WASL
Washington Assessment of Student Learning

A Component of the Washington State Assessment Program

Science

Test and Item Specifications

Grade 5

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I. PURPOSE of ASSESSMENT TOOL

The purpose of this assessment tool is to measure Washington fifth grade students' level of proficiency in Benchmark 1 of the science Essential Academic Learning Requirements (science EALRs approved July 17, 1998). These science EALRs consist of three standards. The first standard focuses on the scientific concepts and principles of the physical, earth, space, and life sciences. The second standard focuses on the skills and processes of science and technology. The third standard focuses on understanding the nature and context of science and technology.

II. ESSENTIAL ACADEMIC LEARNING REQUIREMENTS STRANDS and LEARNING TARGETS for SCIENCE

In keeping with the science EALRs and the science EALR Interpretation and Clarification document (Interim Version May 7, 1999), these standards have been regrouped into the following strands. These five strands have letter codes, (PC, SI, etc.), short names (Properties & Characteristics, Systems & Interconnections, etc.), and a color code in eth order of the colors of the rainbow, red, orange, yellow, green, blue.

PC Strand **Properties & Characteristics in the Physical, Earth, Space, and Life Sciences** Red

PC01 1.1.1 Properties of Substances
PC01 1.1.2 Motion of Objects
PC01 1.1.3 Wave Behavior
PC02 1.1.4 Nature & Properties of Earth Materials
PC03 1.1.5 Basis of Biological Diversity

SI Strand **Systems & Interconnections in the Physical, Earth, Space, and Life Sciences** Orange

SI01 1.2.1 Systems Physical, SI02 Earth/Space, SI03 Life, and SI04 Integrated
SI01 1.2.2 Energy Sources & Kinds
SI01 1.2.3 Energy Transfer & Transformation
SI01 1.2.4 Structure of Matter
SI01 1.2.5 Physical/Chemical Changes
SI02 1.2.6 Components & Patterns of Earth Systems
SI02 1.2.7 Components of the Solar System Beyond
SI03 1.2.8 Structure & Organization of Living Systems
SI03 1.2.9 Molecular Basis of Heredity
SI03 1.2.10 Human Biology

CH Strand	**Changes in Matter & Energy in the Physical, Earth, Space, and Life Sciences**	Yellow
CH01 1.3.1	Nature of Forces	
CH01 1.3.2	Forces to Explain Motion	
CH02 1.3.3	Processes & Interactions in Earth Systems	
CH02 1.3.4	History & Evolution of Earth	
CH02 1.3.5	Hydrosphere/Atmosphere	
CH02 1.3.6	Interactions in the Solar System & Beyond	
CH03 1.3.7	Life Processes & the Flow of Matter & Energy	
CH03 1.3.8	Biological Evolution	
CH03 1.3.9	Interdependence of Life	
CH03 1.3.10	Environmental & Resource Issues	
IP Strand	**Inquiry and Problem Solving in Science and Technology**	Green
IP01 2.1.1	**Questioning**	
IP02 2.1.2	Designing & Conducting Investigations	
IP03 2.1.3	Explanation	
IP04 2.1.4	Modeling	
IP05 2.1.5	Communication	
IP06 2.2.1	Identifying Problems	
IP07 2.2.2	Designing & Testing Solutions	
IP08 2.2.3	Evaluating Potential Solutions	
NC Strand	**Nature and Context of Science and Technology**	Blue
NC01 3.1.1	Intellectual Honesty	
NC02 3.1.2	Limitations of Science & Technology	
NC03 3.1.3	Dealing with Inconsistencies	
NC04 3.1.4	Evaluating Methods of Investigations	
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NC07 3.2.2	Relationship of Science & Technology	
NC08 3.2.3	Careers & Occupations using Science, Mathematics, & Technology	

III. TEST CONTENT ORGANIZATION and CRITERION

The test forms for the fifth grade science test will consist of 38 items or questions, resulting in 56 points per form. Items will be written at a reading level appropriate for a fifth grade audience.

Item Types

The items used in this assessment include multiple choice, short answer and extended response. The multiple choice and short answer questions assess conceptual understanding; short answer and extended response items assess applications of concepts and skills. All three types of questions are used to assess the strands.

Multiple Choice Items (MC): There will be 24 multiple choice items per form, worth 1 point each. Each multiple choice item will have three responses:

- The correct answer and two distractors.
- Distractors will be developed based on the types of errors students are most likely to make.
- Correct responses will be approximately equally distributed among As, Bs, and Cs.

Short Answer Items (SA): The student will construct a short response. There will be 12 short answer items per form, worth 2 points each. For example:

- Given a scientific phenomenon, the student will write an explanation.
- Describe a scientific concept or phenomenon.
- Give another context in which the concept applies.
- Provide a rationale for conclusion using scientific evidence.

Extended Response Items (ER): The student will construct a longer response. There will be 2 extended-response items, worth 4 points each. For example:

- Provide a design for a scientific investigation.
- Describe the effects of a change in some part of a system.
- Propose possible scientific solutions to human problems.

Composition of a 38-item Test

Type of Item	Number of Items	Total Points	Percent of Total Score
Multiple Choice	24	24	43%
Short Answer	12	24	43%
Extended Response	2	8	14%
Total	38	56	100%

Multiple choice and short answer items will be used to assess targets in Cognitive Category I: understanding. Multiple choice, short answer, and extended response items will assess targets in Cognitive Category II: application of conceptual understandings. Short answer items and extended response items will be used to assess targets in Cognitive Category II: thinking and process skills.

Cognitive Level of Items

Items will be classified according to their usage level (type of cognitive ability required for solution). Category I items will assess a student's knowledge of scientific concepts or principles and comprehension of scientific information. Category II items will assess the application of content in a science context, the application of science in a real-life context, the analysis of scientific information, the generation of ideas/models, and evaluation of scientific information or models.

Cognitive Distribution of Items

Cognitive Categories	Items	Points
Category I Conceptual Understanding, and Comprehension	12 – 14	16 – 20 (29 – 36%)
Category II Application, Analysis, Synthesis, and Evaluation	24 – 26	36 – 40 (64 – 71%)
Totals	**38**	**56**

Item Cards

An item card will accompany each item. The item card shall include the following information in the following order:

1. Item Code: a number for tracking purpose
2. Item Order in Scenario
3. Scenario Title or Stand Alone Item name indicating content description
4. EALR Code: strand and learning target (i.e. PC01 1.1.1)
5. Item Characteristic: letter of characteristic (i.e. PC01 1.1.1 a)
6. Curricular Area: Physical (PS), Context Physical (CPS), Earth/Space (ES), Context Earth/Space (CES), Life (LS), Context Life (CLS), Integrated (IS), or Context Integrated (CIS)
7. Grade Level: 10, 8, or 5
8. Cognitive Level (Category I or II)
9. Item Type: (MC, SA, ER)
10. Keyed Correct Answer Key
11. Word count and reading level from Microsoft Word
12. Latest Revision Date
13. Pilot Year and Form
14. Data Review Date
15. Fairness Review Date
16. Content Review Date
17. Writer Information: when, what organization or event (i.e. May 2002 Designing Scenarios)

Operational Test Forms

Each operational test form will contain items in common with another test form, but the vast majority of items will be **unique** to each form. The test will be administered in **three periods**, each of which will be about **45 minutes long**, plus an additional 10 minutes per session for set-up and directions. It is intended that each of the three parts of the test will contain 13 items in approximately the following proportions: eight multiple choice, four short answer, and one extended response on two of the sections.

Pilot Test Forms

Each pilot test form usually follows the same specifications as an operational. However, pilot forms may be designed to test specific types of scenarios and items, therefore, a pilot form may not cover the breath of learning targets of an operational exam.

Test Scoring

Each multiple choice item is worth one point, each short answer item is worth two points, and each extended response item is worth four points.

Scoring criteria will focus on the clear understanding of scientific ideas and concepts, effective application of scientific inquiry, effective application of problem solving, and effective communication of solutions based on inquiry.

- In cases of constructed responses, there will be no attention to conventions of writing (sentence structure, word choice, usage, grammar, spelling, and mechanics), as long as the writing or diagramming does not interfere with the communication.

- In cases of mathematical analysis of information, there will be no score points awarded for simply carrying out correct mathematics without indication of understanding of the concept being measured or manipulated.

IV. REPORTING SCHEMA and ITEM DISTRIBUTION

Reporting Schema

Student results will be reported as their scores in each of the five strands.

Item Distribution

All Essential Academic Learning Requirements strands will be addressed in each test form. The overall item distribution in an operational test form is intended to look as follows:

Essential Academic Learning Requirements Strands (# of Learning Targets & Page Color)	Multiple Choice	Short Answer	Extended Response	Range of Points	Percent of Total
PC Properties and Characteristics (5 targets on red pages)				7-8	50%
conceptual understanding (I)	1-2	0-1			
application/analysis (II)	1-2	1-3			
SI Systems & Interconnections (10 targets on orange pages)				9-11	
conceptual understanding (I)	2-3	1-2			
application/analysis (II)	1-2	2-3	0-1		
CH Changes in Matter & Energy (10 targets on yellow pages)				9-11	
conceptual understanding (I)	2-3	1-2			
application/analysis (II)	1-2	2-3	0-1		
IP Skills & Processes of Science & Technology (8 targets on green pages)				20-22	50%
scientific inquiry	3-4	2-3	1		
problem solving	2-3	1-2	0-1		
NC Nature & Contexts of Science & Technology (8 targets on blue pages)				8-10	
nature of science	1-2	1-2			
science, technology, & society	1-2	1			
Total Number of Items	**24**	**12**	**2**	**38**	
Total Number of Points	**24**	**24**	**8**	**56**	

V. GENERAL CHARACTERISTICS of SCENARIOS and ITEMS

All Scenarios

Scenarios developed for this assessment are to conform to the following considerations. These considerations include, but are not limited to, the following:

