OREGON STATEWIDE ASSESSMENT

2012-2014

Science

Benchmark 2

Tested in grade 5

TEST SPECIFICATIONS and BLUEPRINTS

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Developed by the Office of Assessment and Information Services

Oregon Department of Education
255 Capitol Street NE
Salem, Oregon 97310-0203
(503) 947-5600

Susan Castillo
State Superintendent of Public Instruction

Doug Kosty
Assistant Superintendent

Steve Slater
Manager, Scoring, Psychometrics and Validity

Kathleen Vanderwall
Manager, Test Design and Administration

Holly Carter
Assessment Operations and Policy Analyst

Michelle McCoy
ELPA and Assessment Implementation Specialist

Ken Hermens
Language Arts Assessment Specialist

Rachel Aazzerah
Science and Social Sciences Assessment Specialist

James Leigh
Mathematics Assessment Specialist

Bradley J. Lenhardt
Monitoring and Assessment Specialist

Sheila Somerville
Electronic Publishing Specialist

Kathy Busby
Project Manager

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TABLE of CONTENTS

Introduction 1
Background 1
Content Standards Map 3
Item Specifications 39
Test Blueprint 42
Score Reporting Categories 44
Weighting Chart 45
Test Blueprint Content Coverage 46
Target Cognitive Demand and Item Pool Distribution by Difficulty 47
Achievement Level Descriptors 48
Local Performance Assessments 55

Appendices

A. Oregon Achievement Standards Summary A-1
B. Target Cognitive Demand and Item Pool Distribution Goals for all Grades B-1
C. Item Development Process C-1
D. Life of an Item D-1

Science Test Specifications

Introduction

The primary purpose of Oregon's Test Specifications and Blueprints is to provide the consistency necessary for the development and administration of the Oregon Assessment of Knowledge and Skills (OAKS). OAKS provide critical data for Oregon's accountability system which meets Peer Review Requirements of the Elementary and Secondary Education Act. All students in grades 5 and 8 are required to take the science assessment, and those in grades 4 and 7 take the writing assessment. In high school, reading, writing, mathematics, and science are required assessments by grade 11, the reporting year.

OAKS is also one way for students to demonstrate proficiency in the Essential Skills of reading, writing, and mathematics, which will be necessary for earning a high school diploma beginning with seniors graduating in 2011-2012. In addition, English Language Proficiency Assessment (ELPA) is required for non-English speaking students until they acquire sufficient skills in English to exit the program. Social Sciences is an optional assessment.

Test specifications provide guidelines for item writers, who are typically Oregon teachers, on what content may be tested and how items must be written. These specifications lead to test blueprints that outline test design and the number of questions to be tested in each score reporting category (SRC). The Test Specifications and Blueprints document is an important resource, not only for item writers and reviewers, but for educators administering OAKS and the general public who are interested in understanding the content and format of test items.

Background

The purposes of the Oregon Statewide Assessment Program are (1) to provide information on individual student achievement on performance standards set by the State Board of Education at grade and grade-group levels; (2) to provide information for federal Elementary and Secondary Education Act requirements and for policy decisions by the legislature, the governor, the State Board of Education, and local school districts; (3) to support instructional program improvement efforts; and (4) to inform the public about student achievement in Oregon schools.

The Oregon Statewide Assessment is different from national norm-referenced tests used in many districts and states. The Oregon Statewide Assessment is a criterion-referenced assessment based on the Oregon Content Standards. As a result, the types of scores produced from the Oregon Statewide Assessment are somewhat different from those produced by national norm-referenced tests.

Oregon educators contribute to the test development and alignment process by serving on advisory committees called Content and Assessment Panels. Stakeholders in these committees are involved in each phase of the development of these specifications to assure that they accurately and clearly explain the overall design of the test and describe the specific content that might appear on the test to measure the knowledge and skills described in the content standards.

Oregon's knowledge and skills test questions use multiple choice and computer scored constructed response formats. Each multiple choice item has only one correct answer while computer scored constructed response items may have many correct answers.

scored constructed response items may have many correct answers. A computer electronically collects and scores responses which are scored against the answer key to produce a raw score. The raw score is converted to a scale score called a Rasch unit or RIT score. Students receive a scale score based on the number of questions answered correctly compared to the total number of questions on the form—taking into account the difficulty of the questions. Students are not penalized for guessing.

The content of these specifications reflects the skill expectations outlined in the Content Standards adopted February 2009 by the State Board of Education for implementation beginning in the 2011-12 school year. These standards were developed, in part, to correlate to the skills assessed on the science portion of the National Assessment of Educational Progress and align with the National Science Standards. As a result, Oregon uses similar terminology in its descriptions of the science subject score reporting categories (listed later in this document).

Statewide and Local Assessments

Statewide assessments are multiple choice and computer scored constructed response tests of knowledge and skills that are developed and scored by the state. Local assessments include performance assessments that may be scored using statewide scoring guides that are administered and scored at the local level (see Appendix F). Local assessments **are not** **included** in state accountability reports, e.g. AYP reports.

Electronic Administration

On the science knowledge and skills OAKS online tests, there are three opportunities to participate in fully-adaptive testing. In this format, the accuracy of the student responses to questions determines the next item or set of items the student will see. Students are allowed to preview test questions if a set of questions link to a specific graphic or stimulus. Having the tests fully adaptive allows for more precision in measurement and less frustration for the students.

Electronic administration of the science test for each grade tested includes up to three test opportunities in English or English-Spanish formats. Students who need to have the test read to them may access the text to speech function of each test. The OAKS Online test delivery system for the 2011-12 school year will allow students with visual impairments, who use Braille, to access the OAKS Online testing system. These students will have the same number of testing opportunities as other students and have access to the adaptive OAKS Online test starting in the 2011-12 school year. In 2011-12, paper-based Braille assessments will no longer be available. An online practice test of sample items is available for students who may need practice using a scrollbar, or who need practice with new item types.

The following pages contain a more detailed examination of the test content for science. The first column lists the content standard assessed for that particular score reporting category and academic vocabulary sometimes linked to that standard. The second column provides a description of the testable content and gives a more detailed explanation of how the standard will be assessed. Finally, the third column provides sample items that are very similar to the type of questions asked on a test related to that eligible content.

Core Standard: 3.1 Structure and Function **Score Reporting Category 1/5**

Living and non-living things vary in their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.1P.1 Compare and contrast the properties of states of matter.

Academic Vocabulary:

- mass
- particle
- property
- state
- volume

Links to National Standards:

2009 NAEP Framework: : P4.3

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127 and 149-154

AAAS Science Literacy Benchmarks pgs: 76-77

Explanation:

Matter

- Matter exists in different states: commonly: solid, liquid and gas
- Solids hold their own shape
- Gases are easily compressed
- Liquids and gases take the shape of the containers they are in
- Heating and cooling cause changes in the properties of material and in states of matter.

Example of states of matter:

- Solid: ice
- Liquid: water
- Gas: oxygen

Content Connections from Previous Grades:

1.1P1

Sample Items:

Which of the following changes is caused by removing heat?

A. A solid changes to a gas.
B. A liquid changes to a gas.
C. A solid changes to a liquid.
D. A liquid changes to a solid.

Massachusetts Released item #9 pg. 24

Answer Key: D

Which of the following statements describes one way that solids are different from liquids?

A. Solids have weight and liquids do not.
B. Solids take up space and liquids do not.
C. Solids have a definite shape liquids do not.
D. Solids have a definite volume and liquids do not.

Massachusetts Released Item# 4 pg. 412

Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 3.1 Structure and Function **Score Reporting Category 1/6**

Living and non-living things vary in their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.1L.1 Compare and contrast the characteristics of offspring and parents.

Academic Vocabulary:

- inherited
- learned
- species

Links to National Standards:

2009 NAEP Framework: L4.6, L4.7

National Science Education Standards: Life Science Content Standard C, pgs. 127-129

AAAS Science Literacy Benchmarks pgs: 103 & 107

Explanation:

Characteristics:

- Parents and their offspring have similar characteristics (e.g. eye color, hair color, skin color, instincts, flower color, number of animal limbs)
- Parents and offspring have unlike characteristics (e.g. favorite food, riding a bicycle)

Content Connections from Previous Grades:

K.1L.1,2.2L.1

Sample Items:

Naomi has a pet dog. Which of the following characteristics did the dog most likely inherit from its parents?

A. its weight
B. its favorite food
C. the color of its fur
D. the place where it lives

Massachusetts Released item #10, pg 244

Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 3.2 Interaction and Change **Score Reporting Category 2/5**

Living and non-living things interact with energy and forces.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.2P.1 Describe how forces cause changes in an object's position, motion, and speed.

Academic Vocabulary:

- friction
- gravity
- mass
- weight

Links to National Standards:

2009 NAEP Framework: P4.12, P4.13, and P4.14:

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127

AAAS Science Literacy Benchmarks pgs:89 & 94

Explanation:

Force

- Forces cause changes in the speed or direction of an object in motion.
- The greater the force, the greater the change in motion will be.
- The amount of change is related to amount of force (push or pull) and the mass of the object on which the force is exerted.
- Objects will not change position without a force.
- Friction will cause an object to change speed.

