and Applications	3	7.17	14.67	3.09	13	27	43	44	44	49	YES
Total	27	31.67	66.33	12.92	31	41	45	42	24	38	

Table 10.2a

Alternate Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Does Not Assume Each Objective Should Have Equal Representation)
GR10 Science M07 Form 10B
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	6	6	12.33	2.81	8	42	54	42	38	39	YES
2 - Life Sciences	10	10.5	19	5.07	59	230	28	42	13	33	WEAK
3 - Physical Sciences	8	8	20.33	6.65	32	158	49	36	20	20	YES
4 - Scientific Methods and Applications	3	7.17	14.67	3.09	16	119	39	44	45	49	YES
Total	27	31.67	66.33	12.92	31	41	45	42	24	38	

This Table Is In Development And The Results May Be Invalid

Table 10.3

Range-of-Knowledge Correspondence and Balance of Representation Between Standards and Assessment as Rated by Six Reviewers
GR10 Science M07 Form 10B
Number of Assessment Items - 38

Standards			Hits		Range of Objectives				Rng. of Know.	Balance Index				Bal. of Represent.
					# Objs Hit		% of Total			% Hits in Std/Ttl Hits		Index		
Title	Goals #	Objs #	Mean	S.D.	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.	
1 - Earth and Space Sciences	6	6	12.33	2.81	4.83	0.69	81	11	YES	19	3	0.75	0.04	YES
2 - Life Sciences	10	10.5	19	5.07	7.83	1.67	75	16	YES	28	4	0.75	0.03	YES
3 - Physical Sciences	8	8	20.33	6.65	6	0.58	75	7	YES	30	5	0.74	0.04	YES
4 - Scientific Methods and Applications	3	7.17	14.67	3.09	4.5	0.96	63	13	YES	23	7	0.80	0.07	YES
Total	27	31.67	66.33	12.92	5.79	1.68	73	14		25	7	0.76	0.05	

Table 10.4

Summary of Attainment of Acceptable Alignment Level on Four Content Focus Criteria as Rated by Six Reviewers
GR10 Science M07 Form 10B
Number of Assessment Items - 38

Standards	Alignment Criteria			
	Categorical Concurrence	Depth-of-Knowledge Consistency	Range of Knowledge	Balance of Representation
1 - Earth and Space Sciences	YES	YES	YES	YES
2 - Life Sciences	YES	YES	YES	YES
3 - Physical Sciences	YES	YES	YES	YES
4 - Scientific Methods and Applications	YES	YES	YES	YES

Table 10.5
Source-of-Challenge Issues by Reviewer
GR10 Science M07 Form 10B

Item Number	Comments by Reviewer
7	My ESL students had major difficulty with the concept that you could put a lense into an animals eye-they could not grasp that concept to be able to respond appropritely.
13	This could also be a two because the predictive information is easily surmised.
24	Extremely variable answers that could present bias or confuse depending on background knowledge - many variable that play into some of the answers
25	This is a wide open question. Care should be essential in range finding since the possibilities will increase as the technology is developed over time.
25	My ESL students did not understand telemedicine-it is not a word that is in a dictionary-and the definition in the prompt defines it as medicine from a distance! ESL students from countries lacking in technology have not had the every day exposure to the types of ideas that could be used to answer this question.
26	Confusing question - Oil & water in same cup?
31	I don't like the wording on this. "Identify two savings" - savings of what? Money? Time? Resources? Or is it meant to be vague to give students the chance to interpret it freely?
34	For many students this question will not be recall because they do nt study meterology. This is a great question.
35	When reading the information prior to test items, the structure may be off: "A group of students designs" reads better as 'A group of students design'. Also, I'm not sure "an" belongs in front of herbicide. The structural issues may be small but they can trip up a struggling reader.
41	nothing stated about no friction; students with any knowledge of terminal velocity would know that the heavier one would hit first in the presence of friction. (although if they know that they'd likely choose the correct answer from the given foils anyway...)

Table 10.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR10 Science M07 Form 10B

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
1	2	2	1	1	1	2
2	1	1	1	1	2	2
3	1	1	1	1	2	2
4	2	2	2	2	2	2
5	1	1	1	1	1	1
6	1	1	1	2	1	1
7	3	2	2	3	3	2
8	1	1	1	2	2	2
9	2	2	2	1	1	2
10	2	1	2	2	2	2
11	1	1	2	1	2	2
12	2	1	2	2	3	2
13	3	3	2	3	3	3
14	1	1	2	1	2	1
15	2	2	2	2	2	3
16						
17						
18						
19						
20						
21						
22	2	1	2	1	1	2
23	1	1	1	1	1	1
24	2	1	1	1	2	2
25	3	3	3	3	3	3
26	1	1	2	1	2	1
27	1	1	1	1	1	1
28	2	2	1	2	2	2
29	2	2	2	2	2	2
30	2	2	2	1	2	1
31	3	2	2	2	2	3
32	1	1	1	1	1	2
33	2	2	2	2	2	1
34	1	2	1	2	1	2
35	2	2	2	2	3	2
36	2	1	2	1	2	2
37	2	2	3	3	3	2
38	2	2	4	2	3	2
39	1	1	1	1	1	1
40	1	2	2	2	2	2

Table 10.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR10 Science M07 Form 10B

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
41	1	1	1	1	1	2
42	2	2	2	2	2	2
43	3	2	3	3	2	2
44	2	2	2	1	2	3

Intraclass Correlation: 0.8812

Pairwise Comparison: 0.6105

Table 10.7
Notes by Reviewer
GR10 Science M07 Form 10B

Item Number	Comments by Reviewer
3	11 b/c MC
8	Applies to many within 2
10	I couldn't find anything more specific on this one in the standards
10	Making decisions
11	Read Graph
13	Just had to explain - no more. Could be L3 easily
14	Read & Graph
23	Even though this is a level one in my scores, it could be a two based on multiple steps.
28	again - i personally didn't locate a more specific connection
28	Students will key to word in chart - photosynthesis
29	Read/ Interpret
31	L3 possibly 4, if what recycled was not given 'cans' - Also no justification of answer
35	L3 if S.A.
36	I couldn't distinguish between the indicators for this question. Its outside my field.
37	I gave this a 2 and not a 3 because no justification seemed to required, just a description.
38	Several variables; complex/novel exp.....
40	L3 if S.A.
42	This question seemed to be representing all of the indicators in 4.3 in some way, and we can only input up to 2 secondaries.
42	Assimilate data
43	Explain why, justify

Table 10.8
DOK Levels and Objectives Coded by Each Reviewer
GR10 Science M07 Form 10B