1. Scenarios will be real examples of what students would encounter beyond school or investigations they can relate to.
2. Scenarios should be **necessary but not sufficient** for student response. Some questions may be strongly related to the inquiry or system and can be asked in association with the scenario rather than in a stand alone manner. These related questions will come at the end of the scenario's associated questions.
3. Scenarios must be one of the themes of this assessment: scientific inquiry, technological problem solving or systems.
4. Scenarios are short, textual information less than100 words.
5. Scenarios will **not** be a reading burden, written at the third grade level.
6. Scenarios should have a lot of "white space," **not** a lot of text.
7. Vocabulary will be as common or simple as possible (i.e. an air-tight lid could be described as a lid that does not allow air in or out).
8. Scenarios will provide opportunity for assessment of more than one EALR strand through natural, not forced, connections.
9. Scenarios may be a combination of up to three elements (i.e. a graph, a diagram, and a written description).
10. Scenarios will always explain why a picture or diagram is included.
11. Titles for scenarios should be accurate, friendly, catchy, and interesting but not distracting or misleading. Avoid titles that may have copyright issues.
12. Scenarios will have five to eight questions associated with them.
13. More than one question should be possible for a given scenario element.
14. Character names on each form will be representative of the ethnic diversity of Washington students. The names will generally be short and simple to read.
15. Investigations should be written in past tense because the investigation has already happened.
16. Anything under a title should be on the same page (procedures, data, etc.).
17. Steps of procedures, or anything else, should have some white space between the steps (6 to 12 points, 1.5 to 2 spaces).
18. Use 12 pt. New Century Schoolbook font for text and 12 pt. Arial font for data and diagrams.
19. Diagrams should be high quality with labels.
    a. Bolded titles should be included as needed for clarification above the diagram.
    b. Labels should be in a different font, not bolded, with slightly curved arrows that point to object or component of the object.
    c. Labels should be consistent with references in the text.
    d. Diagrams should provide visual context for potentially unfamiliar words or objects (i.e. birdfeeder on a window sill to clue in unfamiliar objects).
    e. Simple, direct, not cluttered, familiar layouts to students at given grade.
    f. Use 'black line master" quality so that diagrams photocopy well.

20. Data is presented in a simple and clear manner with lots of "white space."
    a. Bolded titles and text for column and row labels of chart
    b. Use the format that fits best with the data with minimum verbiage
    c. Data may include numbers, words or symbols
    d. Limit total number of 'data cells' to12 (i.e. 2x6, 3x4).
    e. When conditions are labeled A, B, C, etc, the chart/data table should briefly describe the condition as well as the A, B, C, etc. (i.e. Jar 1 blue food coloring).
21. Graphs, tables, or figures must be clearly associated with their intended questions. Graphics will appear either on the same page as the scenario or on the facing page. If there is any reasonable chance of confusion, page references will direct students to look at the appropriate graphic.
22. In development, when the scenario is finished, all unnecessary language should be removed (i.e. ~~Adriana and Tuan~~ both participate in track).
23. Scenarios must have a summary sheet illustrating the design of the scenario and accompanying items as follows.

Title:								**Grade: 5**		
Description:										
Item Description		**EALR Strand, Learning Target, and Item Characteristic**					**Item Type**			
		Systems			**Inquiry & Problem Solving**					
		Properties and Characteristics	**Systems and Interconnections**	**Changes in Matter & Energy**	**Inquiry and Problem Solving**	**Nature and Context**	**Multiple Choice**	**Short Answer**	**Extended Response**
1									
2									
3									
4									
5									
6									
7									
8									
					Total				
					Ideal Totals		3 to 6	1 to 2	1 to 0

Note: Items must cover more than one EALR strand

All Items

Items developed for this assessment are to conform to the following considerations. These considerations include, but are not limited to, the following:

1. Test items will focus on events, situations, and phenomena that are real world as well as scientific and to which fifth grade students can relate.
2. Items will be connected to informative scenarios/stimuli that are necessary but not sufficient for demonstration of conceptual understanding.
3. Items testing application of a concept or skill will involve understandable, realistic situations to which as many students as possible can relate.
4. Focus of items will be on what ALL children should know and be able to do as they exit fifth grade.
5. Each test form will contain items assessing learning targets from all strands according to the test schema.
6. Items should serve specific purposes; each should assess something important rather than trivial.
7. Items must go beyond recall of facts; examinees must use and apply concepts (if we can easily look it up in a book, it doesn't belong on a state assessment).
8. Concepts within each discipline (e.g. physical, Earth, space, or life science) shall be the focus of the assessment rather than vocabulary knowledge or simple facts.
9. Items shall focus on the 'big ideas' of science:
    - Properties, classification, & characteristics
    - Structure & function of components of systems
    - Interdependence
    - Systems change
    - Models
10. Items should elicit rich thinking even in multiple choice items.
11. Items should require upper levels of Bloom's taxonomy:
    Level I
    - Conceptual Understanding
    - Comprehension

    Level II
    - Application (in scientific and 'real-life' situations)
    - Analysis (in scientific and 'real-life' situations)
    - Synthesis (using scientific knowledge/thinking/skills to generate new ideas, plans, hypotheses, to draw conclusions, etc.)
    - Evaluation (in scientific and 'real-life' situations)
12. Responses to items and selection of an answer choice show clear understanding relevant to the learning target—not just a "sort of" relationship.
13. Some items present phenomena and ask for explanations, predictions, and potential investigations (This is not meant to be narrowly prescriptive).
14. Inquiry items are grounded in the procedures and concepts of the relevant content area(s).
15. The items shall be precise and clear.
16. All items are to avoid bias and should not be offensive to any group of students. The items should not display stereotyped representations of gender, race, persons with disabilities, or cultural or religious groups.
17. All items must clearly indicate what is expected in a response and must help students.
18. Items in each form are to be balanced by gender and are gender-neutral for active/passive roles.
19. Pictorial representations shall be realistic and authentic for the respective grade.

Inquiry Scenarios

Inquiry scenarios developed for this assessment are to conform to the following considerations. These considerations include, but are not limited to, the following:

1. Statements that introduce an inquiry should be brief, no more than three sentences, while describing the reasons, or contexts for the inquiry.
2. Inquiry scenarios should deal only with the concepts and processes of the EALRs. Scenarios should not "teach" EALR concepts. Inquiries may NOT include a brief "content" paragraph.
3. Investigations should model good investigations.
4. The investigative question must be included or implied in the description of an investigation. The question may be left out in order to ask a MC item such as, "What is the investigative question?"
5. Formal or controlled investigations must be written with the following format: Question, Prediction, Materials, Procedure, Data, and Conclusion. The 'Question' and 'Conclusion' sections may be left out of the scenario in order to ask students about them.
6. The Prediction must be included; it may not be excluded in order to ask an MC question later.
7. Procedures of investigations should be easily read. Steps should be used for controlled investigations. However, observations in nature can be described without being in step format.
8. Procedures should be succinct, approximately four steps.
9. Procedures should state or imply the following variables: kept the same (constant or controlled), changed (manipulated), all variable being measured.
10. Procedures should describe how often measurements are taken.

Inquiry Items

Inquiry items developed for this assessment are to conform to the following considerations. Inquiry items ask students to **apply** their conceptual understanding of investigations in the following manners:

1. Identify the investigative question.
2. Identify questions that can be investigated scientifically using the same materials.
3. Design an investigation based upon a given investigative question.
4. Identify variables as kept the same (constant or controlled), changed (manipulated), all variable being measured.
5. Explain how an investigation is a fair test of a prediction.
6. Describe the technology (measurement tools, electronics, computers, etc.) needed to do scientific inquiry.
7. Write a conclusion for the investigation. A standard item reads as follows:

   Write a conclusion to the investigation.

   Be sure to:

   - Answer the investigative question.

   OR

   - Explain whether or not the prediction is supported by the data.

   AND

   - Give data from the table to support your conclusion.
8. Identify safety precautions in investigations.
9. Identify sources of error in measurement or describe how to improve measurement error.
10. Summarize the data or results of an investigation. This summary is different than a conclusion.
11. Summarize the design of an investigation. This summary is different than a conclusion.
12. Design tests to answer questions such as, “What substance is in a container?”
13. Describe how a model (physical and/or mathematical) can be used to investigate a system.
14. Compare the design of a different investigation of the same investigative question.
15. Based upon data from the current investigation, predict the results of an extension of this or a similar investigation.

System Scenarios

System scenarios developed for this assessment are to conform to the following considerations. These considerations include, but are not limited to, the following:

1. Description of the system as an object or connections of objects within some defined boundaries.
2. Description of the system inputs, changes (transfers), and/or outputs of matter, information, and/or energy.
3. Description of the appropriate phenomena associated with the system (i.e. phases of the Moon in an Earth, Moon, Sun system).
4. A labeled picture or labeled diagram of the system.
5. Only one system should be explored in a scenario. There may be many smaller systems within the main system and the main systems may be connected to other systems, however, the focus of a scenario should be a single system. Avoid multiple systems.
6. Scenarios should not "teach" EALR concepts. Scenarios should only deal with concepts and processes articulated in the science EALRs.
7. Some examples of systems are: pencil, battery-powered toy, wind up toy, glass of water with ice, a plant or animal cell, plant or animal life cycle, a plant, simple ecosystem, the water cycle.

Systems Items

System items developed for this assessment are to conform to the following considerations. System items ask students to **apply** their conceptual understanding in the following manners:

1. Identify the parts or components of a system.
2. Describe interconnections within a system or between systems.
3. Extract a component of a system, describe its properties/characteristics and/or explain its function.
4. Describe inputs, changes (transfers), and/or outputs of matter, information, and/or energy through a system including the order of transfer.
5. Describe energy changing forms (transformations) within a system.
6. Describe changes in matter throughout a system.
7. Explain the interactions and interdependencies between parts of a system.
8. Determine the orders or sequences of a system based upon evidence over time.
9. Compare one part of the system to another part of the system or to a part in a similar system in terms of their properties, characteristics, and/or function.
10. Compare the system to another, similar system.
11. Describe the forces acting between parts of a system and/or acting upon the whole system.
12. Predict changes within a system based on patterns of interactions within a system and explain your prediction.
13. Predict what would happen if a part of a system changed and explain your prediction.
14. Predict what would happen if a part of a system were to be changed from outside the system and explain your prediction.
15. Predict what would happen if the input to a system changes and explain your prediction.
16. Predict what could cause an output of a system to change in a particular way.
17. Create a model of a system correlating the model's parts and connections to the real system.