Examples:

- Pushing and pulling
- Friction of different surfaces

Content Connections from Previous Grades:

K.2P.1, 1.2P.1

Sample Items:

Which of the following would cause an object to slow down?

A. Friction
B. Gravity
C. Pulling an object downhill
D. Pushing an object downhill

Answer Key: A

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Core Standard: 3.2 Interaction and Change **Score Reporting Category 2/6**

Living and non-living things interact with energy and forces.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.2L.1 Compare and contrast the life cycles of plants and animals.

Academic Vocabulary:

- larva
- germinate
- metamorphosis
- pollinate
- pupa
- reproduction
- stage

Links to National Standards:

2009 NAEP Framework: L4.5

National Science Education Standards: Life Science Content Standard C, pgs. 127-129

AAAS Science Literacy Benchmarks pgs:119 & 132

Explanation:

Life cycles

- Similar animals and plants have similar lifecycles (e.g. birds lay eggs, mammals have live young, plants produce seeds).
- Different plants and animals have different lifecycles (e.g. fish vs. birds, flower vs. pine tree).
- Plants and animals go through similar lifecycles (e.g. fertilization).
- Plants and animals go through different lifecycles (e.g. plant produce seeds that can grow into new plants, birds lay eggs that hatch producing new birds).

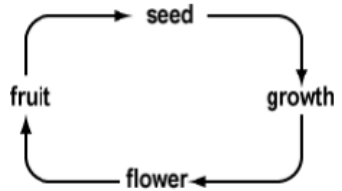
Content Connections from Previous Grades:

2.2L.1

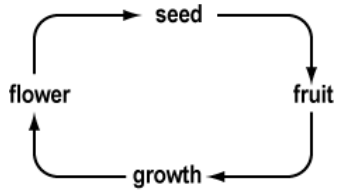
Sample Items:

Which of the following drawings best shows the life cycle of berry bushes growing naturally in a forest?

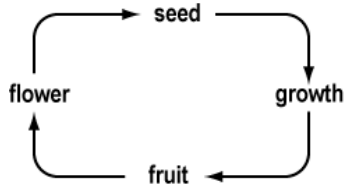
A.



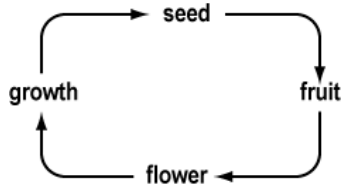
B.



C.



D.



Massachusetts Released item #20, pg 422

Answer Key: A

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Core Standard: 3.2 Interaction and Change **Score Reporting Category 2/7**

Living and non-living things interact with energy and forces.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.2E.1 Identify Earth as a planet and describe its seasonal weather patterns of precipitation and temperature.

Academic Vocabulary:

- patterns
- planet
- seasonal

Links to National Standards:

2009 NAEP Framework: E4.7-4.9

National Science Education Standards: Earth and Space Science Content Standard D, pgs. 130-134

AAAS Science Literacy Benchmarks pgs:67 & 68

Explanation:

The Earth orbits the sun

Weather on Earth

- The sun provides light and heat to maintain the temperature of the Earth.
- Weather changes from day to day and over the seasons.
- Weather tends to follow somewhat predictable patterns that vary according to season, location and climate.
- Weather is the outside conditions at a certain time and place.
- Climate is weather conditions over time
- Precipitation can occur in a variety of forms.

Seasonal weather elements

- Temperature
- Precipitation

Content Connections from Previous Grades:

K.1E.1, 2.2E.2

Sample Items:

One reason the Earth is considered a planet is because it

A. has a moon.
B. orbits the sun.
C. has seasons.
D. has life.

Answer Key: B

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Core Standard: 3.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.3S.1 Plan a simple investigation based on a testable question, match measuring tools to their uses, and collect and record data from a scientific investigation.

Academic Vocabulary:

- claim
- hypothesis
- measure
- procedure
- variable

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks pgs:10-11

Explanation:

Investigation

- Develop a practical plan for a simple investigation (with teacher guidance).
- Propose a testable question (with teacher guidance).
- Collect and record reasonable data.
- Use correct measuring tools to gather data.

Scientific Inquiry Skills:

- Prediction
- Data recording

Content Connections from Previous Grades:

1.3S.1, 1.3S.2, 2.3S.1

Sample Items:

Steven's class meets in a classroom with a leaking faucet in the back. What tools does Steven need to conduct an experiment to find out how much water is wasted by this leak in one hour?

A. A ruler and a clock
B. A measuring cup and a ruler
C. A test tube and a burner
D. A measuring cup and a clock

Answer Key: D

Andrea's class meets in a classroom with many windows and heat vents. Students complain that it is too hot or too cold in certain seats. What tool does Andrea need to conduct an experiment to find out the hottest and coldest places in the room?

A. Wind vane
B. Thermometer
C. Blanket
D. Beaker

Answer Key: B

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Core Standard: 3.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.3S.2 Use the data collected from a scientific investigation to explain the results and draw conclusions.

Academic Vocabulary:

- conclusions
- explain
- scientific
- interpret

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks pgs: 10-11

Explanation:

Collect Data

- Use data to describe the results of an investigation.
- Use data to explain why the results are accurate.
- Use data to draw a conclusion.

Scientific Inquiry skill development

- Graphic organizers
- Logs, journals, pictures
- Data collections

Content Connections from Previous Grades:

2.3S.2, 2.3S.3

Sample Items:

WATERMELONS IN POUNDS PER ACRE					
Seed Type	**Units of Fertilizer Used**				
	0	**1**	**2**	**3**	**4**
Round	25	32	35	29	18
Wrinkled	15	25	33	30	19

What does the chart show about fertilizer use in this garden?

A. The more fertilizer the better.
B. Without fertilizer nothing grows.
C. Fertilizer affects both seed types exactly the same way.
D. Too much fertilizer can hurt growth.

Answer Key: D

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Core Standard: 3.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.3S.3 Explain why when a scientific investigation is repeated, similar results are expected.

Academic Vocabulary:

- constant
- discrepancy
- reliable
- repetition

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks pgs: 10-11

Explanation:

Investigate

- A repeated investigation will result in similar outcomes.
- Accurate records of investigations must be kept.
- Investigations which cannot be repeated are not reliable.

Content Connections from Previous Grades:

1.3S.3, 2.3S.2

Sample Items:

A class performed a scientific investigation. Each group obtained similar results because

A. the data was identical.
B. their question was the same.
C. their procedure was the same.
D. their hypotheses were similar.

Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 3.4 Engineering Design **Score Reporting Category 4/8**

Engineering design is a process that uses science to solve problems or address needs or aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.4D.1 Identify a problem that can be addressed through engineering design, propose a potential solution, and design a prototype.

Academic Vocabulary:

- engineering design
- limitations
- problem
- prototype

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks pgs: 49-50, 54-55

Explanation:

Solutions to a problem

- Identify a problem and propose a solution. (Problems *should* be real and engaging.)
- A prototype is an initial design solution
- Develop a prototype to address the solution to the problem.
  - Suggest possible solutions:
    - Try one out
    - Make adjustments or start over

Content Connections from Previous Grades:

2.4D.3

Sample Items:

Which problem below can be addressed through engineering design?

A. Determining what your favorite food is.
B. Making a boat that cannot sink.
C. Writing a story about an animal.
D. Reading a story in your textbook.

Answer Key: B

Shelby decided to make a new type of ship that will not sink. She drew out plans for her new ship. What is the next step in the engineering design process that she should follow?

A. Create a prototype
B. Determine the price
C. Build a full model
D. Adjust her plans

Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 3.4 Engineering Design **Score Reporting Category 4/8**

Engineering design is a process that uses science to solve problems or address needs or aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.4D.2 Describe how recent inventions have significantly changed the way people live.

Academic Vocabulary:

- convenience
- invention
- lifestyle
- necessity
- technology

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks pgs:54-55

Explanation:

Effect of recent Inventions

- People alone or in groups are always inventing new ways to solve problems and get work done.
- Inventions have changed the way people communicate, cook, play, travel, etc.

Examples of inventions:

- ipods
- cell phones
- fuel efficient cars
- microwave ovens
- washers and dryers
- LED light bulbs
- Halogen light bulbs

Content Connections from Previous Grades:

2.4D.3

Sample Items:

Which of the following inventions has changed the way people communicate?

A. Ipods
B. Electric cars
C. Cell phones
D. Wind Turbines

Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 3.4 Engineering Design **Score Reporting Category 4/8**

Engineering design is a process that uses science to solve problems or address needs or aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

3.4D.3 Give examples of inventions that enable scientists to observe things that are too small or too far away.

Academic Vocabulary:

- magnify
- invention

Explanation:

- Technology enables scientists and others to observe things that are too small or too far away to be seen otherwise.

Examples of observation tools/inventions:

- Hubble space telescope
- International space station
- Microscopes/magnifying glass
- Binoculars
- Telescopes

Sample Items:

Which of the following is BEST to use to look at a plant cell?