Item	DO K0	PObj 0	S1Ob j0	S2Ob j0	DOK 1	PObj 1	S1Ob j1	S2Ob j1	DOK 2	PObj 2	S1Ob j2	S2Ob j2	DOK 3	PObj3	S1Obj3	S2Ob j3	DOK 4	PObj 4	S1Ob j4	S2Ob j4	DOK 5	PObj 5	S1Ob j5
1	2	1.5	1.2		2	1.5			1	1.5			1	1.5			1	1.5			2	1.5	
2	1	2.6			1	2.6	2.5		1	2.6			1	2.6			2	2.6			2	2.6	
3	1	2.6			1	2.5	2.6		1	2.6			1	2.6			2	2.6			2	2.6	
4	2	2.6			2	2.5			2	2.6	2.5		2	2.7			2	2.6	2.4		2	2.6	
5	1	3.4			1	3.4			1	3.4			1	3.4			1	3.4	3.3		1	3.4	
6	1	1.1	3.6		1	1.1			1	3.7	1.1		2	1.1			1	1.1			1	1.1	
7	3	4.3.3	2.10		2	4.3.3			2	4.3.3			3	4.3.3			3	4.3.3			2	4.3.3	
8	1	2.8	2.5	2.9	1	2.7	2.9		1	2.5	2.7	2	2	2.3			2	2.3	2.9		2	2.3	
9	2	2.3	2.8		2	2.3			2	2.3	2.8		1	2.3			1	2.3			2	2.3	
10	2	2.3	2.9		1	2			2	2.8			2	2.9			2	4.3.1			2	4.2.1	
11	1	4.2.1	3.3	3.6	1	3.3			2	3.3	3.5		1	4.2.1			2	3.3	3.6	4.2.1	2	4.2.1	
12	2	3.6	3.3		1	3.3	3.6		2	3.5			2	3.3	3.6	4.2.1	3	3.3	3.6	4.2.1	2	3.6	
13	3	3.6	3.3	4.2.1	3	3.3			2	3.5			3	4.3.1			3	3.3	3.6	4.2.1	3	4.2.1	
14	1	4.2.1	3.3	3.6	1	3.3			2	3.3	3.5		1	4.2.1			2	3.3	4.2.1		1	4.2.1	
15	2	2.6	2.4		2	2.9			2	2.4	2.5		2	2.6			2	2.4			3	2.6	
16																							
17																							
18																							
19																							
20																							
21																							
22	2	3.3	3.6		1	3.3			2	3.6	3.3		1	3.6			1	3.3			2	3.6	
23	1	2.1	2.2		1	3.1			1	2.2	2.1		1	2.1			1	2.1			1	2.1	
24	2	1.2	2.6		1	2.6			1	1.2			1	1.2			2	1.2	2.6		2	1.2	
25	3	4.1.2	4.1.1		3	4.2.1	4.3.1		3	4.3.1			3	4.1.2			3	4.1.1	4.3.4		3	4.1.1	
26	1	3.3			1	3.3			2	3.3			1	3.3			2	3.3			1	3.3	
27	1	3.1			1	3.1			1	3.1			1	3.1			1	3.1			1	3.1	
28	2	1.3	2.4		2	2			1	2.4	1.3	2.9	2	1.3			2	2.1			2	2.1	
29	2	1.2	2.6		2	2.6			2	1.2			2	1.2			2	1.2	2.6		2	1.2	
30	2	1.2	2.6		2	2.6			2	1.2			1	1.2			2	1.2	2.6		1	1.2	
31	3	1.4			2	1.4			2	1.4			2	1.4			2	1.4			3	1.4	
32	1	3.5			1	3.5	3.4	3.3	1	3.5			1	2.5			1	3.5			2	3.5	
33	2	3.7			2	3.7			2	3.7			2	3.7			2	3.7			1	4.2.1	
34	1	1.2	1.5	1.6	2	1.2	1.3		1	1.2			2	1.2			1	1.5			2	1.2	
35	2	2.5	2.3	2.9	2	2.6	2.5		2	2.5			2	4.2.1			3	2.2	2.7	4.2.1	2	2.9	
36	2	2.6			1	2.6	2.7		2	2.6			1	2.6			2	2.6			2	2	
37	2	1.4			2	2.7			3	4.1.1	2.10		3	4.2.1			3	2.7			2	2.7	
38	2	2.8	2.6		2	2.8	2.6	2.7	4	2.3			2	2.2	2.1		3	2.3			2	2.3	
39	1	1.5	1.3		1	1.3			1	1.2	1.5		1	1.5			1	1.5			1	1.5	
40	1	3.7			2	3.6	3.7		2	3.7	4.1.1	4.1.2	2	3.7	4.1.1		2	3.7	3.3		2	3.7	
41	1	3.4	3.5	3.6	1	3.4	3.5		1	3.4			1	3.4			1	3.4			2	3.4	
42	2	3.8	4.3		2	4.3.1			2	3.1	3.3	4.3.3	2	4.3.2			2	4.3.1	4.3.3		2	4.3.2	4.3.3
43	3	3.5	3.4	3.6	2	3.4			3	3.4			3	3.4	4.1.2		2	3.4			2	3.6	
44	2	3.4	3.5		2	3.4	3.6		2	3.4			1	3.4			2	3.4			3	3.5	3.6

Objective Pairwise Comparison: 0.4306
Standard Pairwise Comparison: 0.7576

Table 10.9
Objectives Coded to Each Item by Reviewers
GR10 Science M07 Form 10B

Low		Medium		High							
0		9.045455		36							
1	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5			
2	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.6			
3	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.6			
4	2.4	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.7		
5	3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.4			
6	1.1	1.1	1.1	1.1	1.1	1.1	3.6	3.7			
7	2.10	2.10	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	
	4.3.3	4.3.3	4.3.3	4.3.3							
8	2	2.3	2.3	2.3	2.5	2.5	2.7	2.7	2.8	2.9	
	2.9	2.9									
9	2.3	2.3	2.3	2.3	2.3	2.3	2.8	2.8			
10	2	2.3	2.8	2.9	2.9	4.2.1	4.3.1				
11	3.3	3.3	3.3	3.3	3.5	3.6	3.6	4.2.1	4.2.1	4.2.1	
	4.2.1										
12	3.3	3.3	3.3	3.3	3.5	3.6	3.6	3.6	3.6	3.6	
	4.2.1	4.2.1									
13	3.3	3.3	3.3	3.3	3.3	3.3	3.5	3.5	3.6	3.6	
	3.6	3.6	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.2.1	4.3.1		
	4.3.1										
14	3.3	3.3	3.3	3.3	3.5	3.6	4.2.1	4.2.1	4.2.1	4.2.1	
15	2.4	2.4	2.4	2.5	2.6	2.6	2.6	2.9			
16	Field Test										
17	Field Test										
18	Field Test										

Table 10.9
Objectives Coded to Each Item by Reviewers
GR10 Science M07 Form 10B

st											
19											
Field Test											
20											
Field Test											
21											
Field Test											
22	3.3	3.3	3.3	3.3	3.6	3.6	3.6	3.6			
23	2.1	2.1	2.1	2.1	2.1	2.2	2.2	3.1			
24	1.2	1.2	1.2	1.2	1.2	2.6	2.6	2.6			
25	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	
	4.1.1	4.1.1	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2		
	4.1.2	4.2.1	4.2.1	4.2.1	4.2.1	4.3.1	4.3.1	4.3.1	4.3.1		
	4.3.1	4.3.1	4.3.1	4.3.1	4.3.4	4.3.4	4.3.4	4.3.4			
26	3.3	3.3	3.3	3.3	3.3	3.3					
27	3.1	3.1	3.1	3.1	3.1	3.1					
28	1.3	1.3	1.3	2	2.1	2.1	2.4	2.4	2.9		
29	1.2	1.2	1.2	1.2	1.2	2.6	2.6	2.6			
30	1.2	1.2	1.2	1.2	1.2	2.6	2.6	2.6			
31	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4		
	1.4	1.4	1.4	1.4	1.4						
32	2.5	3.3	3.4	3.5	3.5	3.5	3.5	3.5			
33	3.7	3.7	3.7	3.7	3.7	4.2.1					
34	1.2	1.2	1.2	1.2	1.2	1.3	1.5	1.5	1.6		
35	2.2	2.3	2.5	2.5	2.5	2.6	2.7	2.9	2.9	4.2.1	
	4.2.1										
36	2	2.6	2.6	2.6	2.6	2.6	2.7				
37	1.4	1.4	2.7	2.7	2.7	2.7	2.7	2.7	2.10	2.10	
	4.1.1	4.1.1	4.2.1	4.2.1							
38	2.1	2.2	2.3	2.3	2.3	2.6	2.6	2.7	2.8	2.8	