Problem Solving Scenarios

Problem solving scenarios developed for these assessments are to conform to the following considerations. These considerations include, but are not limited to, the following:

To Be Developed

Problem Solving Items

Problem solving items developed for these assessments are to conform to the following considerations. These considerations include, but are not limited to, the following:

To Be Developed

VI. ITEM DEVELOPMENT RULES

All Types of Item Rules

1. Each item begins with a stem that asks a question or poses a clear problem. A stem will seldom include an incomplete sentence.
2. All items must clearly indicate what is expected in a response and must help students focus their response. That is, items will clearly state the criteria by which the response will be evaluated, so that students understand what they are expected to do (e.g. create a table, provide a written explanation, etc.). General directions that allow the student more freedom in response format may read as follows: "Use words, labeled pictures, and/or labeled diagrams to show or explain your response."
3. All stems will be positively worded—no use of the word "not" in any form.
4. A stimulus that gives information must precede a question or a set of questions (see rules for scenarios and other stimulus materials).
5. To the extent possible, no stimulus, stem, or response for one item will serve as a clue to the correct response for another item.
6. Reading will be kept to a minimum to help make items clear and precise.
7. Test items will be independent in the sense that the answer for any test item does not depend on knowing the correct answer to another item, so items are not "linked."
8. If a question is stated in terms of one measurement system, all response options should be given in terms of the same measurement system. Units do not have to be included in the stem, but they should appear in every distractors or response when appropriate.
9. All items, scenarios, and other stimuli materials will be framed in terms of the metric system unless the situation lends itself to another system (e.g., Standard, psi).

Multiple Choice Item Rules

1. Each multiple choice item will have a stem (question, statement, or incomplete statement) and three answer (or completion) options, only one of which is correct.
2. Multiple choice item stems will present a complete problem so that students will know what to do before looking at the answer choices. Students should **not** need to read all answer choices before knowing what is expected.
3. Multiple choice item stems will be short, about 25 words or two lines.
4. All multiple-choice answer choices will be similar in length, semantic complexity, and syntax. Students should not be able to rule out a wrong answer or identify a correct response by virtue of it looking or sounding different.
5. Distractors must present plausible alternatives. They should be created so that students *think* their way to the correct answer instead of identifying incorrect answers by virtue of their inappropriate nature.
6. Incorrect answer choices (distractors) will include "common errors" or less-sophisticated understanding so that they are attractive to students with emerging understanding.
7. Distractors should always be plausible (but, of course, incorrect) in the context of the item stem and the stimulus materials. The responses or distracters will be arranged in a logical order (i.e. numerical or chronological order or according to the length of the distracters).
8. Distractors will NOT be partially correct or "trick" students into choosing an incorrect response.
9. Correct responses will be approximately equally distributed among *A*s, *B*s, and *C*s.

Multiple Choice Item Rules (continued)

10. The responses "Both of the above", "All of the above", "None of the above", and "Neither of the above" will not be used.
11. Some items should include graphics for answer choices.

Short Answer and Extended Response Item Rules

1. Each short answer or extended response item will give clear indications, bulleted when appropriate, of what is required of students (e.g. if two examples are required, the stem will indicate this).
2. Anything required by the scoring guide will be asked for in the item stem.
3. When "explain" or "describe" are used, there must be explicit instructions to help clarify or define these action terms.
4. Short answer and extended response item stems will be short and succinct with simple syntax and familiar words. Item stems will contain no more than three sentences (about 35 words): two to set up the situation and one to prompt or question.
5. Short answer and extended response items should need a full thought or sentence, more than one word, for a correct response.
6. All short answer items and extended response items will be developed with accompanying scoring guides.
7. The structure of items should give students a set of information; specific requirements should be bulleted and key words will be bold-faced in order to draw attention to key requirements of the item or task.
8. Any item that requires the student to use data from a scenario, or other stimulus, will specifically ask for the data from the scenario that was needed to respond. Use the word data when asking students to cite actual numeric value from the investigation. (e.g. "Support your response with specific data").
9. Graphic organizers (boxes with labels or minimal directions) should be used to assist students to frame their responses.

Short Answer Only Item Rules

1. Short answer items should require a limited response that may range from a few words, one or two sentences, completion of a table, graph, or chart, construction of a diagram, a brief comparison or a brief contrast, a brief justification of a choice, or a brief conclusion.
2. Short answer items will involve justifying a multiple choice response, listing examples, explaining a simple concept or principle, making a prediction with supportive evidence, drawing a conclusion with supportive evidence, making an inference with supportive evidence.
3. Short answers should require more than a one-word response for a score point.

Extended Response Only Item Rules

1. Item stems for extended response items will contain no more than three sentences: two to set up the situation and one to prompt or question.
2. Extended response items will require responses that range in length from lists of words or data to labeled diagrams, graphs, tables, and/or charts to extended explanations, justifications, comparisons, and contrasts that include sufficient detail to show clear understanding.

Rules for Developing Scoring Guides

1. An item-specific scoring guide will be developed for each short answer and extended response item.
2. Scoring Guides must specifically reflect the intended learning target by using language from the EALR in the full point description.
3. Information from the pilot is used to refine these scoring guides for use with the final items.
4. Scoring guides generally follow an "analytical" model in which score points are well defined by the bulleted statements in the item stem.
5. Scoring guides may follow a "focused holistic" model in which the score for the response is based on overall quality, but also results from focusing on several important features of the student's performance.
6. Scoring guides for each item will follow from the scoring criteria given on pages 52 through 55.
7. Scoring guides for conceptual understanding focus on level of conceptual development or (emerging) understanding as described in the learning target.
8. Scoring guides for processes will focus on effectiveness in use of inquiry processes, effectiveness of application, reasonableness of justification, selection of useful information to support claims, degree to which responses are viable and follow from the scenario or other stimulus materials.
9. Scoring guides for an investigation design items must follow the "Generic Scoring Guide for Investigation Design Extended Response Items" on page 56.
10. Short answer items will be scored with a three-level scoring guide (0-2); students may receive full credit, partial credit, or no credit.
11. Extended response items will be scored with a five-level scoring guide (0-4); the levels may be summarized:
    - 4 Thorough; accurate; effective; shows accurate understanding; clear communication
    - 3 Mostly complete/mostly accurate; reasonable, mostly clear
    - 3 Somewhat complete/accurate; partially supported; somewhat clear
    - 1 Attempted/minimal accuracy; little support; problematic communication
    - 0 Shows no understanding of the concepts or processes being assessed

VII. ITEM DEVELOPMENT GUIDE for the PROPERTIES and CHARACTERISTIC STRAND

Red

PC Properties and Characteristics Strand

Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.

PCO1 Physical Science Properties

Demonstrates an understanding of how to use properties to identify, describe, and categorize physical substances and objects.

Item Format

Multiple choice and short answer items may be used to assess these learning targets.

Stimulus/Scenario Attributes

- All stimuli must be age and grade appropriate situations or phenomena.

Stimuli may include:

- Phenomena, situations, diagrams, or charts with information about physical objects and materials.
- Objects or materials that students can sort by size, weight, shape, color, texture, and hardness.
- Two-dimensional distance-time grids that represent relative positions or motions of objects. Grids will only be in the first quadrant of the Cartesian plane.
- Labeled graphics of tools, such as rulers, balances, spring scales, and thermometers.
- Situations and phenomena in which experiences with sound and light are described or visually represented.

Scientific Vocabulary and Terms

- Terms that may be used:

amount of time	inch (in)	pitch	speed
centimeters (cm)	kilogram (kg)	pound	texture
color	kilometer (km)	property	vibration
echo	liter (L)	rate	weight
feet	meter (m)	shape	yard
gram	mile (mi)	size	
hardness	ounce	sound	

- Terms that may be used with definitions or examples: absorb, magnify, reflect
- Terms that may not be used: interval, refract, transmit
- All terms allowed and restricted under other strands apply to Properties and Characteristics.

PC01 1.1.1 Properties of Substances Red

Use properties to sort natural and manufactured materials and objects, for example size, weight, shape, color, texture, and hardness.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Apply their understanding of classification, position, and motion of objects in the context of real phenomena.
b) Identify, describe, or sort objects and materials, using physical properties.
c) Describe objects using measurements of physical quantities, including length, weight, and temperature.

PC01 1.1.2 Motion of Objects

Describe the relative position and motion of objects.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Use positional language such as in front of, behind, to the left, to the right, above, and below, to describe the position of one object relative to another object or relative to surroundings.
b) Describe the position of an object in relation to another object on a distance scale laid out in units.
c) Identify or describe the position of an object in relation to itself on a distance-time grid with a scale laid out in units.
d) Identify the position of an object at a particular time on a clock (an instant in time) or to identify the distance traveled in a straight line by an object given an amount of time.
e) Compare the distance traveled by two objects in the same amount of time.
f) Use appropriate directional and positional numbers and words to describe motions of an object in terms of distance and time when given a graph, labeled diagram, or other representation of motion.

PC01 1.1.3 Wave Behavior

Describe experiences with sound, for example vibrations, echoes, and pitch. Describe experiences with light in terms of bouncing off, passing through, and changes in path and direction.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Identify relationship between the pitch of a sound and the rate of vibrations.
b) Describe what happens to the pitch when the rate of vibrations changes.
c) Identify or describe the motion of light waves when the waves hit substances that bouncing off light, allow light to pass through, or change the light's path and direction.

PC02 Earth and Space Science Properties Red

Demonstrates an understanding of how to use properties to identify, describe, and categorize Earth and space substances.

Item Format

Multiple choice or short answer items may be used to assess this learning target.

Stimulus Attributes

- All stimuli must be age and grade appropriate situations or phenomena.

Stimuli may include:

- Situations in which other students observe and examine the physical properties of Earth materials such as rocks, soil, and water.
- Situations in which other students observe and examine the physical properties of the gases of the atmosphere.
- Descriptions of situations or diagrams where water can go from one form of matter to another.
- Charts, or labeled diagrams that include the properties of soil, such as color, texture, capacity to retain water, and ability to support the growth of many plants.

Scientific Vocabulary and Terms

- Terms that may be used:

condensation	gas	precipitation	vapor
evaporation	liquid	solid	wind

- Terms that may be used with definitions or examples: nutrients
- Terms that may not be used: atmosphere, wind currents
- All terms allowed and restricted under other strands apply to Properties and Characteristics.