A. Telescope
B. Binoculars
C. Microscope
D. Magnifying glass

Answer Key: C

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks pgs:54-55

Content Connections from Previous Grades:

2.4D.3

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Core Standard: 4.1 Structure and Function **Score Reporting Category 1/5**

Living and non-living things can be classified by their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.1P.1 Describe the properties of forms of energy and how objects vary in the extent to which they absorb, reflect, and conduct energy.

Academic Vocabulary:

- attract
- circuit
- electromagnetic
- field
- friction
- magnetic
- opaque
- radiation
- reflect
- refract
- repel
- sound
- thermal
- translucent
- transparent
- vibration
- waves

Links to National Standards

2009 NAEP Framework: P4.7-P4.10

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127

AAAS Science Literacy Benchmarks pgs: 83-84

Explanation:

Forms of energy

- Chemical
- Electrical
- Heat
- Light
- Mechanical
- Nuclear

Properties of Energy

- Heat will transfer from a hotter object to a cooler object until both are the same temperature.
- Sound and light can be absorbed, redirected, bounced back, or allowed to pass through,
- Light travels in straight lines. When light strikes substances and objects through which it cannot pass, shadows result.
- When light travels (obliquely) from one substance to another (air and water) it changes direction.
- Heat results when substances burn, when certain kinds of materials rub against each other and when electricity flows through wires.

(Continued on next page)

Sample Items:

When you hook up a battery to a complete circuit, what flows through the wires from one pole of the battery to the other?

A. Heat
B. Electricity
C. Light
D. Sound

Answer Key: B

Pieces of scrap iron are attracted to a metal disk. The metal disk is most likely functioning as which of the following?

A. a battery
B. an engine
C. an insulator
D. an electromagnet

Answer Key: D

(Continued on next page)

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.1 Structure and Function **Score Reporting Category 1/5**

Living and non-living things can be classified by their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard: (cont.)

4.1P.1 Describe the properties of forms of energy and how objects vary in the extent to which they absorb, reflect, and conduct energy.

Links to National Standards

2009 NAEP Framework: P4.2, and P4.7-P4.10

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127

AAAS Science Literacy Benchmarks pgs: 83-84

Explanation: (cont.)

Properties of objects

- Some materials conduct heat, light, electricity, etc. better than others. Metals are good conductors of heat and electricity.
- Some materials are good insulators

Content Connections from Previous Grades:

2.2P.1

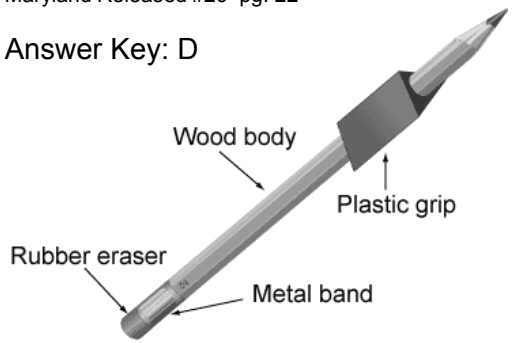
Sample Items: (cont.)

Which object in a room is the best conductor of heat?

A. an area rug
B. a wood table
C. a glass mirror
D. a metal spoon

Maryland Released #20 pg. 22

Answer Key: D



Which part of the pencil is the best conductor of electricity?

A. metal band
B. plastic grip
C. rubber eraser
D. wood body

Massachusetts Released Item #9 pg. 413

Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.1 Structure and Function **Score Reporting Category 1/6**

Living and non-living things can be classified by their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.1L.1 Compare and contrast characteristics of fossils and living organisms.

Academic Vocabulary:

- extinct
- geology
- paleontology
- prehistoric
- sedimentary

Links to National Standards

2009 NAEP Framework: L4.7

National Science Education Standards: Life Science Content Standard C, pgs. 127-129

AAAS Science Literacy Benchmarks pg: 123

Explanation:

- Fossils can be compared to one another and to living organisms according to their similarities and differences.
- Some organisms that lived long ago are similar to existing organisms, but some are quite different.
- Fossils indicate that most species that lived long ago are now extinct.
- Living organisms can be compared to one another according to their similarities and differences.

Content Connections from Previous Grades:

1.1L.1

Sample Items:

Which of the following physical characteristics did Tamara most likely use to sort the organisms into the two groups?

Group 1	Group 2
alligator	bat
goldfish	deer
snake	mouse
tuna	rabbit

A. number of legs
B. size of the body
C. shape of the feet
D. type of body covering

Massachusetts Released item #34, pg 429

Answer Key: D

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.1 Structure and Function **Score Reporting Category 1/7**

Living and non-living things can be classified by their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.1E.1 Identify properties, uses, and availability of Earth materials.

Academic Vocabulary:

- raw materials

Links to National Standards:

2009 NAEP Framework: E4.4- 4.6

National Science Education Standards: Earth and Space Science Content Standard D, pgs. 130-134

AAAS Science Literacy Benchmarks pgs: 75-77

Explanation:

- Earth materials (e.g. rocks, minerals, soil) have various properties.
- People use and transform Earth materials into useful objects.
- Some Earth materials are easily available and other Earth materials are limited in quantity.
- Some materials can be reused, recycled, or redesigned.
- Some Earth materials have properties that make them useful in their present form or can be designed and modified to solve human problems and enhance quality of life. (building, fuels, transportation)

Content Connections from Previous Grades:

1.1E.1

Sample Items:

Mrs. Baker's class went on a walking field trip to a river near the school. They stopped at four places along the way and collected samples of earth materials. Here is a table of what they found. From the information in the table, answer the questions that follow.

SAMPLE NUMBER	DESCRIPTION OF SAMPLE	WHERE FOUND
1	reddish material that felt "slimy" and stuck to the hands, made a tight ball when squeezed	in a pile near a sign reading "AJAX CLAY PIT"
2	shiny black hard chunks the size of a fist, seemed less dense than most rocks	near a train filled with coal in open-topped cars
3	clean mixture of sand, gravel and small pebbles	in the river bottom
4	dark brown mixture of sand, clay, and decaying plants, moist enough to make a ball when squeezed together	in a flat area near the walking path

Which sample of material might be used for energy to make electricity?

A.1 B. 2 C. 3 D. 4

Answer Key: B

Which material would be part of the ingredients used to make cement sidewalks?

A.1 B. 2 C. 3 D. 4

Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.2 Interaction and Change **Score Reporting Category 2/5**

Living and non-living things undergo changes that involve force and energy.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.2P.1 Describe physical changes in matter and explain how they occur.

Academic Vocabulary:

- boiling
- condensation
- evaporation
- freezing
- melting
- precipitation

Links to National Standards

2009 NAEP Framework: P4.3 and P4.6

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127

AAAS Science Literacy Benchmarks pgs: 75-77

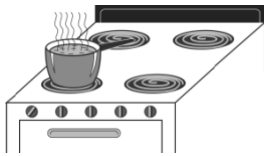
Explanation:

- Heating and cooling cause changes in the properties of materials.
- Heating and cooling of materials can result in a change of state (e.g. heat added to ice Æ liquid water Æ water vapor)
- Things can be done to materials to change some of their properties, but not all materials respond the same way.

Content Connections from Previous Grades:

1.1P.1, 3.1P.1

Sample Items:



What change of state is shown?

A. Liquid to gas
B. Solid to gas
C. Gas to liquid
D. Solid to liquid

Answer Key: A

Eduardo pours himself a glass of cola with ice in it. Identify which objects are solid, liquid, and gas.

A. The cola is the solid, the ice is the liquid, and the bubbles are the gas.
B. The ice is the solid, the bubbles are the liquids, and the cola is the gas.
C. The bubbles are the solids, the cola is the liquid, and the ice is the gas.
E. The ice is the solid, the cola is the liquid, and the bubbles are the gas.

Answer Key: D

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.2 Interaction and Change **Score Reporting Category 2/6**

Living and non-living things undergo changes that involve force and energy.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.2L.1 Describe the interactions of organisms and the environment where they live.

Academic Vocabulary:

- predator /prey
- decomposer
- producer/consumer
- parasite/host
- ecosystem
- habitat
- photosynthesis
- herbivore/carnivore
- omnivore

Links to National Standards

2009 NAEP Framework: L4.3-4.4

National Science Education Standards: Life Science Content Standard C, pgs. 127-129

AAAS Science Literacy Benchmarks pg: 116

Explanation:

Organisms and the environment

- Interactions between organisms can be shown using simple food chains and food webs.
- Animals eat plants or other animals for food.
- Organisms interact with their environments.
- Organisms interact with each other
- Organisms can survive only in environments in which their needs are met.
- Organisms interact in various ways including providing food and s helter to one another.
- Some interactions are beneficial; others are detrimental to the organism.
- Competition for food and other resources (e.g. water and shelter) are examples of interactions.

Content Connections from Previous Grades:

2.1L.1

Sample Items:

What most likely caused the plant to bend this way?

A. fertilizer
B. gravity
C. heat
D. light

Massachusetts Released item #20 pg. 422
Answer Key: D

Some young fish develop in estuaries. While these fish develop, they hide in water plants. When the fish reach a certain age, they leave for the ocean.

Which organism in the estuary relies on the sun to make food?