Table 10.9
Objectives Coded to Each Item by Reviewers
GR10 Science M07 Form 10B

39	1.2	1.3	1.3	1.5	1.5	1.5	1.5	1.5			
40	3.3	3.6	3.7	3.7	3.7	3.7	3.7	3.7	4.1.1	4.1.1	
	4.1.2										
41	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.5	3.6		
42	3.1	3.3	3.8	4.3	4.3.1	4.3.1	4.3.2	4.3.2	4.3.3	4.3.3	
	4.3.3										
43	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	
	3.5	3.5	3.6	3.6	3.6	3.6	4.1.2	4.1.2			
44	3.4	3.4	3.4	3.4	3.4	3.5	3.5	3.6	3.6		

Table 10.10
 Items Coded by Reviewers to Each Objective
 GR10 Science M07 Form 10B

Low		Medium		High
0		10.20513		36

1																				
1.1	6	6	6	6	6	6														
1.2	1	24	24	24	24	24	29	29	29	29	29	30	30	30	30	30	34	34	34	34
	34	39																		
1.3	28	28	28	34	39	39														
1.4	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
	31	31	31	31	37	37														
1.5	1	1	1	1	1	1	34	34	39	39	39	39	39							
1.6	34																			
2	8	10	28	36																
2.1	23	23	23	23	23	28	28	38												
2.2	23	23	35	38																
2.3	8	8	8	9	9	9	9	9	9	10	35	38	38	38						
2.4	4	15	15	15	28	28														
2.5	2	3	4	4	8	8	15	32	35	35	35									
2.6	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	15	15	15	24
	24	24	29	29	29	30	30	30	35	36	36	36	36	36	36	38	38			
2.7	4	8	8	35	36	37	37	37	37	37	37	37	38							
2.8	8	9	9	10	38	38														
2.9	8	8	8	10	10	15	28	35	35											
2.10	7	7	37	37																
3																				
3.1	23	27	27	27	27	27	27	42												
3.2																				
3.3	5	11	11	11	11	12	12	12	12	13	13	13	13	13	13	14	14	14	14	22
	22	22	22	26	26	26	26	26	26	32	40	42								
3.4	5	5	5	5	5	5	32	41	41	41	41	41	41	41	43	43	43	43	43	43
	43	43	43	44	44	44	44	44												
3.5	11	12	13	13	14	32	32	32	32	32	41	41	43	43	44	44				
3.6	6	11	11	12	12	12	12	12	13	13	13	13	14	22	22	22	22	40	41	43
	43	43	43	44	44															
3.7	6	33	33	33	33	33	40	40	40	40	40	40								
3.8	42																			
4																				
4.1																				
4.1.1	25	25	25	25	25	25	25	25	25	25	25	25	25	37	37	40	40			
4.1.2	25	25	25	25	25	25	25	25	40	43	43									
4.2																				

Table 10.10
Items Coded by Reviewers to Each Objective
GR10 Science M07 Form 10B

4.2.1	10	11	11	11	11	12	12	13	13	13	13	13	13	14	14	14	14	25	25	25
	25	33	35	35	37	37														
4.3	42																			
4.3.1	10	13	13	25	25	25	25	25	25	25	25	42	42							
4.3.2	42	42																		
4.3.3	7	7	7	7	7	7	7	7	7	7	7	7	42	42	42					
4.3.4	25	25	25	25																

Table 10.11

Number of Reviewers Coding an Item by Objective (Item Number: Number of Reviewers)

GR10 Science M07 Form 10B

Table 10.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR10 Science M07 Form 10B

Low		Medium		High
1		3		6

1	1.2: 1	1.5: 6				
2	2.5: 1	2.6: 6				
3	2.5: 1	2.6: 6				
4	2.4: 1	2.5: 2	2.6: 4	2.7: 1		
5	3.3: 1	3.4: 6				
6	1.1: 6	3.6: 1	3.7: 1			
7	2.10: 1	4.3.3: 6				
8	2.1 3	2.3: 3	2.5: 2	2.7: 2	2.8: 1	2.9: 3
9	2.3: 6	2.8: 2				
10	2.1 1	2.3: 1	2.8: 1	2.9: 2	4.2.1: 1	4.3.1: 1
11	3.3: 4	3.5: 1	3.6: 2	4.2.1: 4		
12	3.3: 4	3.5: 1	3.6: 5	4.2.1: 2		
13	3.3: 3	3.5: 1	3.6: 2	4.2.1: 3	4.3.1: 1	
14	3.3: 4	3.5: 1	3.6: 1	4.2.1: 4		
15	2.4: 3	2.5: 1	2.6: 3	2.9: 1		
16	Field Test					
17	Field Test					
18						

Table 10.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR10 Science M07 Form 10B

Field Test								
19 Field Test								
20 Field Test								
21 Field Test								
22	3.3: 4	3.6: 4						
23	2.1: 5	2.2: 2	3.1: 1					
24	1.2: 5	2.6: 3						
25	4.1.1: 3	4.1.2: 2	4.2.1: 1	4.3.1: 2	4.3.4: 1			
26	3.3: 6							
27	3.1: 6							
28	1.3: 3	2.1: 1	2.1: 2	2.4: 2	2.9: 1			
29	1.2: 5	2.6: 3						
30	1.2: 5	2.6: 3						
31	1.4: 6							
32	2.5: 1	3.3: 1	3.4: 1	3.5: 5				
33	3.7: 5	4.2.1: 1						
34	1.2: 5	1.3: 1	1.5: 2	1.6: 1				
35	2.2: 1	2.3: 1	2.5: 3	2.6: 1	2.7: 1	2.9: 2	4.2.1: 2	
36	2.1: 1	2.6: 1	2.7: 1					

Table 10.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)
 GR10 Science M07 Form 10B

		5	1					
37	1.4: 1	2.7: 3	2.10 :1	4.1.1 :1	4.2.1 :1			
38	2.1: 1	2.2: 1	2.3: 3	2.6: 2	2.7: 1	2.8: 2		
39	1.2: 1	1.3: 2	1.5: 5					
40	3.3: 1	3.6: 1	3.7: 6	4.1.1 :2	4.1.2 :1			
41	3.4: 6	3.5: 2	3.6: 1					
42	3.1: 1	3.3: 1	3.8: 1	4.3: 1	4.3.1 :2	4.3.2 :2	4.3.3 :3	
43	3.4: 5	3.5: 1	3.6: 2	4.1.2 :1				
44	3.4: 5	3.5: 2	3.6: 2					

Table 10.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR10 Science M07 Form 10B