PC02 1.1.4 Nature & Properties of Earth Materials

Discriminate among physical properties of Earth materials, such as rocks and soil, water (as liquid, solid, and vapor) and the gases of the atmosphere. *

* The water cycle for Earth

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Apply their understanding of classification in the context real phenomena.
b) Sort or describe pictures of rocks or soils based on color, shape, size, and texture.
c) Describe or identify the functions of soils (retain water, support plant growth, provide plant nutrients).
d) Identify or describe water's state of matter in different situations.
e) Describe the processes that change water's state of matter.
f) Identify or describe states of air (still, moving).

PC03 Life Science Characteristics Red

Demonstrates an understanding of how to use characteristics to categorize living things.

Item Format

Multiple choice and short answer items may be used to assess this learning target.

Stimulus Attributes

- Stimuli must include age and grade appropriate situations or phenomena
- Stimuli may include diagrams, or charts, that include living organisms and nonliving objects.

Scientific Vocabulary and Terms

- Terms that may be used: characteristic, energy, food, living, nonliving.
- Terms that may be used with definitions or examples:
- Terms that may not be used: photosynthesis
- All terms allowed and restricted under other strands apply to Properties and Characteristics.

PC03 1.1.5 Basis of Biological Diversity

Distinguish living organisms from nonliving objects and use characteristics to sort common organisms into plant and animal groups.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Apply their understanding of classification in the context real phenomena.
b) Sort objects and organisms based on whether they have the characteristics of living things.
c) Identify or describe the characteristics of living organisms.
d) Identify or describe how plants make food and animals eat food.

VIII. ITEM DEVELOPMENT GUIDE for the SYSTEMS and INTERCONNECTIONS STRAND

SI Systems and Interconnections Strand

Recognize the components, structure, and organization of systems and the interconnections within and among them.

SI01 Systems

Recognize the components, structure, and organization of systems not explicitly expressed in other learning targets and the interconnections within and among them.

Item Format

Refer to item format under each discipline's section.

Stimulus/Scenario Attributes

Refer to stimulus/scenario attributes under each discipline's section.

Scientific Vocabulary and Terms

Refer to scientific vocabulary and terms under each discipline's section.

SI01 1.2.1 Physical Systems

Identify the parts of a physical system, how the parts go together, and how they depend on each other. *

SI02 1.2.1 Earth and Space Systems

Identity the parts of Earth's subsystems, how they go to together, and how they depend on each other. *

SI03 1.2.1 Living Systems

Identify the parts of a living system, how the parts go together, and how they depend on each other. *

SI04 1.2.1 Integrated Systems

Identify the parts of physical, Earth, space, and/or living systems go to together, and how they depend on each other. *

*Other than the systems described in other SI learning targets

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Identify or describe the inputs, outputs, and/or transfers of a system.
b) Identify or describe how the parts of the system go together.
c) Identify or describe the function of a part within a system.
d) Identify or describe how one part of the system depends on other parts of the same system.
e) Identify or describe what would happen if one part of the subsystem was missing or broken.
f) Identify or describe what humans can do with the system that they could not do without that system.

SI01 Physical Systems and Interconnections Orange

Recognize the components, structure, and organization of physical systems and the interconnections within and among them.

Item Format

Multiple choice, short answers, and extended response items may be used to assess these learning targets. Extended response items may be used only when students are asked to identify parts of a system and describe how the parts of the system interconnect and/or depend upon one each other.

Stimulus/Scenario Attributes

- Stimuli must include age- and grade-appropriate situations and phenomena.

Stimuli may include:

- Graphics that show parts of a physical system including subsystems.
- Diagrams of matter in different forms.
- Diagrams of different forms of energy.
- Diagrams of parts of materials.

Scientific Vocabulary and Terms

- Terms that may be used:

cause	electricity	inclined plane	pulley
condense	energy of motion	lever	stored energy
depend	evaporate	machine	system
effect	freeze	melt	thaw
electrical	heat energy	part	

- Terms that may be used with definitions or examples: transfer, states of matter, matter, states, potential energy, kinetic energy, conduction, chemical, mechanical, circuit
- Terms that may not be used: subsystem, transformation, impact, thermal
- All terms allowed and restricted under other strands apply to Systems and Interconnections.

SI01 1.2.2 Energy Sources and Kinds

Understand that energy keeps things running; and comes in many forms.

Item Characteristics

Given a labeled diagram or drawing of a simple physical or electrical system, items may ask students to:

a) Identify or describe the source of energy for the system.
b) Identify or describe the forms of energy present in a system such as heat, light, electrical, sound, stored (potential), or energy of motion (kinetic).
c) Identify or describe how energy keeps the system running, moving, making sound, working, playing, etc.

SI01 1.2.3 Energy Transfer and Transformation Orange

Know that energy can be changed between various forms.

Item Characteristics

Given a labeled diagram or drawing of a simple physical or electrical system, items may ask students to:

a) Identify or describe where an energy change occurs in the system.
b) Identify or describe the energy before and after a change has occurred such as the energy of motion of a hands clapping changing into sound energy.
c) Identify or describe where stored energy is changed to another energy form such as energy of motion, heat, light, or sound.
d) Identify or describe where an object has the greatest or least stored energy due to lift or falling in a system.
e) Identify or describe where in a system an object has the greatest (or least) stored energy and/or energy of motion.

SI01 1.2.4 Structure of Matter

Know that matter is made of small particles.

Item Characteristics

Given a labeled diagram or drawing of a simple object or material, items may ask students to:

a) Identify or describe the smaller parts of the object or material that cannot be seen with the naked eye.
b) Identify or describe objects that are made of only one kind of material and objects made of several kinds of material.

SI01 1.2.5 Physical and Chemical Changes

Know that matter can undergo changes of state such as evaporation, condensation, or freezing and thawing. *

*The water cycle when not part of the Earth sciences.

Item Characteristics

Given a labeled diagram or drawing of a simple object, material, or material within a system, items may ask students to:

a) Identify or describe the different states of matter for the object or material.
b) Identify or describe what happens to matter as it changes state.
c) Identify or describe what happens to the shape or the matter or object as it changes state.

SI02 Earth and Space Systems and Interconnections

Orange

Recognize the components, structure, and organization of Earth and space systems and the interconnections within and among them.

Item Format

Multiple choice, short answer, and extended response items may be used to assess these learning targets. Extended response items may be used only when students are asked to identify parts of a system and describe how the parts of the system interconnect and/or depend upon one each other.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations and phenomena

Stimuli may include:

- Graphics that show parts of Earth's subsystems (a landmass and its topography, vegetation, and bodies of water **or** oceans and landmasses, including landmass topography, and bodies of water **or** a side-view of Earth's core, landforms, and atmosphere).
- Graphics that show Earth in relation to the Sun, the Moon, or both.
- Graphics that show the Earth in relation to other planets in the solar system.

Scientific Vocabulary and Terms

- Terms that may be used:

continent	lake	pattern	stream
Earth	Moon	planet	Sun
forest	mountain	river	
grassland	ocean	sea	

- Terms that may be used with definitions or examples: crust, core, sphere, landmass, body of water
- Terms that may not be used: metallic, spherical, topography, mantle
- All terms allowed and restricted under other strands apply to Systems and Interconnections.

SI02 1.2.6 Components and Patterns of Earth Systems

Recognize that Earth is a spherical planet with a mainly solid interior and a surface composed of landforms, bodies of water, and an atmosphere.

Item Characteristics

Given a map or labeled diagram of a part of Earth's oceans and landmasses, items may ask students to:

a) Identify or describe patterns found in the map or diagram.
b) Identify the function of a given part of the Earth system.
c) Identify or describe how one part of the Earth system depends on another part of the system.
d) Identify or describe what would happen if one part of Earth's subsystem was missing.

SI02 1.2.7 Components of the Solar System and Beyond Orange

Know that Earth is one of several planets that orbit the Sun, and the Moon orbits Earth.

Item Characteristics

Given a map or labeled diagram Earth-Sun-Moon system, items may ask students to:

a) Identify or describe how the parts of the system go together.
b) Identify or describe how one part of the system depends on another part of the same system.
c) Identify or describe what would happen if one part of the system were missing.
d) Identify or describe how the parts of the system appear from Earth.
e) Identify or describe the Moon's cycle, how long the cycle lasts, and/or why the Moon looks different at different times.
f) Identify or describe Earth's solar cycle and how long it lasts.

SI03 Living Systems and Interconnections Orange

Recognize the components, structure, and organization of living systems and the interconnections within and among them.

Item Format

Multiple choice, short answer, and extended response items may be used to assess this learning target. Extended response items may be used only when students are asked to identify parts of a system and describe how the parts of the system interact and/or depend upon one another.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations and phenomena.

Stimuli may include diagrams or pictures of:

- Parts of plant subsystems (e.g. flower, leaf, stem; stamen, pistils, and ova).
- Human body subsystems (e.g. lungs, windpipe, mouth and nose; heart, veins and arteries; brain, spinal cord, and nerves; skin; mouth, teeth, esophagus, stomach, and intestines).

Scientific Vocabulary and Terms

- Terms that may be used:

acquired	heart	oxygen	stem
bone	inherited	reproduction	structure
brain	leaf	root	substance
cell	lung	seed	waste
egg	muscle	skeleton	
flower	nutrient	special	
function	organism	sprout	

- Terms that may be used with definitions and examples: offspring, organ, ecosystem, factors blood vessel, intestine
- Terms that may not be used: tissues, subsystem, specialized, esophagus, pistil, stamen, ova, photosynthesis, carbon dioxide, names of any cell parts (nucleus, cell walls, cell membranes, etc.)
- All terms allowed and restricted under other strands apply to Systems and Interconnections.

SI03 1.2.8 Structure and Organization of Living Systems

Know that living things are composed of parts made of cells.

Item Characteristics

Given a picture or labeled diagram of the parts of a plant or animal, items may ask students to:

a) Identify or describe how the parts of the organism go together.
b) Identify or describe how one part of the organism depends on other parts.
c) Identify or describe what would happen if one part of the subsystem was missing.
d) Identify or describe how cells are arranged into body structures.

Given a picture or labeled diagram of plant or animal cells, items may ask students to:

e) Describe how the cells look different.
f) Identify or describe the functions of cells.