A. horseshoe crab
B. hard clam
C. salt grass
D. osprey

Maryland Released Item #11 pg. 17
Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.2 Interaction and Change **Score Reporting Category 2/7**

Living and non-living things undergo changes that involve force and energy.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.2E.1 Compare and contrast the changes in the surface of Earth that are due to slow and rapid processes.

Academic Vocabulary:

- tsunami
- fault
- hurricanes
- tornadoes
- glacier

Links to National Standards

2009 NAEP Framework: E4.3

National Science Education Standards: Earth and Space Science Content Standard D, pgs. 130-134

AAAS Science Literacy Benchmarks p g: 72

Explanation:

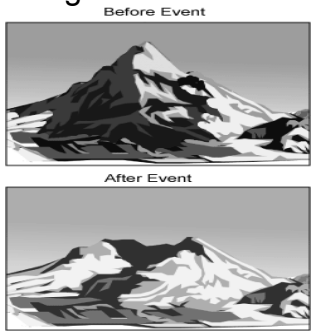
- Some changes in the Earth's surface are abrupt (e.g. earthquakes, landslides and volcanic eruptions) while other changes happen very slowly (e.g. erosion, weathering).
- The Earth's surface is shaped and reshaped by the motion of waves, wind, water, and ice.

Content Connections from Previous Grades:

none

Sample Items:

Which of the following events most likely caused the change in this area?



A. a flood
B. a hurricane
C. a volcanic eruption
D. a strong earthquake

Massachusetts Release item #29, pg 426
Answer Key: C

Which of the following is most likely to make a rock crack and crumble?

A. dew evaporating on the rock
B. leaves decaying on the rock
C. snow melting in the crack in the rock
D. water freezing in a crack in the rock

Massachusetts Released Item pg 411 #3
Answer Key: D

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.3S.1 Based on observations identify testable questions, design a scientific investigation, and collect and record data consistent with a planned scientific investigation.

Academic Vocabulary:

- data
- control
- hypothesis
- inquiry
- procedure
- variable

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks pgs: 10-11

Explanation:

Investigation

- Develop testable questions.
- Design an investigation.
- Collect and record reasonable and accurate data.

Results are shown in:

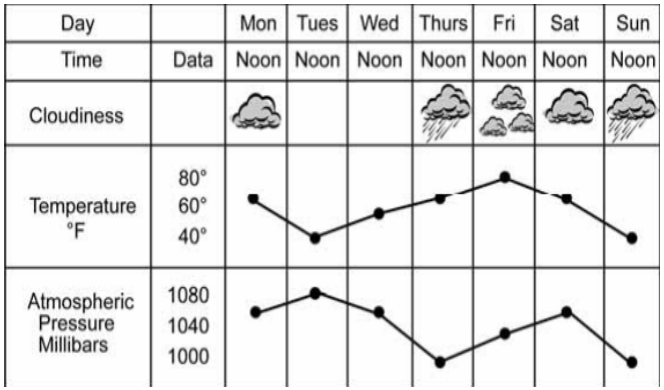
- Logs
- Journals
- Graphs
- Pictures
- Graphic organizers
- Diagrams
- Charts

Content Connections from Previous Grades:

2.3S.1, 2.3S.3, 3.3S.1

Sample Items:

Sun City



Which approach would be MOST important to collecting a second week of weather data for Sun City?

A. The same person should collect the weather data.
B. The same scientific instruments should be used to collect the data.
C. The weather data should be collected at a different location.
D. The data collector needs to wait until it is 40°F on a Monday.

Answer Key: B

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Core Standard: 4.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.3S.2 Summarize the results from a scientific investigation and use the results to respond to the question being tested.

Academic Vocabulary:

- conclusion
- error
- outlier
- prediction
- summarize

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks pgs: 10-11

Explanation:

Explanation of the Results

- Use data to explain results.
- Use results to answer the question being tested.

Results are shown in:

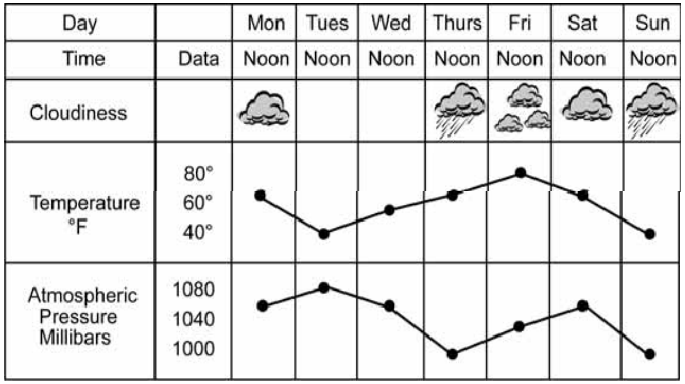
- Logs
- Journals
- Graphs
- Pictures
- Graphic organizers
- Diagrams
- Charts

Content Connections from Previous Grades:

3.3S.2

Sample Items:

Sun City



Which question can be answered through investigation of the collected data of Sun City's weather?

A. Does it ever rain when the temperature is below 50°F?
B. How much cloudiness was there during the week?
C. What was the average atmospheric pressure for the week?
D. Does the temperature and atmospheric pressure always drop when it rains?

Answer Key: C

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Core Standard: 4.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.3S.3 Explain that scientific claims about the natural world use evidence that can be confirmed and support a logical argument.

Academic Vocabulary:

- conclusion
- inference
- theory
- hypothesis

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks pgs: 10-11

Explanation:

- Scientists rely on evidence to back up claims.
- Claims without evidence cannot be scientifically confirmed.
- Evidence helps support a logical argument for a scientific claim.

Examples of evidence include:

- observations
- data
- collections

Content Connections from Previous Grades:

K.1E.1, 2.3S.2

Sample Items:

Which of the following would be considered a way to gather evidence to support a claim?

A. Collect data from an investigation
B. Listen to people on the radio
C. Talk to a friend
D. Watch a new program

Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.4 Engineering Design **Score Reporting Category 4/8**

Engineering design is a process of using science principles to solve problems generated by needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.4D.1 Identify a problem that can be addressed through engineering design using science principles.

Academic Vocabulary:

- science principles
- engineering design

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks pgs: 49-50, 54-55

Explanation:

- State a problem and generate criteria for an acceptable solution using science principles.
- Suggest possible solutions to a problem.
- Design is both a product and a process.

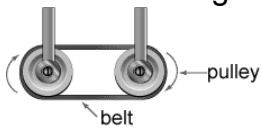
Content Connections from Previous Grades:

2.4D.3, 3.4D.1

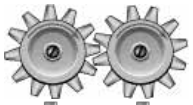
Sample Items:

Alexa wanted to build a machine for her technology class. To think of ideas, she drew four sketches of moving parts for her machine. Which design will work?

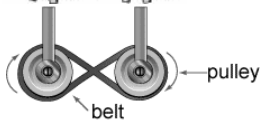
A.



B.



C.



D.

Massachusetts Released item #25, pg 424

Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.4 Engineering Design **Score Reporting Category 4/8**

Engineering design is a process of using science principles to solve problems generated by needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.4D.2 Design, construct, and test a prototype of a possible solution to a problem using appropriate tools, materials, and resources.

Academic Vocabulary:

- mass

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks pgs: 49-50, 54-55

Explanation:

Prototype

- Identify relevant design features (e.g. size, shape, weight) for building a prototype of a solution to a given problem.
- Describe different ways in which a problem can be represented. (e.g., sketches, diagrams, graphic organizers, and lists)
- Identify and explain the appropriate materials and tools (e.g., hammer, screwdriver, pliers, tape measure, screws, nails, and other mechanical fasteners) to construct and test a given prototype safely.

Content Connections from Previous Grades:

1.4D.3, 2.4D.3, 3.4D.1

Sample Items:

Juan wants to build a wooden model of a house for a school project. What tools should he use?

A. Cement and Bricks
B. Pliers and Wrenches
C. Scale and Weights
D. Nails and Hammer

Answer Key: D

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 4.4 Engineering Design **Score Reporting Category 4/8**

Engineering design is a process of using science principles to solve problems generated by needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

4.4D.3 Explain how the solution to one problem may create other problems.

Academic Vocabulary:

- consequence
- outcome

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks pgs: 49-50, 54-55

Explanation:

Solutions

- A solution to a problem may lead to further problems. (e.g. in Klamath Falls, Oregon, midges were introduced to take care of mosquitoes but they have caused problems of their own)
- Solutions involve trade-offs. (e.g. Electric cars are more fuel efficient, but their batteries contain materials hazardous to the environment.)

Content Connections from Previous Grades:

3.4D.2

Sample Items:

Chemical pesticides are sometimes sprayed on crops to kill insects that eat the crops. People have different viewpoints about the use of pesticides on crops. What might be a concern about using pesticides on the crops?

A. Will the food ripen?
B. Will the food stay fresh?
C. Will the food harm humans?
D. Will the food harm bugs in the home?

Maryland Released item #1, pg 3

Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.1 Structure and Function **Score Reporting Category 1/6**

Living and non-living things are composed of related parts that function together to form systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.1L.1 Explain that organisms are composed of parts that function together to form a living system.