2.9 [3]:	8:3[1.33]	10:2 [2]	15:1 [2]	28:1 [1]	35:2 [2]						
2.10 [2]:	7:1[3]	37:1 [3]									
3 [2]:											
3.1 [1]:	23:1 [1]	27:6 [1]	42:1 [2]								
3.2 [1]:											
3.3 [2]:	5:1[1]	11:4 [1.5]	12:4 [2]	13:3 [3]	14:4 [1.5]	22:4 [1.5]	26:6 [1.3 3]	32:1 [1]	40:1 [2]	42:1 [2]	
3.4 [2]:	5:6[1]	32:1 [1]	41:6 [1.1 7]	43:5 [2.6]	44:5 [1.8]						
3.5 [2]:	11:1 [2]	12:1 [2]	13:1 [2]	14:1 [2]	32:5 [1.2]	41:2 [1]	43:1 [3]	44:2 [2.5]			
3.6 [2]:	6:1[1]	11:2 [1.5]	12:5 [2]	13:2 [3]	14:1 [1]	22:4 [1.7 5]	40:1 [2]	41:1 [1]	43:2 [2.5]	44:2 [2.5]	
3.7 [2]:	6:1[1]	33:5 [2]	40:6 [1.8 3]								
3.8 [2]:	42:1 [2]										
4 [2]:											
4.1 [3]:											
4.1.1 [3]:	25:3 [3]	37:1 [3]	40:2 [2]								
4.1.2 [2]:	25:2 [3]	40:1 [2]	43:1 [3]								
4.2 [3]:											
4.2.1 [3]:	10:1 [2]	11:4 [1.5]	12:2 [2.5]	13:3 [3]	14:4 [1.2 5]	25:1 [3]	33:1 [1]	35:2 [2.5]	37:1 [3]		
4.3 [2]:	42:1 [2]										
4.3.1	10:1	13:1	25:2	42:2							

Table 10.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR10 Science M07 Form 10B

[2]:	[2]	[3]	[3]	[2]
4.3.2	42:2			
[2]:	[2]			
4.3.3	7:6[	42:3		
[1]:	2.5]	[2]		
4.3.4	25:1			
[1]:	[3]			

Table 10.14
Group Consensus
Gr 10 Science Combined, Science, Grade 10

Level	Description	DOK
1	Earth and Space Sciences	2
1.1	Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe.	2
1.2	Explain that many processes occur in patterns within the Earth's systems.	1
1.3	Explain the 4.5 billion-year-history of Earth and the 4 billion-year-history of life on Earth based on observable scientific evidence in the geologic record.	1
1.4	Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources.	2
1.5	Explain the processes that move and shape Earth's surface.	1
1.6	Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of Earth and space sciences.	2
2	Life Sciences	2
2.1	Explain that cells are the basic unit of structure and function of living organisms, that once life originated all cells come from pre-existing cells, and that there are a variety of cell types.	1
2.2	Explain the characteristics of life as indicated by cellular processes and describe the process of cell division and development.	1
2.3	Explain the genetic mechanisms and molecular basis of inheritance.	2
2.4	Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological).	2
2.5	Explain how evolutionary relationships contribute to an understanding of the unity and diversity of life.	3
2.6	Explain the structure and function of ecosystems and relate how ecosystems change over time.	3
2.7	Describe how human activities can impact the status of natural systems.	2
2.8	Describe a foundation of biological evolution as the change in gene frequency of a population over time. Explain the historical and current scientific developments, mechanisms and processes of biological evolution.	3
2.9	Explain how natural selection and other evolutionary mechanisms account for the unity and diversity of past and present life forms.	3
2.10	Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of life sciences.	2
3	Physical Sciences	2
3.1	Describe that matter is made of minute particles called atoms and atoms are comprised of even smaller components. Explain the structure and properties of atoms.	1
3.2	Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances.	1
3.3	Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance.	2
3.4	Explain the movement of objects by applying Newton's three laws of motion.	2
3.5	Demonstrate that energy can be considered to be either kinetic (motion) or potential	2

Table 10.14
Group Consensus
Gr 10 Science Combined, Science, Grade 10

Level	Description	DOK
	(stored).	
3.6	Explain how energy may change form or be redistributed but the total quantity of energy is conserved.	2
3.7	Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.	2
3.8	Trace the historical development of scientific theories and ideas, and describe emerging issues in the study of physical sciences.	2
4	Scientific Methods and Applications	2
4.1	Science and Technology	3
4.1.1	Explain the ways in which the processes of technological design respond to the needs of society.	3
4.1.2	Explain that science and technology are interdependent; each drives the other.	2
4.2	Scientific Inquiry	3
4.2.1	Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations	3
4.3	Scientific Ways of Knowing	2
4.3.1	Explain that scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world.	2
4.3.2	Explain how scientific inquiry is guided by knowledge, observations, ideas and questions.	2
4.3.3	Describe the ethical practices and guidelines in which science operates.	1
4.3.4	Recognize that scientific literacy is part of being a knowledgeable citizen.	1

Table 10.15
Debriefing Summary
GR10 Science M07 Form 10B

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- Seemed to be a heavy weight on ecosystems and very light on 3.1, 3.2. It would be nice to see a more even distribution between physical and life.
- This is true especially for the science processes section. Each area seemed to be fairly represented.
- For ESL students, the amount of current events in the field of Biology and Life Science included in the test questions were so very broad. The level of language for most students brand new to the country is so basic that they can not grasp the concepts much less the language.
- Yes, I thought so.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- yes I think so
- Yes, I didn't find any true level fours, but one had the possibility if it were a novel concept. There were many ones and twos.
- I felt there were many topics that went way beyond the standards, too numerous to mention here (also because I feel braindead and can't think (sorry)). There just doesn't seem to be enough time to teach to the depth that the test items are requiring. Especially ESL students-as they need time to practice and work not only with the content, but with the language as well, just to be able to remember information. There has never been enough time for any type of mastery!
- There tended to be many DOK level 1's and 2's, but I think that's appropriate.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- Some of the life science standards are very broad.
- Yes. Some may have been more difficult reading passages, but the topic covered and the questions were fair.
- Yes.

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (5) : 83%
- iii. Needs slight improvement (1) : 17%

Table 10.15

Debriefing Summary

GR10 Science M07 Form 10B

E. Comments

· I think form b is better aligned than form a. I was able to locate the connections much easier. Graphs, charts, etc. were clear and concise. CAUTION - some of your questions are testing READING skills with Science as a back up! The construction of some questions that require lengthy reading or passages heavy with vocabulary are really difficult for the challenged reader EVEN WHEN the DOK may be a mere 1 or 2. For example, the Cataracs passage could be presented in more of an outline format of facts - thus eliminating the reading challenge.

· Couple questions need to be reviewed. I offered source of challenge

· I see lots of great test items that are aligned to the standards. However, there are also many test items that seem to go into much greater depth and breadth than what the standard states. Again-time is a major issue when it comes to teaching all the standards, especially for ESL students. I love the fact that we want to reach for the higher levels of thinking-but I feel that with so much content to teach, if we want our students to be able to answer these higher level questions, we must give them more time for mastery.