SI03 1.2.9 Molecular Basis of Heredity Orange

Describe the life cycles of plants and animals, and recognize the differences between inherited and acquired characteristics.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Identify or explain which given traits and characteristics of plants or animals are likely to be inherited or acquired.
b) Describe the life cycle of a plant or animal when given a labeled picture or diagram of that plant or animal.

SI03 1.2.10 Human Biology

Understand the organization and function of human body structures and internal organs, and how they work together.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Describe that the human body breathes in air and use the oxygen in order to live.
b) Describe that the human body obtains energy and substances from food for living, growth, and body repair.
c) Identify or describe that the skin protects the human body from harmful substances, unhealthy organisms, and from drying out.

Given a simplified picture or labeled diagram of human body subsystems, items may ask students to:

d) Identify or describe that the brain gets signals from the parts of the human body, controls the life functions, and sends signals out to the body parts.
e) Identify or describe that one part of the subsystem depend on other parts of the same system.
f) Identify or describe what would happen if one part of the subsystem was missing.

IX. ITEM DEVELOPMENT GUIDE for the CHANGES in MATTER and ENERGY STRAND

Yellow

CH Changes in Matter and Energy Strand

Understand how interactions within and among systems cause changes in matter and energy.

CH01 Physical Changes in Matter and Energy

Understand how interactions within and among physical systems cause changes in matter and energy:

Item Format

Multiple choice and short answer items may be used to assess this learning target. Extended response items may be used only when students are asked to identify interaction within and among physical systems.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations and phenomena.

Stimuli may include:

- Labeled graphics that show various forces, the direction of a force, or the effects of a force.
- Labeled graphics showing magnetic forces electrical forces, or forces from colliding or moving objects.

Scientific Vocabulary and Terms:

- Terms that may be used: force, magnetic, pull, push, strength
- Terms that may be used with examples or definitions: attract, opposing, opposite, repel
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Changes in Matter and Energy.

CH01 1.3.1 Nature of Forces

Describe forces in terms of strength and direction.

Item Characteristics

Given a labeled diagram of one or more objects and forces acting, items may ask students to:

a) Decide if a force is acting on an object.
b) Identify or describe the direction in which the force is acting.
c) Identify the force that is acting on the object(s).
d) Compare the strength of one force with the strength of another force in the same or opposite direction.
e) Compare the strength of a force given different opposing forces.

CH01 1.3.2 Forces to Explain Motion Yellow

Investigate and recognize factors that determine the effects of a push or pull on the motion of objects.

Item Characteristics

Given a scenario involving one or more objects and forces, items may ask students to:

a) Determine whether an object is likely to speed up, slow down, or maintain speed over time.
b) Determine which force is likely to cause an object to move in a particular direction.
c) Determine how the same force causes different mass objects to move differently.
d) Determine how much motion an object gets from a force acting over different amounts of time.
e) Determine which object requires the greatest force to move.

CH02 Earth and Space Changes in Matter and Energy
Understand how interactions within and among Earth and space systems cause changes in matter and energy.

Item Format
Multiple choice, short answer, and extended response items may be used to assess this learning target. Extended response items may be used only when students are asked to identify interaction within and among Earth and space systems.

Stimulus/Scenario Attributes
- Stimuli must be age and grade appropriate situations and phenomena.

Stimuli may include:
- Simplified graphics that show landforms of Earth.
- Labeled pictures, charts and graphics showing or representing changes that occur to the surface of the earth.
- Labeled pictures or descriptions of situations that show plant and/or animal fossils.
- Labeled diagrams of the Earth-Moon-Sun system with indications of motion.
- Charts, graphs, or tables indicating locations of the Sun (from the Earth's perspective) at different times of the year **or** of the Moon (from the Earth's perspective) at different times of the month.
- Charts, graphs, or tables showing evidence of weather patterns (precipitation, snowfall, temperatures, wind directions, wind speed).

Scientific Vocabulary and Terms
- Terms that may be used:

cycle	fossil remains	orbit (revolution)	volcano
earthquake	fossil	orbit (revolve)	weather
erosion	glacier	spin (rotate)	
eruption	gravity	temperature	

- Terms that may be used with definitions or examples: weathering
- Terms that may not be used: glaciology, meteorology
- All terms allowed and restricted under other strands apply to Changes in Matter and Energy.

CH02 1.3.3 Processes and Interactions in Earth System
Identify processes that slowly change the surface of Earth such as erosion and weathering, and those that rapidly change the surface of Earth such as landslides, volcanic eruptions, and earthquakes.

Item Characteristics
Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:
a) Identify or describe the pull of Earth's gravity on objects near Earth.
b) Identify or describe the causes of erosion.
c) Identify or describe how weathering and/or erosion change Earth's surface.
d) Identify or describe how volcanic eruptions and earthquakes change Earth's surface.

CH02 1.3.4 History and Evolution of Earth Yellow

Recognize how fossils provide evidence of plants, animals, and environments that existed long ago.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Identify or describe fossils as the remains of prehistoric plants and animals.
b) Identify or describe fossils as any evidence of prehistoric plants and animals.
c) Identify or describe what fossil remains can tell us about environments and animal in the past.

CH02 1.3.5 Hydrosphere and Atmosphere

Observe and measure weather indicators such as temperature, wind direction and speed, and precipitation; noting changes and patterns of change from day to day and over the seasons.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Identify or describe weather patterns from simple tables of data.
b) Predict future weather from simple tables of data.
c) Identify or describe how the Sun provides the light and heat energy necessary to maintain the temperature on Earth.

CH02 1.3.6 Interactions in the Solar System and Beyond

Observe and describe the patterns of movement of the Sun and Moon relative to each other and Earth, and relate them to Earth's rotation.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Identify or describe patterns of the Sun or Moon in the sky based upon labeled diagrams or simple tables of data.
b) Identify or describe how the spin (rotation) of Earth determines day and night.

CH03 Changes in Matter and Energy of Living Systems Yellow

Understand how interactions within and among living systems cause changes in matter and energy.

Item Format:

Multiple choice, short answer, and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes:

- Stimuli must include age and grade appropriate situations and phenomena.

Stimuli may include:

- Charts and labeled graphics that show matter and energy (food, light, water) being transferred from one organism to another.
- Labeled graphics that show how matter and energy (food, light, water) are exchanged between organisms and their physical environment.
- Situations and labeled graphics where energy is changed from one form to another in an organism.
- Charts with labeled pictures showing plant and/or animal fossils in rocks from different time periods or timelines with pictures of fossils.
- Descriptions (stories) of organisms affected by changes in environmental conditions such as fire, flood, drought, climate change, increase or decrease in predators, decomposers, producers, etc.

Scientific Vocabulary and Terms:

- Terms that may be used:

air	decomposer	producer	water
climate	food chain	reproduce	
consumer	molecule	soil	

- Terms that may be used with definitions or examples: body of water, carbon dioxide, chemical, ecosystem, factor, offspring, organ, transfer
- Terms that may not be used: impact, subsystem, thermal, transformation
- All terms allowed and restricted under other strands apply to Changes in Matter and Energy.

CH03 1.3.7 Life Processes and the Flow of Matter and Energy Yellow

Recognize that living things need constant energy supplied from food or light and that, in ecosystems, substances such as air, water, nutrients, and the chemicals in food are continually recycled.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Identify or describe the sources of energy used by plants and animals to live.
b) Identify or describe how plants use water, light, air (carbon dioxide), and nutrients to produce food molecules.
c) Identify or describe how plants release oxygen when producing food molecules.
d) Identify or describe how animals take in water, oxygen, and the food molecules produced by plants to live.
e) Identify a simple path of matter and/or energy when it is being exchanged between organisms and/or between their environment in a food web or chain.
f) Identify or describe the exchange of oxygen and carbon dioxide between plants and animals.
g) Identify or describe how substances such as air, water, nutrients, and the chemicals in food are recycled.
h) Identify or describe the role of soil to a plant.

CH03 1.3.8 Biological Evolution

Know how fossil records show patterns of structural change in organisms over time.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Identify or describe how fossils are used to trace changes in organisms over time.
b) Compare and contrast the remains of existing organisms with fossil remains for similar organisms.

CH03 1.3.9 Interdependence of Life

Describe how an organism's behavior and ability to survive is influenced by its environment, other life forms, and availability of food and/or other resources.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Explain what animals need to sustain life.
b) Explain what plants need to sustain life.
c) Identify or describe the role of animal senses in their survival.
d) Identify or describe how an organism's role (predator, prey, consumer, producer, decomposer, scavenger, etc.) contributes to the balance of an ecosystem.
e) Analyze or predict the effects of a major increase or decrease (or elimination) of an organism from a simple food chain.
f) Analyze or predict the effects of a major environmental change on the maintenance or survival of a species.

CH03 1.3.10 Environmental and Resource Issues Yellow

Know how humans and other living things depend on the natural environment; and can cause changes in their environment that affect their ability to survive.

Item Characteristics

Given a labeled picture or labeled diagram of an appropriate system, items may ask students to:

a) Analyze or predict the effects of human behaviors on the health of an ecosystem.
b) Describe how humans or other living things depend on the living and non-living environment for their survival.
c) Describe how resources can be conserved through reusing, reducing and recycling.

X. ITEM DEVELOPMENT GUIDE for the SKILLS and PROCESSES STRAND

Green

IP Strand Inquiry and Problem Solving in Science and Technology

Develop abilities necessary to do scientific inquiry and apply science knowledge and skills to solve problems or meet challenges.

IP01 2.1.1 Questioning

Ask questions about objects, organisms, and events in the environment.

Item Format

Multiple choice and short answer items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age- and grade-appropriate investigations.
- Descriptions of scientific investigations must have an indication that the investigation was guided by a question.
- All formal or controlled investigations must include a prediction, materials, procedure, and data section.

Scientific Vocabulary and Terms

- Terms that may be used:

chart	event	observation	question
classify	graph	observe	report
conclude	investigate	organize	result
conclusion	investigation	predict	sort
data	material	prediction	table
diagram	milliliter (mL)	procedure	variable

- Terms that may be used with definitions or examples:
- Terms that may not be used: experiment, dependent, independent, infer, inference, phenomenon
- All terms allowed and restricted under other strands apply to Questioning.

Item Characteristics

Given a description of a scientific investigation, items may ask students to:

a) Identify one question that was investigated through investigation.
b) Identify a new question that can be investigated with the same materials.