Academic Vocabulary:

- locomotion
- systems
- skeleton

Links to National Standards:

National Science Education Standards: Life Science Content Standard C, pgs. 155-158

AAAS Science Literacy Benchmarks pg: 136

Explanation:

Organism parts

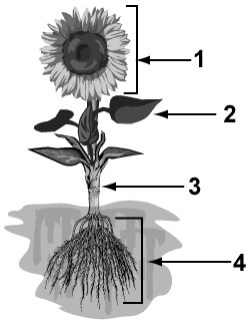
- Organisms are systems composed of parts.
- Systems have parts (e.g. brain, bones, roots, leaves) that function together and some of those parts are other systems.
- Organs function together to form systems.
- Major systems are necessary for an organism to function together as a whole. (e.g. digestive, respiration, circulatory, skeletal, muscular, reproductive, and nervous systems)

Content Connections from Previous Grades:

none

Sample Items:

Four parts of a sunflower plant are identified by numbers in the picture below.



Which numbered part of the sunflower plant is mainly responsible for reproduction?

A. part 1
B. part 2
C. part 3
D. part 4

Massachusetts Released Item #10 pg. 414
Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.1 Structure and Function **Score Reporting Category 1/7**

Living and non-living things are composed of related parts that function together to form systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.1E.1 Describe the Sun-Earth-Moon system.

Academic Vocabulary:

- axis
- eclipse
- equator
- lunar
- moon phase
- orbit
- planet vs. moon

Links to National Standards:

2009 NAEP Framework: E4.1-4.2 and E8.1

National Science Education Standards: Earth and Space Content Standard D, pgs. 158-161

AAAS Science Literacy Benchmarks pgs:62-23, 67-68

Explanation:

Sun

- The sun is the central and largest body in the solar system.
- Earth revolves around the sun. (year)

Earth

- Earth rotates on its axis. (day/night)
- Tilt of the Earth + position in orbital path results in seasons (introductory level)
- Earth is the third planet from the sun in a system of eight planets.

Moon

- Changes occur in the observable shape of the moon over the course of a month.
- The Moon orbits the Earth. (month)

Content Connections from Previous Grades:

K.2E.1, 2.2E.1, 3.2E.1

Sample Items:

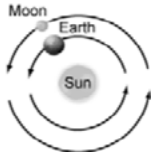
Which statement best describes Earth's movement in relation to the sun?

A. The sun orbits around the Earth.
B. The sun and Earth go around each other.
C. The Earth goes around the sun.
D. The sun and Earth go around other planets.

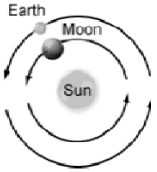
Answer Key: C

Which of the following drawings BEST represents the motion of a planet and its moon around the Sun?

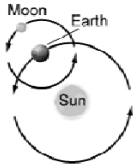
A.



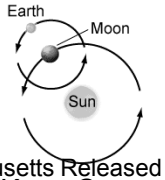
B.



C.



D.



Massachusetts Released item #9, pg 414

Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.2 Interaction and Change **Score Reporting Category 2/5**

Force, energy, matter, and organisms interact within living and non-living systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.2P.1 Describe how friction, gravity, and magnetic forces affect objects on or near Earth.

Academic Vocabulary:

- attract
- gravity
- height
- mass
- orbit
- repel
- satellite

Links to National Standards:

2009 NAEP Framework: P4.14-4.15

National Science Education Standards: Physical Science Content Standard B, pgs. 149-155

AAAS Science Literacy Benchmarks pgs: 67-68

Explanation:

- Friction causes objects to slow down or prevents movement of objects.
- Earth pulls all objects on or near it with a force called gravity.
- The closer an object is to the Earth, the stronger the gravitational pull.
- Magnets have poles that repel and attract each other. (e.g. N pole repels N pole; S pole attacts N pole)
- The Earth has a magnetic field.

(Continued on next page)

Sample Items:

Two students met at a local park. While at the park, the students played on the swings and a slide.

Swings

Slide

Each student has a different mass, yet they both reached the same height while swinging.
Which of these statements explains why the students reached the same height while swinging?

A. The students had the same speed while on the swing.
B. The students used different amounts of force while swinging.
C. The students were on the swing for the same amount of time.
D. The students used the same amounts of force while swinging.

Maryland Release item # 10 pg 12
Answer Key: B

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.2 Interaction and Change **Score Reporting Category 2/5**

Force, energy, matter, and organisms interact within living and non-living systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.2P.1 Describe how friction, gravity, and magnetic forces affect objects on or near Earth.

Academic Vocabulary:

(See previous page)

Links to National Standards:

2009 NAEP Framework: P4.14-4.15

National Science Education Standards: Physical Science Content Standard B, pgs. 149-155

AAAS Science Literacy Benchmarks pgs: 67-68

Explanation:

(See previous page)

Content Connections from Previous Grades:

1.2P.1, 2.2P.1, 3.2P.1

Sample Items: (cont.)

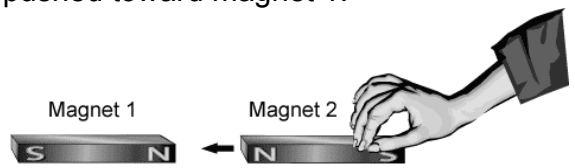
Both students played on the slide. Student 1 wore shorts, and Student 2 wore long pants.

Which of these explanations best identifies why Student 2 moved down the slide more smoothly than Student 1?

A. Less gravity
B. Less friction
C. More weight
D. More acceleration

Maryland Release item # 11 pg. 12 Answer Key: B

The picture below show magnet 2 being pushed toward magnet 1.



Which of the following will most likely happen to magnet 1 as magnet 2 is moved closer?

A. Magnet 1 will move under magnet 2.
B. Magnet 1 will move toward magnet 2.
C. Magnet 1 will move on top of magnet 2.
D. Magnet 1 will move away from magnet 2.

Massachusetts Release Item #33 pg. 428 Answer Key: D

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.2 Interaction and Change **Score Reporting Category 2/6**

Force, energy, matter, and organisms interact within living and non-living systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.

Academic Vocabulary:

- ecology
- adaptation
- interdependence
- extinct
- endangered
- energy
- predator/prey
- metamorphosis
- hibernation

Links to National Standards:

2009 NAEP Framework: L4.3-4.4 and L8.6

National Science Education Standards: Life Science Content Standard C, pgs. 155-158

AAAS Science Literacy Benchmarks pg: 116

Explanation:

Ecosystems

- Balance must be maintained within the ecosystem or some species may not survive.
- Interdependence of organisms can be shown using a food web.
- Organisms play certain roles within the environment (e.g. producers, consumers, and decomposers).
- Different kinds of organisms have characteristics that enable them to survive in different environments.

Interdependence

- Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing. Ex: fins, feathers, feet
- Organisms are part of and depend on the environment in which they live.
- Individuals live and die but not all individuals need to survive to ensure species survival.
- Adaptation influences survival.

Content Connections from Previous Grades:

4.2L.1

Sample Items:

Some young fish develop in estuaries. While these fish develop, they hide in water plants. When the fish reach a certain age, they leave for the ocean.

If the water plants were removed from the estuary, the young fish would

A. decrease in number.
B. move to a new estuary.
C. find another food source.
D. swim to the ocean earlier.

Maryland Released Item #14 pg. 17 Answer Key: A

The pictures below show the change in the fur of an arctic hare from summer to winter.

Fur in summer Fur in winter

Which of the following statements best describes how this change helps arctic hares?

A. It lowers their body temperature.
B. It protects their eyes from sunlight.
C. It helps them move on slippery ice.
D. It makes them less visible to predators.

Massachusetts Released Item #8 pg 413 Answer Key: D

Some types of trees are able to survive the heat of a forest fire. Which of the following characteristics would best help a tree survive a fire?

A. large leaves
B. shallow roots
C. thick bark
D. thin trunks

Massachusetts Released Item #1 pg 409 Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.2 Interaction and Change **Score Reporting Category 2/7**

Force, energy, matter, and organisms interact within living and non-living systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.2E.1 Explain how the energy from the sun affects Earth's weather and climate.

Academic Vocabulary:

- air pressure
- anemometer
- current
- evaporation
- condensation
- precipitation
- atmosphere
- barometer
- thermometer

Links to National Standards:

2009 NAEP Framework: E8.11and E8.13

National Science Education Standards: Earth and Space Content Standard D, pgs. 158-161

AAAS Science Literacy Benchmarks pgs: 66-67

Explanation:

- Weather is the temperature, precipitation and other factors and the present time and place.
- Climate is an average of temperature, precipitation and other factors over time.
- Weather and climate vary from place to place and season to season.
- The components of weather *(3.2E.1)*

The Sun

- The sun provides the light and heat necessary to maintain the temperature of the Earth.
- Energy received at the Earth's surface varies from place to place, hour to hour and season to season.
- The tilt of the Earth and how it affects the seasons and weather. *(5.1E.1)*

Content Connections from Previous Grades:

K.1E.1, 2.2E.2, 3.2E.1

Sample Items:

Different parts of the Earth receive different amounts of sunlight. Which area on Earth receives the most sunlight?