Table 10.1

Categorical Concurrence Between Standards and Assessment as Rated by Six Reviewers

GR10 Science M07 Form 10C

Number of Assessment Items - 38

Standards			Level by Objective			Hits		Cat. Concurr.
Title	Goals #	Objs #	Level	# of objs by Level	% w/in std by Level	Mean	S.D.	
1 - Earth and Space Sciences	6	6	1 2	3 3	50 50	11.33	3.20	YES
2 - Life Sciences	10	10.33	1 2 3	2 4 4	20 40 40	25.83	6.62	YES
3 - Physical Sciences	8	8	1 2	2 6	25 75	15	3.56	YES
4 - Scientific Methods and Applications	3	7.5	1 2 3	2 3 2	28 42 28	14	4.83	YES
Total	27	31.83	1 2 3	9 16 6	29 51 19	66.17	10.25	

Table 10.2

Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Assumes Each Objective Should Have Equal Representation)
GR10 Science M07 Form 10C
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	6	6	11.33	3.20	15	31	54	41	31	39	YES
2 - Life Sciences	10	10.33	25.83	6.62	58	42	25	34	18	31	WEAK
3 - Physical Sciences	8	8	15	3.56	21	33	48	43	31	46	YES
4 - Scientific Methods and Applications	3	7.5	14	4.83	31	42	35	41	34	43	YES
Total	27	31.83	66.17	10.25	34	42	39	41	27	40	

Table 10.2a

Alternate Depth-of-Knowledge Consistency Between Standards and Assessment as Rated by Six Reviewers (Does Not Assume Each Objective Should Have Equal Representation)
GR10 Science M07 Form 10C
Number of Assessment Items - 38

Standards			Hits		Level of Item w.r.t. Standard						DOK Consistency
					% Under		% At		% Above		
Title	Goals #	Objs #	M	S.D.	M	S.D.	M	S.D.	M	S.D.	
1 - Earth and Space Sciences	6	6	11.33	3.20	12	55	49	41	38	39	YES
2 - Life Sciences	10	10.33	25.83	6.62	53	228	27	34	20	31	WEAK
3 - Physical Sciences	8	8	15	3.56	25	125	50	43	25	46	YES
4 - Scientific Methods and Applications	3	7.5	14	4.83	20	96	35	41	45	43	YES
Total	27	31.83	66.17	10.25	34	42	39	41	27	40	

This Table Is In Development And The Results May Be Invalid

Table 10.3

Range-of-Knowledge Correspondence and Balance of Representation Between Standards and Assessment as Rated by Six Reviewers
GR10 Science M07 Form 10C
Number of Assessment Items - 38

Standards			Hits		Range of Objectives				Rng. of Know.	Balance Index				Bal. of Represent.
					# Objs Hit		% of Total			% Hits in Std/Ttl Hits		Index		
Title	Goals #	Objs #	Mean	S.D.	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.	
1 - Earth and Space Sciences	6	6	11.33	3.20	5	1.15	83	19	YES	17	4	0.75	0.05	YES
2 - Life Sciences	10	10.33	25.83	6.62	7.67	1.37	74	14	YES	39	6	0.74	0.03	YES
3 - Physical Sciences	8	8	15	3.56	5.5	0.96	69	12	YES	23	3	0.76	0.05	YES
4 - Scientific Methods and Applications	3	7.5	14	4.83	4.67	1.25	63	19	YES	22	9	0.76	0.05	YES
Total	27	31.83	66.17	10.25	5.71	1.67	72	18		25	10	0.75	0.05	

Table 10.4

*Summary of Attainment of Acceptable Alignment Level on Four Content Focus Criteria
as Rated by Six Reviewers
GR10 Science M07 Form 10C
Number of Assessment Items - 38*

Standards	Alignment Criteria			
	Categorical Concurrence	Depth-of- Knowledge Consistency	Range of Knowledge	Balance of Representation
1 - Earth and Space Sciences	YES	YES	YES	YES
2 - Life Sciences	YES	WEAK	YES	YES
3 - Physical Sciences	YES	YES	YES	YES
4 - Scientific Methods and Applications	YES	YES	YES	YES

Table 10.5
Source-of-Challenge Issues by Reviewer
GR10 Science M07 Form 10C

Item Number	Comments by Reviewer
19	This test item is soooo broad. The content in this particular test item is not really taught; one must draw from prior knowledge from current events and content taught throughout grades 8-10 which puts ESL students at a total disadvantage. They do not have the knowledge necessary to answer this question!
21	I believe this test item asks for too much detail, compared to the standard.
22	Again, test item goes deeper than the standard.
23	rotational inertia will also play a part in slowing the motor (as well as increased friction).
25	Scorers better be ready for a myriad of possible answers as question criteria doesn't reign the student in as to a direction to answer. - Ponds located next to each other or different counties - Vegetaion surrounding ponds? Sun angle vs vegetation - Cloud cover - Classic lake or flow through - inflow/input (farm adjacent to one?) - homes around 1? septic etc..... Bias towards rural students
32	Concern regarding methane not burned equates to ok to put into atmosphere. Just because combustion does not occur, doesn't mean it's ok. Methane ~20x (depending) more efficient greenhouse gas and would be arguably better to combust. Good question - I think it needs more definition.
35	Diagram not necessary
38	Seq. not necessary
39	It does not mention ethics in this question, but it needs to be addressed in a questions in this series.

Table 10.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR10 Science M07 Form 10C

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
1	1	2	1	1	1	1
2	1	1	2	1	2	1
3	2	1	2	2	2	2
4	1	1	2	1	1	2
5	2	2	2	2	2	2
6	3	2	2	2	2	1
7	2	2	2	2	2	3
8	1	2	1	2	2	2
9	2	2	2	2	1	2
10	2	2	2	1	2	2
11						
12						
13						
14						
15						
16						
17	1	2	2	1	2	2
18	1	2	1	1	2	2
19	3	2	3	3	3	2
20	1	2	1	2	2	1
21	2	2	2	2	2	2
22	1	2	1	2	2	2
23	1	2	2	2	3	2
24	2	1	1	1	1	1
25	3	2	2	3	3	3
26	1	1	1	1	1	1
27	1	1	1	1	1	1
28	3	2	3	3	2	2
29	2	2	1	2	2	2
30	2	2	1	1	2	2
31	1	2	2	1	2	2
32	2	1	2	1	2	2
33	3	3	3	3	2	2
34	2	2	1	2	2	2
35	1	1	1	1	1	1
36	1	2	2	1	2	2
37	3	3	2	3	3	3
38	1	2	1	1	1	2
39	2	2	1	2	2	2
40	2	1	2	1	2	2

Table 10.6
Depth-of-Knowledge Levels by Item and Reviewers
Intraclass Correlation
GR10 Science M07 Form 10C

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
41	1	2	1	1	2	2
42	1	1	1	1	2	1
43	2	2	2	1	2	2
44	2	2	2	1	3	2

Intraclass Correlation: 0.8467

Pairwise Comparison: 0.5877

Table 10.7
Notes by Reviewer
GR10 Science M07 Form 10C

Item Number	Comments by Reviewer
5	Nice graphic. Easy for the students to see and understand.
5	The question is out of my field, so I could not narrow it down.
6	2 variables
8	L2/3 if S.A.
9	L3 if S.A.
10	It is not clear to me exactly which benchmark this question matches, but seems to be in the general category of 4.3.
10	Describe interpret
10	We must be careful. This would be a good place for teachers to warn against studies that are based in pseudoscience.
17	students do not need to interpret any of the information in the graphic to answer the question
17	Read/ Interpret
19	WOW this is so excessively wordy! Why TWO questions. Make it ONE: Identify TWO negative consequences of increased animal waste in lakes and waterways and describe how the increased animal waste results in this consequence.
19	Multi-variable, recall key, justify
20	I see this as a level three based on the graphic. This takes a while to match info if it is hard to discern whether or not it is linked to the graphic.
21	Next Step
23	Relation
28	Wasn't sure exactly which benchmark this question matched.
28	'Speculate on'
32	next step
33	Students are not directed as to their direction to answer
34	L2/3 if S.A.
36	Graphic is not essential to answer the question.
36	Neat question
37	Covers several aspects of 4.3
37	relation
38	Graphic is not essential to answer the question.
38	recall
40	Next Step
42	i don't see a specific area for herbivores
42	This question was out of my field, so I couldn't narrow it down.
44	extention S.A. if L3

Table 10.8
DOK Levels and Objectives Coded by Each Reviewer
GR10 Science M07 Form 10C