IP02 2.1.2 Designing and Conducting Investigations Green

Plan and conduct simple investigations, using appropriate tools, measures, and safety rules.

Item Format

Multiple choice, short answer, and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate investigations.
- Descriptions of scientific investigations must have an indication that the investigation was guided by a question.
- All formal or controlled investigations must include a prediction, materials, procedure, and data section.
- All descriptions of investigation must include the variables that were kept the same (controlled) and changed (manipulated).
- All descriptions of investigation must include what is being measured and how often.
- All tables, charts, and/or graphs must have informative titles, appropriate labels, units, and appropriate scales.
- Tables, graphs, and charts will NOT include irrelevant data or data designed to 'trick' students into giving an incorrect response.
- Stimuli may include descriptions, charts, and labeled graphics that show a repeated or related scientific investigation that includes the results and conclusions.
- Stimuli may include labeled diagrams or labeled pictures of objects used in a scientific investigation.

Scientific Vocabulary and Terms

- Terms that may be used:

balance scale	hand lens	thermometer
describe	magnifying glass	variable changed (manipulate)
design	spring scale	variable kept the same (controlled)

- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Designing and Conducting Investigations.

Item Characteristics

Given a complete description of a scientific investigation, items may ask students to:

a) Design a second study for a different investigative question and involving a minimal change in original design.
c) Identify one variable kept the same (controlled).
d) Identify the one variable changed (manipulated).
e) Identify what variable is being measured.
f) Identify safety requirements that would be needed in the investigation.

IP03 2.1.3 Explanation Green

Use data to construct reasonable explanations.

Item Format

Short answers and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate investigations.
- All descriptions of scientific investigations must have either a clearly stated question that guides the investigation OR an indication that the investigation was guided by a question.
- All descriptions of investigations must include the prediction, materials, procedure, and data.
- All descriptions of investigation must include the variables that were kept the same (controlled) and changed (manipulated).
- All descriptions of investigation must include what is being measured and how often.

Stimuli may include:

- Charts and labeled graphics that show the results of a scientific investigation.
- Descriptions, charts, and labeled graphics that show a repeated or related scientific investigation that includes the results and conclusions.

Scientific Vocabulary and Terms

- Terms that may be used: explain, explanation
- Terms that may be used with definitions or examples: compare (similar), contrast (different)
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Explanation.

Item Characteristics:

Given a complete description of a scientific investigation, items may ask students to:

a) Write a conclusion. A standard item reads as follows:
   Write a conclusion to the investigation.
   Be sure to:
   - Answer the investigative question.

   OR
   - Explain whether or not the hypothesis is supported by the data.

   AND
   - Give data from the table to support your conclusion.

b) Identify or describe a scientific interpretation based on the results of an investigation.
c) Compare the results drawn from repeated or two related investigations.
d) Identify or generate an interpretation based on results and support that generalization with specific data.
e) Identify or give a rationale for a given conclusion or interpretation using evidence from the investigation.
f) Predict what logically might occur if the investigation lasted longer.

IP04 2.1.4 Modeling Green

Model objects, events, or processes by representing them with concrete objects, metaphors, analogies, or other conceptual or physical constructs.

Item Format

Multiple choice, short answer, and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations or phenomena.

Stimuli may include:

- Background information about a scientific issue or phenomena.
- A description of a scientific phenomenon.
- Labeled diagrams or graphics that show a model of a scientific phenomenon.

Scientific Vocabulary and Terms

- Terms that may be used:

amount	identify	object	process
direction	model	picture	

- Terms that may be used with definitions or examples: contrast (different), compare (similar), image, metaphor
- Terms that may not be used: analogy, conceptual, construct, experiment, phenomenon
- All terms allowed and restricted under other strands apply to Modeling.

Item Characteristics

Given an appropriate labeled picture or diagram, items may ask students to::

a) Identify or describe how a model can be used to investigate a described phenomenon.
b) Identify or describe a specific example of a given phenomenon for which is it most efficient and effective to investigate using models (e.g. processes that happen too slowly or too quickly; phenomenon that are too small for direct observation, or too vast to be seen; phenomenon that cannot be controlled deliberately, or are potentially dangerous).
c) Identify or describe the similarities or differences between a model, event or object and a scientific phenomenon (e.g. compare a hinge and an elbow; a spinning a globe and Earth's rotations; steam from a tea kettle and evaporation).

IP05 2.1.5 Communication

Record and report observations, explanations, and conclusions, using oral, written, and mathematical expression.

Item Format

Short answer and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate investigations.
- All descriptions of scientific investigations must have either a clearly stated question that guides the investigation OR an indication that the investigation was guided by a question.
- All descriptions of investigations must include the prediction, materials, procedure, and data.
- All descriptions of investigation must include the variables that were kept the same (controlled) and changed (manipulated).
- All descriptions of investigation must include what is being measured and how often.
- All grids to be used for graphs must include an informative title, scale(s), and labels for axes.

Stimuli may include:

- Charts and labeled graphics that show the results of a scientific investigation in numeric and/or descriptive form.
- Descriptions, charts, and labeled graphics that show a repeated or related scientific investigation that includes the results.

Scientific Vocabulary and Terms

- Terms that may be used: report, summary
- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Communication.

Item Characteristics

Given a complete description of a scientific investigation, items may ask students to:

a) Write a summary of the data of an investigation. A standard item is as follows:
   Write a summary of the data from the investigation.
   - Use your own words to report the data.
   - Give data for all conditions investigated.

b) Describe connections between the results, prediction, and phenomenon.

IP06 2.2.1 Identifying Problems Green

Identify problems found in familiar contexts in which science/technology can be or has been used to design solutions.

Item Format

Multiple choice and short answer items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations.

Stimuli may include:

- Descriptions, charts, and/or labeled graphics that include background information about a social/environmental problem related to scientific phenomena.
- Familiar objects or tools that have been invented through science and technology.

Scientific Vocabulary and Terms

- Terms that may be used: problem, solve
- Terms that may be used with definitions or examples:
- Terms that may not be used**:**
- All terms allowed and restricted under other strands apply to Identifying Problems

Item Characteristics

Given an environmental or social problem, items may ask students to:

a) Identify one way in which science/technology could be used to find a solution.
b) Describe and support one way in which science and/or technology could be used to find a solution.
c) Determine how they help to solve problems **or** what kinds of problems they can be used to solve.

Given a familiar object or tool, items may ask students to:

d) Identify or describe what scientific process or principal is used in their design (e.g. identify a pry bar as a lever).
e) Identify what scientific process or principal is at work as they function (e.g. a stretched spring in terms of push/pull forces).

IP07 2.2.2 Designing and Testing Solutions

Propose, design, and test a solution to a problem.

Item Format

Multiple choice, short answer, and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations.
- Stimuli may include descriptions, charts, and/or labeled graphics that include background information about a social/environmental problem related to scientific phenomena.

Scientific Vocabulary and Terms

- Terms that may be used: plan
- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Designing and Testing Solutions.

Item Characteristics

Given an environmental or social problem, items may ask students to:

a) Identify or describe possible difficulties that could arise related to a proposed scientific or technological solution to the problem.
b) Identify a physical solution to the problem (e.g. preventing an injury on the playground by creating a softer landing at the bottom of a slide).
c) Identify or describe a solution using engineering or technological design processes.

IP08 2.2.3 Evaluating Potential Solutions Green

Evaluate how well a design or a product solves a problem.

Item Format

Multiple choice and short answer items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations

Stimuli may include:

- Descriptions, charts, and labeled graphics that include background information about a social/environmental problem, a design or product that has been used to solve the problem, and the results of the design or product.
- A set of criteria upon which a solution is to be evaluated.

Scientific Vocabulary and Terms

- Terms that may be used:
- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Evaluating Potential Solutions.

Item Characteristics

Given a problem, attempted solution, results, and criteria for evaluation, items may ask students to:

a) Identify the reason why the design or product has **or** has not been successful in solving the problem.
b) Modify a design or product to improve its effectiveness using scientific concepts or processes.

XI. ITEM DEVELOPMENT GUIDE for the NATURE and CONTEXT STRAND

Blue

NC Strand Nature and Context of Science and Technology
Understand the nature of scientific inquiry and know that science and technology are human endeavors, interrelated to each other, to society, and to the workplace.

NC01 3.1.1 Intellectual Honesty
Understand that all scientific observations should be reported accurately even when they contradict expectations.

Item Format
Multiple choice and short answer items may be used to assess this learning target.

Stimulus/Scenario Attributes
- Stimuli must include age and grade appropriate investigation results.

Stimuli may include a situation in which:
- Charts and labeled graphics contain unexpected results from an investigation.
- The researcher draws conclusions before results are obtained.
- The researcher is placed in a situation where others' results differ substantially from hers or his.
- A person must decide whether to give credit for a discovery to the person who first made the discovery but didn't report it.

Scientific Vocabulary and Terms
- Terms that may be used: fair test
- Terms that may be used with definitions and examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Intellectual Honesty.

Item Characteristics
Given a clear description of the investigation, items may ask students to:
a) Identify an appropriate scientific response to unexpected results.
b) Identify or describe an appropriate scientific response when a person obtains results very different from others' results.
c) Identify an appropriate scientific response when another has made a discovery first but has not reported it.

NC02 3.1.2 Limitations of Science and Technology Blue

Distinguish between questions that can be answered with science and technology and those that cannot.

Item Format

Multiple choice and short answer items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations
- Stimuli may include descriptions of situations that contain a question that may or may not lead to a scientific investigation.

Scientific Vocabulary and Terms

- Terms that may be used:
- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply Limitations of Science and Technology.

Item Characteristics

Given a clear description of the question or phenomenon, items may ask students to:

a) Identify whether a question about a given a phenomenon or situation can be answered through scientific inquiry.
b) Identify reasons why (or why not) a question can (or cannot) be answered through scientific inquiry.

NC03 3.1.3 Dealing with Inconsistencies Blue

Explain why similar investigations may not produce similar results.

Item Format

Multiple choice, short answer, and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate investigations.
- All descriptions of scientific investigations must have either a clearly stated question that guides the investigation OR indication that the investigation was guided by a question.
- All descriptions of investigations must include the prediction, materials, procedure, and data.
- All descriptions of investigation must include the variables that were kept the same (controlled) and changed (manipulated).
- All descriptions of investigation must include what is being measured and how often.