A. Near the Equator
B. North Pole
C. South Pole
D. Tropic of Cancer

Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.

Academic Vocabulary:

- observation
- theory
- variable

Links to National Standards:

2009 NAEP Framework Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 143-148

AAAS Science Literacy Benchmarks pgs 10-11:

Explanation:

Investigation

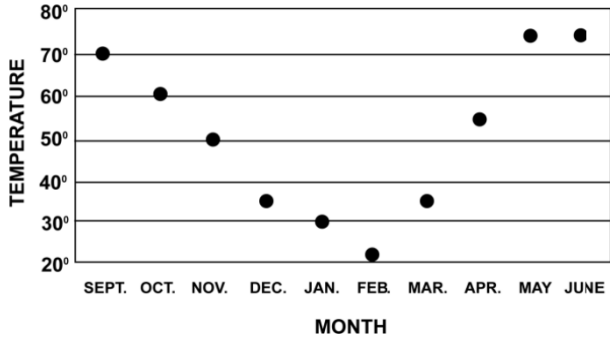
- Clarify questions and direct them towards objects and phenomena that can be described, explained, and predicted by scientific investigations.
- Develop questions and/or hypothesis that can be tested.
- Plan an investigation or experiment, determining the most objective way to answer the question and/or test the hypothesis.
- Use appropriate tools and techniques to gather observations.
  - e.g. Select an instrument that measures desired quantity; length, volume, weight, time interval, or temperature.
- Record observations with accurate pictures, numbers, or written statements.
- Collect multiple observations to increase the reliability of the data.
- Gather qualitative and quantitative observations.

Content Connections from Previous Grades:

3.3S.3, 4.3S.1

Sample Items:

A class recorded the outdoor temperatures at noon on the first day of the month all year. They made this chart.



What was the temperature on the first day of March?

A. 30°
B. 75°
C. 35°
D. 40°

Key: C

If you compared the temperature on the first day of October with the first day of January, you would find the temperature

A. went down.
B. stayed the same.
C. rose slightly.
D. rose a lot.

Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.3S.2 Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.

Academic Vocabulary:

- display
- transcribe

Links to National Standards:

2009 NAEP Framework Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 143-148

AAAS Science Literacy Benchmarks pgs: 10-11

Explanation:

Data

- Use logical reasoning to explain the results of an investigation.
- Record reasonable data and identify patterns.
- Communicate findings of data using graphs, charts, maps, models, etc.

Content Connections from Previous Grades:

3.3S.3
4.3S.2

Sample Items:

Jessica and Daniel wanted to see whether plants would grow better in soil or sand. Jessica planted 5 plants in soil, and Daniel planted 5 plants in sand. They gave all 10 plants equal amounts of water and exposed them to equal amounts of sunlight. After 2 weeks they recorded the growth of each plant.

SOIL	
Plant	Increase in height (cm)
1	2.0
2	1.9
3	2.2
4	2.1
5	1.9

SAND	
Plant	Increase in height (cm)
1	0.5
2	0.6
3	0.4
4	0.7
5	0.6

What conclusion can they draw from this experiment?

A. Plants grow just as well in soil as in sand.
B. Plants grow taller in sand than in soil.
C. Plants do not grow in either sand or soil.
D. Plants grow taller in soil than in sand.

Answer Key: D

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.3 Scientific Inquiry **Score Reporting Category 3/8**

Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.3S.3 Explain the reasons why similar investigations may have different results.

Academic Vocabulary:

- alternative
- control
- error
- outlier
- range
- variables

Links to National Standards:

2009 NAEP Framework Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 143-148

AAAS Science Literacy Benchmarks pgs: 10-11

Explanation:

- All investigations have error
- Accurate records are necessary in investigations.
- Similar investigations with different results need to be examined for inaccuracies (e.g. measurement error, procedural error, anomalies).

Content Connections from Previous Grades:

3.3S.2, 3.3S.3

Sample Items:

Two students were each doing an investigation. They were investigating the effect of sunlight on pea seedlings.

- One student placed one seedling near a window in the sun and another on a counter away from the window.
- The second student placed one seedling outside in the sun and the other on a counter away from the window.

All the seedlings started out at 5 cm. They measured the seedlings at the end of 4 days and observed the following:

Location	Student 1	Student 2
Sun	10 cm	12 cm
No Sun	7 cm	7 cm

Why do you think the students got different results?

A. The sun was not as bright outside.
B. The locations were not exactly the same.
C. The seedlings were not the same size at the beginning.
D. The peas were measured at different times during the day.

Answer Key: B

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.4 Engineering Design **Score Reporting Category 3/8**

Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.4D.1 Using science principles describe a solution to a need or problem given criteria and constraints.

Academic Vocabulary:

- feasibility
- prototype

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 161-166

AAAS Science Literacy Benchmarks pgs: 10-11

Explanation:

Solution

- Identify a problem that reflects needs and wants.
- Describe different solutions given criteria and constraints.

Content Connections from Previous Grades:

3.4D.1, 4.4D.1

Sample Items:

A student developed a method to water plants that needed an additional 100 ml. of water once a week.

Which of the following criteria was essential for developing the DESIGN?

A. Soil type
B. Plant type
C. Size of watering device
D. Water needed for a month

Answer Key: C

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.4 Engineering Design **Score Reporting Category 4/8**

Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.4D.2 Design and build a prototype of a proposed engineering solution and identify factors such as cost, safety, appearance, environmental impact, and what will happen if the solution fails.

Academic Vocabulary:

- criteria
- constraints
- engineering design
- environmental impact

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 161-166

AAAS Science Literacy Benchmarks pgs: 54-55

Explanation:

Engineering Design Solution

- Engineering design failure, and how that is used to further refine design.
- Examples:
  - Windmill designs
  - Newspaper towers
  - Toothpick bridges
  - Paper airplane (wing design)

- Design a prototype for a solution.
- Evaluate a prototype identifying factors such as cost, safety, appearance, or environmental impact.
- Proposed solutions may fail but can lead to refinements of and/or changes to a design.

Content Connections from Previous Grades:

4.4D.2, 4.4D.3

Sample Items:

A student is working on creating a new car design. The student designs, builds and tests a prototype of their design and finds out that the car uses a lot of fuel, but can't travel very far. What should the student do next?

A. Identify possible design improvements and rebuild
B. Identify criteria, constraints and priorities
C. Define a problem that addresses a need
D. Describe relevant scientific principles and knowledge

Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard: 5.4 Engineering Design **Score Reporting Category 4/8**

Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard:

5.4D.3 Explain that inventions may lead to other inventions and once an invention exists, people may think of novel ways of using it.

Academic Vocabulary:

- novel

Links to National Standards:

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 161-166

AAAS Science Literacy Benchmarks pgs: 54-55

Explanation:

Inventions

- Inventions may be used in ways for which they were not originally designed.
- Inventions lead to new ideas.
- Inventions lead to new inventions.

Examples:

- Flying pie plate – Frisbee
- Space program – Velcro®, Tang®

Content Connections from Previous Grades:

4.4D.3

Sample Items:

Lenses were created to correct near and far sightedness. Which of the following inventions was first created based on the use of lenses to correct eyesight?

A. Microscope
B. Lasers
C. Microwave oven
D. X-ray Machine

Answer Key: A

Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Item Specifications

Oregon Assessment of Knowledge and Skills (OAKS) is a multiple choice and computer scored constructed response statewide assessment. It is a required assessment that provides the base for the state accountability system.

Criteria for <u>All</u> OAKS Test Questions

Test items must

- be appropriate for students in terms of grade-level difficulty, cognitive complexity, reading level, interests and experience.
- be free of age, gender, ethnic, religious, socioeconomic, or disability stereotypes or bias.
- provide clear and complete instructions to students.
- ensure each Score Reporting Category will have items with a range of difficulty and complexity levels.
- ensure each multiple choice test item will measure only one Score Reporting Category.

Graphics Criteria

Graphics are used in OAKS to provide both necessary and supplemental information. Some graphics contain information that is necessary for answering the question, while other graphics illustrate or support the context of the question.

- Graphic displays, their corresponding items and answer choices will appear on the same screen for online items.
- Shading and color will be minimized. It will be used to make a figure's size, shape or dimensions clear, and not solely for artistic effect.
- Graphics used for computer scored constructed response items are displayed within a work space and allow students to manipulate answer graphics and answer choices.

Item Style and Format Criteria for <u>Multiple Choice Items</u>

- Test items will be in the form of questions or sentences that require completion.
- Each item will have three, four or five answer choices. Students will be told in the test directions to choose the best answer from among the choices.
- Answer choices will be arranged one of three ways beneath the test item: vertically, horizontally, or in two columns (i.e., A and B in the left column, C and D in the right column).
- Neither "None of the above" nor "All of the above" will be used as one of the answer choices. "There is not enough information" is an allowed answer choice, but infrequently used.
- Test items may be worded in the negative ("Which of these is NOT …"), but this structure will be used only when it offers substantial advantages for the item construction.
- Items should be free of absolute wording, such as "always" and "never," and have qualifying words (e.g., least, most, except) printed in small caps for emphasis.
- Masculine pronouns should NOT be used to refer to both sexes. Plural forms should be used whenever possible to avoid gender-specific pronouns (For example, instead of "The student will make changes so that he ..," it is best to use "The students will make changes so that they...").