Item	DO K0	PObj 0	S1Ob j0	S2Ob j0	DOK 1	PObj 1	S1Ob j1	DOK 2	PObj 2	S1Ob j2	S2Ob j2	DOK 3	PObj 3	S1Ob j3	DOK 4	PObj 4	S1Ob j4	S2Ob j4	DOK 5	PObj 5	S1Ob j5
1	1	3.3			2	3.3		1	3.3			1	3.3		1	3.3			1	3.3	
2	1	2.6			1	2.5	2.6	2	2.6	2.5		1	2.6		2	2.7	2.5		1	2.6	
3	2	2.6			1	2.6	2.9	2	2.1			2	2.7		2	2.7	2.5		2	2.7	
4	1	2.5	2.3		1	2.5		2	2.3	2.5		1	2.8		1	2.8			2	2.8	
5	2	2.5	2.3		2	2.6		2	2.4	2.3		2	2.5		2	2.3			2	2	
6	3	1.2			2	1.2		2	1.2			2	1.2	4.2.1	2	1.2			1	1.2	
7	2	3.2	3.1		2	3.1	3.2	2	3.2	3.1		2	3.2		2	3.2	3.1		3	3.2	
8	1	3.6			2	3.3		1	3.3	3.6		2	4.2.1		2	3.3			2	3.3	
9	2	3.6	3.3		2	3.3		2	3.3	3.6		2	4.3.4		1	3.3			2	3.3	
10	2	3.8	4.3		2	3.8	3.1	2	3.8			1	4.3.3		2	1.6	4.3.1		2	3.8	
11																					
12																					
13																					
14																					
15																					
16																					
17	1	4.3.3			2	4.3.3		2	4.3.3			1	4.1.2		2	4.3.3			2	4.3.3	
18	1	1.6	1.1	4.3.1	2	1.6	1.1	1	1.6			1	4.1.2		2	1.6	1.3		2	1.6	
19	3	2.7	1.4		2	1.4		3	1.4	2.7		3	1.4	4.1.1	3	1.4			2	2.7	
20	1	3.6	3.3		2	3.6		1	3.6			2	3.6		2	3.6			1	3.6	
21	2	3.6	3.3		2	3.6		2	3.6	3.3		2	3.6		2	3.6	3.3		2	3.6	
22	1	3.3			2	3.3	3.6	1	3.3			2	3.3		2	3.6	3.3		2	3.3	
23	1	3.3	3.4		2	3.4		2	3.6			2	3.3		3	3.3			2	3.4	
24	2	1.2	2.6		1	1.2		1	1.2			1	1.2		1	1.2			1	1.2	
25	3	2.4	2.6		2	1.3		2	2.1			3	4.1.1		3	2.4	2.2		3	2.4	
26	1	2.4			1	2.4		1	2.4			1	3.6		1	2.2	2.4		1	2.4	
27	1	2.2			1	2.4		1	1.1			1	2.4		1	2.4	2.2		1	2.4	
28	3	4.1	2.6		2	4.1.2	4.1.1	3	4.1.1	2.10		3	4.1.1	2.6	2	2.6	4.1.1		2	4.1.2	
29	2	2.7	2.8		2	2.6	1.4	1	2.5	2.7		2	2.7		2	2.10	2.3		2	2.7	
30	2	2.8	2.3		2	2.5	2.8	1	2.5	2.6	2.7	1	2.5	2.6	2	2.3	2.9		2	2.8	
31	1	2.7	1.4		2	1.4		2	2.7			1	1.4		2	2.3			2	2.7	
32	2	1.4	3.2		1	1.4		2	1.6	1.4	4	1	1.4		2	1.4			2	4.1.2	
33	3	4.3.3			3	4.3.3		3	4.3.3			3	4.3.3		2	4.3.3			2	4.3.3	
34	2	2.5	2.3	2.9	2	2.5	2.6	1	2.3	2.10	4.1.1	2	4.1.1		2	2.3	2.5		2	2.7	
35	1	1.5			1	1.5		1	1.5			1	1.5		1	1.5			1	1.5	
36	1	3.4			2	3.4		2	3.4			1	3.4		2	3.4			2	3.4	
37	3	2.3	2.8	4.3	3	2.3	2.7	2	4.3.1	2.8		3	4.3.1	2.8	3	2.3	4.2.1	4.3.1	3	4.3.2	2.3
38	1	1.5	1.3		2	1.5		1	1.5	1.3		1	1.5		1	1.6			2	1.3	
39	2	2.4			2	2.6	2.3	1	2.5			2	4.3.1		2	4.2.1			2	4.3.1	
40	2	2.9	2.6		1	2.6		2	2.9			1	2.6		2	3.3	4.2.1		2	2.5	
41	1	3.6	3.3		2	3.6		1	3.7			1	4.3.1		2	3.3	4.2.1		2	3.3	
42	1	2.6			1	2		1	2.6			1	2.6		2	2.6			1	2	
43	2	4.3.1	4.2.1		2	2.6		2	2.5			1	4.3.2	2.5	2	2.6			2	4.2.1	
44	2	2.6			2	2.6		2	2.5			1	2.6		3	2.6			2	2.6	

Objective Pairwise Comparison: 0.437
Standard Pairwise Comparison: 0.7522

Table 10.9
 Objectives Coded to Each Item by Reviewers
 GR10 Science M07 Form 10C

Low		Medium		High
0		9.022727		36

1	3.3	3.3	3.3	3.3	3.3	3.3				
2	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.7	
3	2.1	2.5	2.6	2.6	2.7	2.7	2.7	2.9		
4	2.3	2.3	2.5	2.5	2.5	2.8	2.8	2.8		
5	2	2.3	2.3	2.3	2.4	2.5	2.5	2.6		
6	1.2	1.2	1.2	1.2	1.2	1.2	4.2.1			
7	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.2	3.2
	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	
	3.2									
8	3.3	3.3	3.3	3.3	3.6	3.6	4.2.1			
9	3.3	3.3	3.3	3.3	3.3	3.6	3.6	4.3.4		
10	1.6	3.1	3.8	3.8	3.8	3.8	4.3	4.3.1	4.3.3	

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Table 10.9
Objectives Coded to Each Item by Reviewers
GR10 Science M07 Form 10C

Test											
16											
Field											
Test											
17	4.1.2	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3					
18	1.1	1.1	1.3	1.6	1.6	1.6	1.6	1.6	4.1.2	4.3.1	
19	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4		
	1.4	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7		
	2.7	2.7	2.7	2.7	4.1.1	4.1.1	4.1.1	4.1.1			
20	3.3	3.6	3.6	3.6	3.6	3.6	3.6				
21	3.3	3.3	3.3	3.6	3.6	3.6	3.6	3.6	3.6		
22	3.3	3.3	3.3	3.3	3.3	3.3	3.6	3.6			
23	3.3	3.3	3.3	3.4	3.4	3.4	3.6				
24	1.2	1.2	1.2	1.2	1.2	1.2	2.6				
25	1.3	1.3	2.1	2.1	2.2	2.2	2.4	2.4	2.4	2.4	
	2.4	2.4	2.6	2.6	4.1.1	4.1.1					
26	2.2	2.4	2.4	2.4	2.4	2.4	3.6				
27	1.1	2.2	2.2	2.4	2.4	2.4	2.4				
28	2.6	2.6	2.6	2.6	2.6	2.6	2.10	2.10	4.1	4.1	
	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.1	4.1.2		
	4.1.2	4.1.2	4.1.2								
29	1.4	2.3	2.5	2.6	2.7	2.7	2.7	2.7	2.8	2.10	
30	2.3	2.3	2.5	2.5	2.5	2.6	2.6	2.7	2.8	2.8	
	2.8	2.9									
31	1.4	1.4	1.4	2.3	2.7	2.7	2.7				
32	1.4	1.4	1.4	1.4	1.4	1.6	3.2	4	4.1.2		
33	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	
	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3		
	4.3.3	4.3.3	4.3.3	4.3.3	4.3.3						
34	2.3	2.3	2.3	2.5	2.5	2.5	2.6	2.7	2.9	2.10	
	4.1.1	4.1.1									
35	1.5	1.5	1.5	1.5	1.5	1.5					
36	3.4	3.4	3.4	3.4	3.4	3.4					
37	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.7	2.7	
	2.8	2.8	2.8	2.8	2.8	2.8	4.2.1	4.2.1	4.3		