Stimuli may include:

- Charts and graphics that show the results of a scientific investigation.
- Descriptions, charts, and labeled graphics that show a repeated or related scientific investigation that includes the results and conclusions.
- The procedure, results, and conclusions for two investigations or studies about the same phenomenon.

Scientific Vocabulary and Terms

- Terms that may be used:
- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Evidence and Explanation.

Item Characteristics

Given a clear description of the investigation, items may ask students to:

c) Identify or explain whether sufficient information has been obtained to draw a conclusion.
d) Identify or explain why two similar studies produced different results.
e) Decide whether an investigation is valid and explain why.
f) Identify or describe ways to make increase the validity of an investigation. For example:

What should students do to be more sure of their results?

a. Rewrite the prediction
b. Repeat the investigation
c. Change the data

NC04 3.1.4 Evaluating Methods of Investigations Blue

Recognize when results of scientific investigations have come from expected and unexpected sources.

Item Format

Short answer and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate investigations.
- All descriptions of scientific investigations must have either a clearly stated question that guides the investigation OR indication that the investigation was guided by a question.
- All descriptions of investigations must include the prediction, materials, procedure, and data.
- All descriptions of investigation must include the variables that were kept the same (controlled) and changed (manipulated).
- All descriptions of investigation must include what is being measured and how often.

Stimuli may include:

- Charts and graphics that show the results of a scientific investigation.
- Descriptions, charts, and labeled graphics that show a repeated or related scientific investigation that includes the results and conclusions.
- The procedure, results, and conclusions for two investigations or studies about the same phenomenon.
- Competing explanations for a phenomenon.
- Descriptions of an investigation with results that are inconsistent with previous findings.

Scientific Vocabulary and Terms

- Terms that may be used:
- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Evaluating Methods of Investigation.

Item Characteristics

Given clear descriptions of explanations, phenomena, or investigations, items may ask students to:

a) Identify or describe one or more scientific strategies that could be used to resolve a disagreement between two given explanations for a simple phenomenon.
b) Identify an appropriate scientific response when given a description of a scientific discovery that is inconsistent with previous thinking.
c) Evaluate the design of a given investigation for flaws when the data is inconsistent with the prediction.
d) Identify or describe ways to improve the design of an investigation when the data is inconsistent with a second investigation.
e) Identify or describe one event that could have led to unexpected data in a given investigation.

NCO5 3.1. 5 Evolution of Scientific Ideas Blue

Know how ideas in science change as new scientific thinking, theories, and evidence arise.

Item Format

Multiple choice items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations.
- Stimuli may include descriptions of situations, charts, or labeled graphics that contain background information regarding history of a scientific idea.
- Stimuli may include descriptions of situations in which scientific evidence is used to support a theory or explain an phenomenon.

Scientific Vocabulary and Terms

- Terms that may be used:
- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Evolution of Scientific Ideas.

Item Characteristics

Given clear descriptions of ideas or investigations, items may ask students to:

a) Identify evidence from the stimuli/scenario that was important in changing a theory or scientific thinking.
b) Identify why a scientific idea changed based on evidence when given a description of a change in a simple theory.
c) Determine whether an investigation that resulted in unexpected findings was of value and why.

NC06 3.2.1 All Peoples Contribute to Science & Technology Blue

Know that science and technology have been practiced by all peoples throughout history.

Classroom-based Assessment Only

NC07 3.2.2 Relationship of Science & Technology

Recognize that people have invented tools for everyday life and for scientific investigations.

Item Format

Multiple choice, short answer, and extended response items may be used to assess this learning target.

Stimulus/Scenario Attributes

- Stimuli must include age and grade appropriate situations.

Stimuli may include:

- Descriptions of situations, charts and labeled graphics that show technological development supporting science and/or science supporting technological development.
- Descriptions of situations, charts, and labeled graphics that depict a social or environmental problem.
- Descriptions of situations and graphics of tools for everyday life and science investigations.

Scientific Vocabulary and Terms

- Terms that may be used: invent, inventions, tool
- Terms that may be used with definitions or examples:
- Terms that may not be used:
- All terms allowed and restricted under other strands apply to Relationship of Science and Technology.

Item Characteristics

Given labeled diagram of the technology, items may ask students to:

a) Identify ways in which technology supports scientific investigations.
b) Explain how both science and technology help create tools to extend human ability.
c) Identify ways in which technology helps scientists design solutions to human problems and invent ways to adapt to the environment.
d) Use the results of a scientific investigation to solve human problems.

NC08 3.2.3 Careers & Occupations using Science, Mathematics, & Technology

Identify the knowledge and skills of science, mathematics, and technology used in common occupations.

Classroom-based Assessment Only

XII. SCORING CRITERIA

General Scoring Criteria for Short Answer Science Items

Science Conceptual Understanding

2 A 2-point response shows general understanding (e.g. a simple explanation) of the concept or task, as well as use of applicable information and/or procedures.

1 A 1-point response shows rote understanding (e.g. names or defines) of the concept or task. There may be minor errors in the use of applicable information and/or procedures.

0 A 0-point response shows little or no understanding (e.g. restates task or event) of the concept.

Science Application of Concepts

2 A 2-point response shows an appropriate, simple analysis or application of the concept to a given situation.

1 A 1-point response shows a flawed application or rote analysis of the concept to a given situation.

0 A 0-point response shows little or no understanding of the concept or no understanding of how to apply the concept in the given situation (e.g. describes or restates task or event).

Scientific Inquiry: investigations and problem solving (analyses, interpretations, predictions, evaluations, comparison & contrast)

2 A 2-point response shows effective analysis, interpretation, evaluation, prediction from, comparison and/or contrast of scientific information from a given investigation or problem situation; reasonable claims; support of claims with appropriate evidence.

1 A 1-point response shows weak or minimal analysis, interpretation, evaluation, prediction from, comparison and/or contrast of scientific information from a given investigation or problem situation; claims that are related to but not necessarily supported by information given in the investigation or problem situation; and/or only partial support of claims with evidence.

0 A 0-point response shows little or no understanding of how to analyze, interpret, evaluate, predict from, compare and/or contrast scientific information from a given investigation or problem situation.

Scientific Inquiry: communication (Communication, Arguments, and Representations)

2 A 2-point response shows skill in effectively and clearly organizing and representing information from a given investigation; writing clear explanations and justifications; preparing effective, systematic, and clear arguments and rationales.

1 A 1-point response shows limited skill in organizing and representing information from a given investigation; writing explanations and justifications; preparing arguments.

0 A 0-point response shows little or no skill in organizing and representing information from a given investigation; writing explanations and justifications; preparing arguments.

Nature of Science and Science, Technology & Society (analyses, evaluations, comparison & contrasts, critique)

2 A 2-point response shows effective analysis, comparison and/or contrast of results from one or more given investigations; critique and evaluation of procedures and claims; analysis of influences.

1 A 1-point response shows weak or limited analysis, comparison and/or contrast of results from one or more given investigations; critique and evaluation procedures and claims; analysis influences.

0 A 0-point response shows no analysis, comparison and/or contrast of results from one or more given investigations; no attempt at critique or evaluation of procedures and claims; no analysis of influences.

General Scoring Criteria for Extended Response Science Items

Science Conceptual Understanding:

4 Meets all relevant criteria
- response is thorough and addresses all aspects of the task
- complex and detailed understanding of the relevant concept(s)
- effective and appropriate use of applicable information
- all supporting information and details provided give support for the response

3 Meets most relevant criteria
- response is thorough and addresses most aspects of the task
- general understanding of the relevant concept(s)
- appropriate use of applicable information
- most supporting information and details provided give support for the response

2 Meets some relevant criteria
- response addresses many aspects of the task
- simple or one-dimensional understanding of the concept(s) (e.g. gives definitions)
- use of applicable information may show conceptual confusion
- some information and details provided give support for the response

1 Meets few relevant criteria
- response addresses few aspects of the task
- rote or limited understanding of the concept(s) (e.g. gives names or labels)
- use of applicable information shows conceptual confusion
- little or no information and details provided give support for the response

Application of Science Concepts:

4 Meets all relevant criteria
- response is thorough and addresses all aspects of the task
- complex and detailed understanding of the relevant concept(s)
- effective and appropriate application of the concept(s) to the given situation
- all supporting information and details provided give support for the response

3 Meets most relevant criteria
- response is thorough and addresses most aspects of the task
- general understanding of the relevant concept(s)
- appropriate application of the concept(s) to the give situation
- most supporting information and details provided give support for the response

2 Meets some relevant criteria
- response addresses many aspects of the task
- simple or one-dimensional understanding of the concept(s) (e.g. gives definitions)
- shows difficulties with application of the concept(s) to the given situation
- some supporting information and details provided give support for the response

1 Meets few relevant criteria
- response addresses few aspects of the task
- rote or limited understanding of the concept(s) (e.g. gives names or labels)
- attempt to apply the concept(s) to the given situation may be ineffective
- little or no supporting information and details provided give support for the response

Scientific Inquiry: investigations and problem solving (analyses, interpretations, predictions, evaluations, comparison & contrasts)

4 Meets all relevant criteria
- response thoroughly addresses all aspects of the task
- gives insightful, detailed, and complete analysis, interpretation, evaluation, prediction from, comparison and/or contrast of scientific information from a given investigation or problem situation
- makes reasonable claims
- all claims supported with appropriate, well-chosen, specific evidence

3 Meets most relevant criteria
- response is thorough and addresses most aspects of the task
- gives expected, detailed, and complete analysis, interpretation, evaluation, prediction from, comparison and/or contrast of scientific information from a given investigation or problem situation
- makes reasonable claims
- most claims supported with appropriate, well-chosen, specific evidence

2 Meets some relevant criteria
- response addresses many aspects of the task
- gives general but reasonable analysis, interpretation, evaluation, prediction from, comparison and/or contrast of scientific information from a given investigation or problem situation
- makes plausible claims
- claims supported with appropriate but limited evidence

1 Meets few relevant criteria
- response addresses few aspects of the task
- gives general analysis, interpretation, evaluation, prediction from, comparison and/or contrast of scientific information from a given investigation or problem situation, although response may have serious flaws in thinking
- claims, if given, may not be supportable
- attempts at support use generalities rather than evidence