- An equal balance of male and female names should be used including names representing different ethnic groups.
- Test items aligned to standards may contain extraneous information.
- Stacked English-Spanish test items are used on electronic tests for the English-Spanish OAKS.

Item Style and Format Criteria for Computer Scored Constructed Response

- Test items will be in the form of questions or instructions that require at least one object to be created or matched to an existing picture,
- Each item may have many correct answer choices.
- Test items may be worded so that not all answer choices are used to construct the correct response.
- An equal balance of male and female names should be used including names representing different ethnic groups.
- Test items aligned to standards may contain extraneous information but only to enhance the students' understanding of the question.
- Side-by-side English-Spanish test items are under development.
- Students using Braille will not receive constructed response items but will receive similar content items appropriate for students using Braille.

Criteria for SCIENCE OAKS Test Reporting

Student information from 2011-12 OAKS Online Science will be reported through six Score Reporting Categories (SRC) including three Science Core Standards and three Science subjects as sub categories. Scientific Inquiry (SRC 3) and Engineering Design (SRC 4) scores will be combined and reported together as SRC 8 (Science Processes) for 2011-12.

- **Structure and Function (SRC 1):** Understand living and non-living things have characteristics, form and function, and are composed of components that function together to form systems.
- **Interaction and Change (SRC 2):** Understand components in a system can interact in dynamic ways, within or without that system, and may result in change.
- **Physical Science (SRC 5):** Understand structures and properties of matter, forms of energy, and changes that occur in the physical world.
- **Life Science (SRC 6):** Understand structures, functions, and interactions of living organisms and the environment.
- **Earth and Space Science (SRC 7):** Understand physical properties of the Earth and how those properties change. Understand Earth's relationship to other objects in the Universe.
- **Scientific Inquiry (SRC 3) and Engineering Design (SRC 4) reported as (SRC 8):** Understand science process concepts and skills that characterize the nature and practice of science. Scientific Inquiry is a systematic process that includes proposing testable hypotheses, collecting, analyzing, and interpreting data to produce evidence-based explanations and new explorations. Engineering Design is a process of formulating problem statements, identifying criteria and constraints, testing solutions, and incorporating modifications based on test data and communicating the recommendations.

The Test Items

- Each Structure and Function or Interaction and Change test item will also report out to one subject Score Reporting Category but only count once for a student's total score.
- Each Core Score Reporting Category will have items with a range of difficulty levels. This range of difficulty will be approximately the same across the Core reporting categories.
- Test items are designed to be appropriate for students in the assigned test grade in terms of reading level, interests, and experience.
- Test items will be stated in the clearest manner possible.
- Each stimulus will be free of age, gender, and other bias, as evaluated by the Oregon Assessment Sensitivity Panel.
- Although the stimulus for each module will provide scientific information, students will be required to draw on prior knowledge to answer many of the items. In other words, there may not be sufficient information in the stimulus to answer all associated test questions. The stimulus may simply provide a context for some test questions.
- Each module will often include a title, which will serve to identify the accompanying items as a set.

Criteria for SCIENCE OAKS Modules

A portion of each test will be incorporated into modules. A module is defined as a stimulus containing scientific information, accompanied by two to five knowledge and skills questions. The remaining test items on each test will be discrete/stand-alone knowledge and skills items. Students will not refer to a stimulus when answering those questions.

- The stimulus for each module will vary in length, format and character. It could be one or a combination of any of the following: data table, diagram, chart, drawing, photo or reading text.
- Each Knowledge and Skills test item within a module measures one Core Score Reporting Category (SRC). Within a module, though, items may measure different SRCs.

Science Test Blueprint

Introduction

The blueprints used to construct Knowledge and Skills Tests for Science prescribe the:

- Score Reporting Categories (SRC) included on each test,
- The cognitive demand and difficulty level of items as distributed on a test form,
- the number and percentages of test items from each SRC included on each test, and
- the total number and percentages of operational and field test items included for each test.

Teachers and other educators have historically played a vital role in the development of these specifications and blueprints by serving on Content and Assessment Panels and other review groups. These groups have advised the Department as content standards have been developed, and have helped establish priorities on which standards to assess and the weighting of the strands within each content area assessment.

Alignment of Test Items to Content Standards

Test items are carefully aligned to content standards at the appropriate grade level through a rigorous process at two points in the test item development process:

1. At item development workshops, item writers are provided with adopted content standards to which they must write test items; during a peer review process, this alignment is verified by another grade level item developer.
2. Alignment of items to the content standards is further verified during a review by members of a Content and Assessment Panel, who ensure items not only match the content standards, but also verify overall quality and appropriateness. Reviewers either accept items as a strong match to the targeted standards, edit items to achieve a strong match, or reject items which do not strongly match the standards.

The Appendix to this document includes additional evidence describing procedures ensuring alignment during item, development, including descriptions of the Item Development Process and the Life of an Item.

Content Coverage

Prior to item writing activities, item databases are reviewed to determine the extent that the available items represent the emphasis and content in the standards. If any grade level standards are underrepresented in the item pool, they are identified and targeted specifically for additional item development. This assures that every year; the proportion of items in the item pool is comparable in both emphasis and content to the content standards. The table on the following page describes the emphasis given to each content strand; this emphasis is reflected in both the item pool and administered tests.

All tests and the item pool from which they are constructed follow the weighting of each content strand as reflected in the tables on the following pages. Items within a strand, or SRC, are selected to provide a range of difficulty so that the progressive nature of the test is maintained as students of varied ability levels are presented with items most appropriate to their ability from that pool. Although a student may not see an item addressing every one of the assessable standards in a

single test event, the item pool contains multiple items for each content standard at a variety of difficulty levels.

In addition, the adaptive algorithm specifically considers alignment criteria when drawing test items. As a result, we accomplish the dual purpose of creating a test form that is appropriately developed for each student and meets the criteria set forth for alignment (e.g., balance of representation, depth of knowledge).

In order to report Core and Subject SRCs, no fewer than six items will be used. Online tests report total test scores called a summary score.

Additional Test Design Criteria

Each item assesses content aligned at one grade within the grade level standards.

Online-adaptive test opportunities provide a range and breadth of items within each Core SRC and Subject SRC. Each grade level test pool has approximately 900 items available for testing.

Key placement cannot be controlled for online-adaptive assessments, so to ensure more random correct keys, item writers are instructed to rotate the correct key for their items during item authoring.

Modules**,** or items that have a stimulus and have 1-6 questions, are designed to be presented together on the same test. Between one third and one half of the items from each SRC in each test pool are Modules.

The English test blueprints provide the criteria for all English-Spanish tests. Each Spanish test pool has the same items as the English test pool.

Science Score Reporting Categories- Grade 5 test (OAKS online)

This table diagrams the science unifying concepts and processes to be reported in 2011-12.

Score Reporting Categories		Unifying Concepts and Processes			
		Big Ideas		Science Processes	
		*Structure and Function (SRC 1)	*Interaction and Change (SRC 2)	**Scientific Inquiry (SRC 3)	**Engineering Design (SRC 4)
				**Scientific Inquiry and Engineering Design (SRC 8)	
Science Disciplines or Subjects	*Physical Science (SRC 5)	*Structure and Function in Physical Science*	*Interaction and Change in Physical Science*		
	*Life Science (SRC 6)	*Structure and Function in Life Science*	*Interaction and Change in Life Science*		
	*Earth and Space Science (SRC 7)	*Structure and Function in Earth and Space Science*	*Interaction and Change in Earth and Space Science*		

*Test items aligned to SRC 1 and SRC 2 will also be reported to a subject SRC of Physical Science, Life Science, or Earth and Space Science. But, each test item in SRC 1 or SRC 2 will only be counted **once** toward a student's summary science score.

In 2011-12, test items aligned to SRC 3 and SRC 4 will be reported only **once as SRC 8. Item development will continue so that Scientific Inquiry (SRC 3) and Engineering Design (SRC 4) can be independently reported.

Weighting of Score Reporting Categories

The 2009 science content standards are organized under four Core Standards. The Core Standard statements describe the unifying concepts and processes in science. Core Standards One, **Structure and Function**, and Two**, Interaction and Change**, describe the big ideas in the three science disciplines or subjects of **Physical, Life, and Earth and Space**. Core Standards Three, **Scientific Inquiry**, and Four, **Engineering Design**, describe the science process skills and understandings that characterize the nature and practice of science and engineering.

The chart below shows the score reporting categories (SRC) for each grade tested and the percentage of questions on a given test administration that would asses that category. Test items aligned to SRC 1 and SRC 2 will also be reported to a subject SRC of Physical Science, Life Science, or Earth and Space Science. But, each test item in SRC 1 or SRC 2 will only be counted once toward a student's summary science score. In 2011-12, test items aligned to SRC 3 and SRC 4 will be reported only once as SRC 8.