Table 10.9
Objectives Coded to Each Item by Reviewers
GR10 Science M07 Form 10C

	4.3	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	4.3.1	4.3.2	4.3.2
38	1.3	1.3	1.3	1.5	1.5	1.5	1.5	1.6	
39	2.3	2.4	2.5	2.6	4.2.1	4.3.1	4.3.1		
40	2.5	2.6	2.6	2.6	2.9	2.9	3.3	4.2.1	
41	3.3	3.3	3.3	3.6	3.6	3.7	4.2.1	4.3.1	
42	2	2	2.6	2.6	2.6	2.6			
43	2.5	2.5	2.6	2.6	4.2.1	4.2.1	4.3.1	4.3.2	
44	2.5	2.6	2.6	2.6	2.6	2.6			

Table 10.10
 Items Coded by Reviewers to Each Objective
 GR10 Science M07 Form 10C

Low		Medium		High
0		10.17949		36

1																					
1.1	18	18	27																		
1.2	6	6	6	6	6	6	24	24	24	24	24	24									
1.3	18	25	25	38	38	38															
1.4	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	
	29	31	31	31	32	32	32	32	32												
1.5	35	35	35	35	35	35	38	38	38	38											
1.6	10	18	18	18	18	18	32	38													
2	5	42	42																		
2.1	3	25	25																		
2.2	25	25	26	27	27																
2.3	4	4	5	5	5	29	30	30	31	34	34	34	37	37	37	37	37	37	37	37	
	39																				
2.4	5	25	25	25	25	25	25	26	26	26	26	26	27	27	27	27	39				
2.5	2	2	2	3	4	4	4	5	5	29	30	30	30	34	34	34	39	40	43	43	
	44																				
2.6	2	2	2	2	2	3	3	5	24	25	25	28	28	28	28	28	28	29	30	30	
	34	39	40	40	40	42	42	42	42	43	43	44	44	44	44	44					
2.7	2	3	3	3	19	19	19	19	19	19	19	19	19	19	19	19	29	29	29	29	
	30	31	31	31	34	37	37														
2.8	4	4	4	29	30	30	30	37	37	37	37	37	37								
2.9	3	30	34	40	40																
2.10	28	28	29	34																	
3																					
3.1	7	7	7	7	7	7	7	7	10												
3.2	7	7	7	7	7	7	7	7	7	7	7	7	32								
3.3	1	1	1	1	1	1	8	8	8	8	9	9	9	9	9	20	21	21	21	22	
	22	22	22	22	22	23	23	23	40	41	41	41									
3.4	23	23	23	36	36	36	36	36	36												
3.5																					
3.6	8	8	9	9	20	20	20	20	20	20	20	21	21	21	21	21	21	22	22	23	26
	41	41																			
3.7	41																				
3.8	10	10	10	10																	
4	32																				
4.1	28	28																			
4.1.1	19	19	19	19	25	25	28	28	28	28	28	28	28	28	34	34					
4.1.2	17	18	28	28	28	28	32														

Table 10.10
Items Coded by Reviewers to Each Objective
GR10 Science M07 Form 10C

4.2																				
4.2.1	6	8	37	37	39	40	41	43	43											
4.3	10	37	37																	
4.3.1	10	18	37	37	37	37	37	37	39	39	41	43								
4.3.2	37	37	43																	
4.3.3	10	17	17	17	17	17	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	33	33	33	33	33	33	33	33	33	33										
4.3.4	9																			

Table 10.11

Number of Reviewers Coding an Item by Objective (Item Number: Number of Reviewers)

GR10 Science M07 Form 10C

4.3.4	9:1
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Table 10.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR10 Science M07 Form 10C

Low		Medium		High
1		3		6

1	3.3: 6					
2	2.5: 3	2.6: 5	2.7: 1			
3	2.1: 1	2.5: 1	2.6: 2	2.7: 3	2.9: 1	
4	2.3: 2	2.5: 3	2.8: 3			
5	2.1	2.3: 3	2.4: 1	2.5: 2	2.6: 1	
6	1.2: 6	4.2.1 :1				
7	3.1: 4	3.2: 6				
8	3.3: 4	3.6: 2	4.2.1 :1			
9	3.3: 5	3.6: 2	4.3.4 :1			
10	1.6: 1	3.1: 1	3.8: 4	4.3: 1	4.3.1 :1	4.3.3 :1
11	Field Test					
12	Field Test					
13	Field Test					
14	Field Test					
15	Field Test					

Table 10.12

Number of Reviewers Coding an Objective by Item (Objective: Number of Reviewers)

GR10 Science M07 Form 10C

	6						
37	2.3: 4	2.7: 1	2.8: 3	4.2.1 :1	4.3: 1	4.3.1 :3	4.3.2 :1
38	1.3: 3	1.5: 4	1.6: 1				
39	2.3: 1	2.4: 1	2.5: 1	2.6: 1	4.2.1 :1	4.3.1 :2	
40	2.5: 1	2.6: 3	2.9: 2	3.3: 1	4.2.1 :1		
41	3.3: 3	3.6: 2	3.7: 1	4.2.1 :1	4.3.1 :1		
42	2:2	2.6: 4					
43	2.5: 2	2.6: 2	4.2.1 :2	4.3.1 :1	4.3.2 :1		
44	2.5: 1	2.6: 5					

Table 10.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR10 Science M07 Form 10C

[2]:	2]	2]	[2.6 7]	[1.7 5]	[1]	[1.6 7]	[2]	[3]	
2.8 [3]:	4:3[1.33]	29:1 [2]	30:3 [2]	37:3 [2.6 7]					
2.9 [3]:	3:1[1]	30:1 [2]	34:1 [2]	40:2 [2]					
2.10 [2]:	28:1 [3]	29:1 [2]	34:1 [1]						
3 [2]:									
3.1 [1]:	7:4[2]	10:1 [2]							
3.2 [1]:	7:6[2.17]	32:1 [2]							
3.3 [2]:	1:6[1.17]	8:4[1.75]	9:5[1.8]	20:1 [1]	21:3 [2]	22:6 [1.6 7]	23:3 [2]	40:1 [2]	41:3 [1.6 7]
3.4 [2]:	23:3 [1.6 7]	36:6 [1.6 7]							
3.5 [2]:									
3.6 [2]:	8:2[1]	9:2[2]	20:6 [1.5]	21:6 [2]	22:2 [2]	23:1 [2]	26:1 [1]	41:2 [1.5]	
3.7 [2]:	41:1 [1]								
3.8 [2]:	10:4 [2]								
4 [2]:	32:1 [2]								
4.1 [3]:	28:1 [3]								
4.1.1 [3]:	19:1 [3]	25:1 [3]	28:4 [2.5]	34:2 [1.5]					
4.1.2 [2]:	17:1 [1]	18:1 [1]	28:2 [2]	32:1 [2]					
4.2 [3]:									
4.2.1 [3]:	6:1[2]	8:1[2]	37:1 [3]	39:1 [2]	40:1 [2]	41:1 [2]	43:2 [2]		
4.3	10:1	37:1							