Scientific Inquiry: communication (communication, arguments, and representations)

4 Meets all relevant criteria
- effectively and clearly organizes information and/or data from a given investigation
- clearly, completely, and accurately represents ideas in words, diagrams, charts, graphs, tables, visual models, using appropriate scientific and mathematical terms, symbols, and conventions
- clearly and systematically presents support for explanations and justifications
- effectively, systematically, and clearly presents arguments and rationales

3 Meets most relevant criteria
- organizes information and/or data from a given investigation in an acceptable and understandable manner; there may be minor errors in transfer of information
- completely and accurately represents ideas and/or data in words, diagrams, charts, graphs, tables, visual models, using scientific and mathematical terms, symbols; there may be minor errors in conventions, terms, or symbols
- supports for explanations and justifications are evident but not always clear
- understandably presents arguments and rationales

Scientific Inquiry: communication (communication, arguments, and representations) continued

2 Meets some relevant criteria
- organizes information and/or data from a given investigation in a confusing manner
- representations of ideas and/or data in words, diagrams, charts, graphs, tables, visual models have several problems with incorrect or missing conventions, symbols, and/or incorrectly used terms
- supports for explanations and justifications are difficult to ascertain
- arguments and rationales are unclear

1 Meets few relevant criteria
- information and/or data from a given investigation is given but disorganized or only partially complete
- representations of ideas and/or data in words, diagrams, charts, graphs, tables, visual models are confusing, incomplete, and/or have many problems with incorrect or missing conventions, symbols, and/or incorrectly used terms
- supports for explanations and justifications are missing
- arguments and rationales are vague or missing

Nature of Science and Science, Technology & Society (analyses, evaluations, comparison & contrasts, critique)

4 Meets all relevant criteria
- response thoroughly addresses all aspects of the task
- gives insightful, detailed, and complete analysis, comparison and/or contrast of results from one or more given investigations
- gives effective and detailed critique and/or evaluation of procedures and claims
- accurate and detailed analysis of influences on outcomes
- all ideas supported with appropriate, well-chosen, specific evidence

3 Meets most relevant criteria
- response is thorough and addresses most aspects of the task
- gives expected, detailed, and complete analysis, comparison and/or contrast of results from one or more given investigations
- gives expected critique and/or evaluation of procedures and claims
- detailed analysis of influences on outcomes is mostly accurate
- most ideas supported with appropriate, well-chosen, specific evidence

2 Meets some relevant criteria
- response addresses many aspects of the task
- gives general but reasonable analysis, comparison and/or contrast of results from one or more given investigations
- gives expected critique and/or evaluation of procedures and claims with minor flaws
- analysis of influences on outcomes is partially accurate
- claims supported with appropriate but limited evidence

1 Meets few relevant criteria
- response addresses few aspects of the task
- gives general analysis, comparison and/or contrast of results from one or more given investigations, although response may have serious flaws in thinking
- gives vague or general critique and/or evaluation of procedures and claims with significant flaws
- analysis of influences on outcomes has significant errors
- attempts at support use generalities rather than evidence

Generic Scoring Guide for Investigation Design Extended Response Items

All inquiry scenarios will have an investigation that models the areas awarded the value points of the scoring guide described below.

A **4-point response**: The student shows the ability to plan a simple investigation. The student designs an investigation that earns Q value points for a four-point response.

Question: (1 value point)

Prediction: (1 value point)

Materials: (1-2 value points)

Procedure: (up to 5 value points, 1 per bulleted feature)

- The steps of the investigation are logical.
- At least one variable is identified or implied as kept the same, constant, or controlled.
- A variable is identified or implied as changed or manipulated.
- At least one variable is identified or implied as being observed, measured, and recorded.
- Observations are recorded periodically throughout the investigation.

Note: If a student makes up a different question than the ones given, points may be awarded for an accurate design for the student's question. No points should be awarded to a student who selects the original investigative question and re-states the original design.

A **3-point response**: The student designs an investigation that earns R value points.

A **2-point response**: The student designs an investigation that earns S value points.

A **1-point response**: The student designs an investigation that earns T value points.

A **0-point response**: The student designs an investigation that earns U value points.

Note: Q, R, S, T, and U are ranges of value points depending upon the weight of a section in a particular item.

XIII. SCIENTIFIC VOCABULARY SUMMARY

The following terms are a summary of the vocabulary that may be used on the science WASL at each grade level without definitions. More terms may be used with definitions or examples as noted in the item specifications. The plural form of all these words is assumed useable. However, other forms of these are not accepted unless specified. Every word from a lower grade level may be used at a higher grade level.

This list of scientific vocabulary identifies concepts and processes described in the science EALRs that all students should know without explanation at these grade levels. These are not meant to be exclusive terms used in the science curriculum. The science curriculum should build in-depth understanding of these concepts and processes using many instructional activities and other supporting terms.

A

10th Grade	8th Grade	5th Grade
abiotic	acceleration	acquired
absorption	accuracy	air
amplitude	adaptation	amount
asexual	affect	amount of time
atmospheric	applied force	
atomic number	artery	
	atmosphere	
	attract	

B

10th Grade	8th Grade	5th Grade
biotic	blood vessel	balance scale
	body of water	bone
		brain

C

10th Grade	8th Grade	5th Grade
celestial	camouflage	cause
cell membrane	carbon dioxide	cell
cell nucleus	cell	centimeter (cm)
cell wall	charge	characteristic
circulatory system	chemical	chart
constraint	circuit	classify
contraction	cold-blooded	climate
controlled variable	compare	color
criteria	conduction	conclude
	contrast	conclusion
	controlled variable (kept the same)	condensation
	convection	condense
	conversion	consumer
	core	continent
	crust	cycle

D

10th Grade	8th Grade	5th Grade
diffusion	density	data
digestive system	description	decomposer
diversity		depend
		describe
		design
		diagram
		direction

E

10th Grade	8th Grade	5th Grade
electrical charge	electron	Earth
electrical force	ecosystem	earthquake
electron shell	electrical force	echo
endocrine system	environment	effect
energy chain	evidence	egg
expansion	evolution	electrical
experiment		electricity
experimental control		energy
		energy of motion
		erosion
		eruption
		evaporate
		evaporation
		event
		explain
		explanation

F

10th Grade	8th Grade	5th Grade
family of elements	frequency	fair test
frictional force	friction	feet
	factor	flower
		food
		food chain
		force
		forest
		fossil remains
		fossil
		freeze
		function

G

10th Grade	8th Grade	5th Grade
galaxy	genetic	gas
gravitational force	groundwater	glacier
		gram
		graph
		grassland
		gravity

H

10th Grade	8th Grade	5th Grade
honesty	heat	hand lens
hormone		hardness
host		heart
hydrosphere		heat energy
hypothesis		

I

10th Grade	8th Grade	5th Grade
impact	igneous	identify
inconsistent	image	inch (in)
infer	interpret	inclined plane
inference	interpretation	invent
interference	intestine	invention
investigative control	issue	investigate
investigative design		investigation
investigative question		inherited

K

10th Grade	8th Grade	5th Grade
kinetic energy		kilogram (kg)
		kilometer (km)

L

10th Grade	8th Grade	5th Grade
law	landslide	lake
logical	landmass	leaf
		lever
		liquid
		liter (L)
		living
		lung

M

10th Grade	8th Grade	5th Grade
magnetic pole	magnetic force	machine
manipulated variable	magnetism	magnetic
mechanical energy	manipulated variable (changed)	magnifying glass
metaphor	mantle	material
meteorology	mass	melt
	matter	meter (m)
	metamorphic	mile (mi)
	meter stick	milliliter (mL)
	microscope	model
	millimeter (mm)	molecule
	minerals	Moon
	mixture	mountain
		muscle

N

10th Grade	8th Grade	5th Grade
neurological system	natural selection	nonliving
neutron	nitrogen	nutrient
nuclear energy	nucleus	
nuclear fission		
nuclear force		
nuclear fusion		

O

10th Grade	8th Grade	5th Grade
offspring	opinion	object
ova	organ	observe
		observation
		ocean
		orbit (revolve)
		orbit (revolution)
		organism
		organize
		ounce
		oxygen

P

10th Grade	8th Grade	5th Grade
parasite	particle	part
periodic table	pattern	pattern
phase change	predator	picture
photosynthesis	prediction (hypothesis)	pitch
pistil	prey	plan
potential energy	property	planet
principle		pound
proton		precipitation
		predict
		prediction
		problem
		procedure
		process
		producer
		property
		pull
		pulley
		push

Q

10th Grade	8th Grade	5th Grade
		question

R

10th Grade	8th Grade	5th Grade
radiation	recycle	rate
refract	reflect	report
refraction	reflection	reproduce
relationship	relationship	reproduction
reproduce	relative position	result
reproduction	relative speed	river
reproductive system	repel	root
research question	report	
respiratory system	resource	
responding variable	responding variable (measured)	
	river system	
	rock cycle	

S

10th Grade	8th Grade	5th Grade
scattering	scientist	sea
scavenger	sedimentary	seed
sexual	solar system	shape
skeletal system	solution	size
skeptical	specialized	skeleton
solubility	sphere	soil
solute	stomach	solid
solvent	stored energy	solve
sperm	subsystem	sort
spherical	summarize	sound
spinal cord		special
spore		speed
stamen		spin (rotate)
state		spring scale
state of matter		sprout
succession		stem
		stored energy
		stream
		strength
		structure
		substance
		summary
		Sun
		system

T

10th Grade	8th Grade	5th Grade
theory	telescope	table
thermal	tissue	temperature
thermal energy	transfer	texture
topography	transmit	thaw
transformation		thermometer
transmission		tool

U

10th Grade	8th Grade	5th Grade
	unexpected	

V

10th Grade	8th Grade	5th Grade
validate	valid	vapor
validity	vein	variable
	volume	variable changed (manipulated)
		variable kept the same (controlled)
		vibration
		volcano

W

10th Grade	8th Grade	5th Grade
wind direction	warm-blooded	waste
wind speed	water table	water
wind current	wavelength	weather
work	weathering	weight
	wind direction	wind
	wind speed	

X

10th Grade	8th Grade	5th Grade

Y

10th Grade	8th Grade	5th Grade
		yard

Z

10th Grade	8th Grade	5th Grade