Table 10.13

Assessment Item DOK vs Consensus DOK (Item Number: Number of Reviewers [Average DOK])

GR10 Science M07 Form 10C

[2]:	[2]	[3]				
4.3.1 [2]:	10:1 [2]	18:1 [1]	37:3 [2.6 7]	39:2 [2]	41:1 [1]	43:1 [2]
4.3.2 [2]:	37:1 [3]	43:1 [1]				
4.3.3 [1]:	10:1 [1]	17:5 [1.8]	33:6 [2.6 7]			
4.3.4 [1]:	9:1 [2]					

Table 10.14
Group Consensus
Gr 10 Science Combined, Science, Grade 10

Level	Description	DOK
1	Earth and Space Sciences	2
1.1	Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe.	2
1.2	Explain that many processes occur in patterns within the Earth's systems.	1
1.3	Explain the 4.5 billion-year-history of Earth and the 4 billion-year-history of life on Earth based on observable scientific evidence in the geologic record.	1
1.4	Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources.	2
1.5	Explain the processes that move and shape Earth's surface.	1
1.6	Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of Earth and space sciences.	2
2	Life Sciences	2
2.1	Explain that cells are the basic unit of structure and function of living organisms, that once life originated all cells come from pre-existing cells, and that there are a variety of cell types.	1
2.2	Explain the characteristics of life as indicated by cellular processes and describe the process of cell division and development.	1
2.3	Explain the genetic mechanisms and molecular basis of inheritance.	2
2.4	Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological).	2
2.5	Explain how evolutionary relationships contribute to an understanding of the unity and diversity of life.	3
2.6	Explain the structure and function of ecosystems and relate how ecosystems change over time.	3
2.7	Describe how human activities can impact the status of natural systems.	2
2.8	Describe a foundation of biological evolution as the change in gene frequency of a population over time. Explain the historical and current scientific developments, mechanisms and processes of biological evolution.	3
2.9	Explain how natural selection and other evolutionary mechanisms account for the unity and diversity of past and present life forms.	3
2.10	Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of life sciences.	2
3	Physical Sciences	2
3.1	Describe that matter is made of minute particles called atoms and atoms are comprised of even smaller components. Explain the structure and properties of atoms.	1
3.2	Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances.	1
3.3	Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance.	2
3.4	Explain the movement of objects by applying Newton's three laws of motion.	2
3.5	Demonstrate that energy can be considered to be either kinetic (motion) or potential	2

Table 10.14
Group Consensus
Gr 10 Science Combined, Science, Grade 10

Level	Description	DOK
	(stored).	
3.6	Explain how energy may change form or be redistributed but the total quantity of energy is conserved.	2
3.7	Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.	2
3.8	Trace the historical development of scientific theories and ideas, and describe emerging issues in the study of physical sciences.	2
4	Scientific Methods and Applications	2
4.1	Science and Technology	3
4.1.1	Explain the ways in which the processes of technological design respond to the needs of society.	3
4.1.2	Explain that science and technology are interdependent; each drives the other.	2
4.2	Scientific Inquiry	3
4.2.1	Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations	3
4.3	Scientific Ways of Knowing	2
4.3.1	Explain that scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world.	2
4.3.2	Explain how scientific inquiry is guided by knowledge, observations, ideas and questions.	2
4.3.3	Describe the ethical practices and guidelines in which science operates.	1
4.3.4	Recognize that scientific literacy is part of being a knowledgeable citizen.	1

Table 10.15

Debriefing Summary

GR10 Science M07 Form 10C

A. For each standard, did the items cover the most important topics you expected by the standard? If not, what topics were not assessed that should have been?

- Fairly evenly distributed between life, physical, and earth/space. Still a heavy emphasis on biomes and ecosystems.
- This particular test did a very good job of representing all areas.
- No, I felt that many test items went much further than the standard states. Test item #19 was extremely broad; even though I comment test items that can cover more than 1 standard, this just seemed too broad. The particular content in this item is not necessarily taught; therefore students, especially ESL, would have to have had some other exposure to examples of this nature. The problem is that they do not have enough language to process at this high level required to answer this question.
- Yes, I believe so.

B. For each standard, did the items cover the most important performance (DOK levels) you expected by the standard? If not, what performance was not assessed?

- Seemed to be a fairly even distribution.
- Yes, the items fit very well with the benchmarks and standards which made it easy to verify the dok levels.
- For the most part. There were many L1's and L2's, but that is probably to be expected.

C. Were the standards written at an appropriate level of specificity and directed towards expectations appropriate for the grade level?

- Yes, this does match what students should know and do.
- I believe that the standards are written at an appropriate level, however, the test items (some of them) are asking for knowledge that goes much deeper than time allows us to teach for any kind of mastery. Also-ESL students become frustrated when they spend the majority of their time using a dictionary to find words that aren't even there (i.e. telemedicine). Many ESL students give up as the language is too difficult. They have not had enough time in our country to learn English to the level of being able to process mentally at a higher level in English. It seems like we are testing their reading and English abilities rather than the content. I give my ESL students plenty of OGT practice questions. They consistently have difficulty. I, in turn, become frustrated when I know I have taught them, and they have shown some mastery; and then bomb the test. A large factor that must be taken into consideration is how the English language (vocabulary) is one of the richest in the world. We have so many synonyms, etc. that we have to have a Thesaurus to help us native speakers interpret reading passages sometimes. An ESL student, especially the majority of the ones that have been immigrating here the last couple of years from countries where they have had no English, don't stand a chance when it comes to reading and understanding and processing the vocabulary on the OGT.
- Yes

D. What is your general opinion of the alignment between the standards and assessment:

- ii. Acceptable Alignment (5) : 83%
- iii. Needs slight improvement (1) : 17%

E. Comments

- Overall THIS is the hardest of the three forms, not because of SCIENCE CONTENT but because of READABILITY. There HAS TO BE A WAY to test content knowledge without handicapping poor readers. Rather than long reading passages, paragraphs, etc..try more outline formated things. For example: Himalayan Rabbits 1. Himalayan rabbits a. native to Him. mountains i. lots of snow fall there b. mostly white fur c. black fur on ears, nose, feet, tails This gives students the SAME important information but helps them organize it when they read it for it is presented in an organized fashion rather than traditional paragraph format.
- Couple questions to review- challenge
- This test was well aligned
- Many of the questions are aligned perfectly. However, there are also many test items that seem to test much deeper than the stated standard. This is how it should be!! But because of the bredth of content, there is no time to teach the depth that we would like to teach. Especially for ESL students-who need time to practice with the language and the content as they learn it if-if we want them to retain the knowledge and be able to apply it. It just seems we can't have it both ways!!! I can only hope that maybe there can be some changes to the standards-take away the broadness and let us teach more deeper so that we CAN expect higher level thinking, from ESL students as well as native speakers. I thank you for your time in reading my rantings from a sometimes frustrated teacher who only wants to see her ESL students be able to graduate with the skills necessary to make them productive citizens of the US! ####These are the kids that we want to graduate-they are "the keepers"!! They just need some help, and time as they learn the language!@ Thankyou!!

Table 10.15
Debriefing Summary
GR10 Science M07 Form 10C