For example, at grade 5, 25% of the items on a test will assess Structure and Function, which equals about 11 items on a 45-item test. Those 11 items will also be reported as they align to a Subject SRC, for reporting purposes only.

Targeted Percent of Questions by Core SRC					Targeted Percent of Questions by Subject SRC			
	SRC 1	**SRC 2**	**SRC 3***	**SRC 4***	**SRC 5**	**SRC 6**	**SRC 7**	**SRC 8***
	Structure and Function	Interaction and Change	Scientific Inquiry	Engineering Design	Physical Science	Life Science	Earth and Space Science	Science Processes
Grade 5	25%	50%	13%	12%	25%	25%	25%	25%
Grade 8	30%	45%	13%	12%	25%	25%	25%	25%
High School	30%	45%	13%	12%	24%	27%	24%	25%

* Scores from SRC 3 and SRC 4 are combined and reported as SRC 8 for 2011-12

Science Test Blueprint- Grade 5 Test

Content Coverage and Weighting

Score Reporting Categories		Testable content codes	Number of OAKS Online Items	Target % of Questions Assessed per Test*		Online Test Pool Size
Structure and Function	Physical Science	3.1P.1, 4.1P.1,	11-15	25%		290+
	Life Science	3.1L.1,4.1L.1, 5.1L.1				
	Earth and Space Science	4.1E.1,5.1E.1				
Interaction and Change	Physical Science	3.2P.1,4.2P.1, 5.2P.1	22-26	50%		500+
	Life Science	3.2L.1,4.2L.1, 5.2L.1				
	Earth and Space Science	3.2E.1,4.2E.1,5.2L.1,5.2E.1				
Science Processes (SI and ED)	Scientific Inquiry	3.3S.1, 3.3S.2, 3.3S.3,4.3S.1, 4.3S.2, 4.3S.3,5.3S.1,5.3S.2,5.3S.3	11-15	25%		250+
	Engineering Design	3.4D.1, 3.4D.2, 3.4D.3, 4.4D.1, 4.4D.2,4.4D.3,5.4D.1,5.4D.2,5.4D.3				
Operational Item Total			45			Approx. 1040
Field Test Item Total			6			300
Total items on Test			51	100%		

*During an individual student testing session, the test algorithm selects items from each SRC, targeting the percentages indicated. Furthermore, items are selected to match the target item difficulty level, determined by the student's performance on previous items, and also to match the Cognitive Demand Distribution Goals for the test. The numbers of items available in the item pool for each SRC are sufficient to allow three tests per student each year, without the student seeing any item more than once.

Target Cognitive Demand and Item Pool Distribution by Difficulty

The science test pools are designed so that a range of cognitive demand items and a range of difficult items are included for each student's test opportunity. The target item pool difficulty distribution for the Grade 5 test is outlined in the chart. A target range of cognitive demand item delivery is also included. (See Appendix B, Cognitive Demand and Target Item Pool Difficulty Distribution for all grades).

The three Cognitive Demand levels used to qualify Oregon's test items are:

- Recall: Item requires a student to recall a fact, information or procedure.
- Skill/Concept: Item requires a student to use skill or concept, including thinking that requires two or more steps.
- Strategic Thinking: Item requires a student to use reason, develop a plan or use a sequence of steps.

Online adaptive tests provide students with questions at the beginning of the test at or about the mean RIT level and as the student responds, the test item delivery system makes adjustments by selecting appropriate items for each student based upon their correct and incorrect responses. Student scores on each test will vary due to performance and the set of unique test items issued to the student. Generally, students will earn scores between the maximum high and minimum low range. The following are the possible high and low RIT student scores for grade 5 tests, within one or two points, based on a given year's item pool.

High RIT	285
Low RIT	159

Difficulty Criteria for Grade 5 level

Grade 5 Science	**Target Item Pool Difficulty Distribution**
RIT by Difficulty	
204-223	33%
224-231	33%
232-249	33%
RIT Range	204-249
Mean RIT	228
Cognitive Demand	**Target for Item Delivery**
Recall	25%
Skill/Concept	50%
Strategic Thinking	25%

Achievement Level Descriptors

Achievement level descriptors describe what students know and can do based on their performance on statewide knowledge and skills tests in the various content areas. These may be used by educators to target instruction and inform parents and students of the expectations for students to be considered proficient at a particular grade level.

The Achievement Level Descriptors are based on a sampling of a larger set of testable content outlined in the Oregon Content Standards. Results for individual students are only one indicator of student ability as measured at the time of testing. These statements give a general description of what most students know and can do within a particular band of achievement and are presented in the order of the way they are reported rather than by importance or test emphasis.

Students who score at or within a particular level of achievement possess the bulk of the abilities described at that level and generally have mastered the skills described in the preceding achievement levels.

Achievement Level Descriptors for each subject area were developed by groups of parents, educators, and business people who worked with state officials to establish the minimum scores required for Exceeds, Meets, Nearly Meets and Does Not Yet Meet.

The following Draft Science Achievement Level Descriptors were adopted by the Oregon State Board of Education on May 19, 2011and used during the Science Achievement Standard Verification Meeting held July 19-21, 2011. At that meeting, the Draft Science Achievement Level Descriptors will be revised and submitted to the State Board for approval in October, 2011.

Science Achievement Level Descriptors

STRUCTURE AND FUNCTION – GRADE 5

	Does Not Yet Meet	Nearly Meets	Meets	Exceeds
General Policy Definitions (Apply to all grades and all subjects)	Students do not demonstrate mastery of grade-level knowledge and skills required for proficiency.	Students demonstrate partial mastery of grade-level knowledge and skills required for proficiency.	Students demonstrate mastery of grade-level knowledge and skills required for proficiency.	Students demonstrate mastery of grade-level knowledge and skills exceeding the requirement for proficiency.
Science Policy Definitions (Apply to all grade groups)	Students demonstrate limited mastery of science, scientific inquiry and engineering design knowledge and skills, through the application of basic concepts with occasional success.	Students demonstrate partial mastery of science, scientific inquiry and engineering design knowledge and skills, through the application of basic concepts with regular success.	Students demonstrate mastery of science, scientific inquiry and engineering design knowledge and skills, through the interpretation and application of grade-level concepts with consistent success.	Students demonstrate mastery of science, scientific inquiry and engineering design knowledge and skills, through the interpretation and application of advanced concepts with consistent success.
PHYSICAL SCIENCE	Identifies a substance as a solid or liquid, but cannot describe the properties that make it so.	Identify substances as solids, liquids, or gases. Name some critical properties.	Compare and contrast the properties of states of matter.	Place an unknown substance in the correct category of matter by comparing and contrasting properties.
	Identify some types of energy.	Identify some types of energy and their effects on matter.	Describe the properties of forms of energy and how objects vary in the extent to which they absorb, reflect and conduct energy.	Compare various forms of energy and describe why objects vary in the extent to which they absorb, reflect and conduct energy.
LIFE SCIENCE	Identify that living things have parents that are similar to them in appearance.	Identify some characteristics offspring and parents share.	Compare and contrast the characteristics of offspring and parents.	Predict what a young organism will look like when it is mature based on the appearance of the parents.
	Identify that there are fossils of once living organisms.	Identify some characteristics of fossils and living organisms.	Compare and contrast characteristics of fossils and living organisms.	Explain why fossils may be different than living organisms.
	Identify that organisms have different parts.	Identify that organisms have different parts that function together.	Explain that organisms are composed of parts that function together to form a living system.	Apply the concept of systems to something other than a living organism.
	Differentiate between Earth	Identify properties of Earth	Identify properties, uses and	Justify the use of an Earth

Science Achievement Level Descriptors

EARTH AND SPACE SCIENCE	materials and synthetic materials. Identify Sun, Moon, and Earth, but not that they form a system.	materials that affect their use. Describe Earth's place and movement in the Sun-Earth-Moon system.	availability of Earth materials. Describe the Sun-Earth-Moon system, including changes that occur in the observable shape of the moon over the course of a month.	material based on its properties and/or availability. Demonstrate an understanding that the interactions between the Sun, Earth, and Moon are a function of their size and relative placement.

Science Achievement Level Descriptors

INTERACTION AND CHANGE – GRADE 5

	Does Not Yet Meet	Nearly Meets	Meets	Exceeds
PHYSICAL SCIENCE	Understand that a push makes an object change speed and position.	Relate the amount of force acting on an object to the degree of change in its position, motion, or speed.	Describe how forces cause changes in an object's position, motion, and speed.	Describe and compare the motion of objects in terms of one or more forces acting upon them.
	Recognize that matter has undergone a physical change.	Describe a physical change in matter that has taken place.	Describe physical changes in matter and explain how they occur.	Predict the physical change that will occur as a result of an action.
	Identify that friction, gravity, and magnetism are forces.	Identify that friction, gravity, or magnetic forces affect objects.	Describe how friction, gravity, and magnetic forces affect objects on or near Earth.	Utilize understanding of friction, gravity, and magnetic forces to predict how the movement of objects will be affected
LIFE SCIENCE	Identify that there are stages of development of plants and animals.	Identify some stages of development of plants and/or animals.	Compare and contrast the life cycles of plants and animals.	Apply the concept of cycles in nature. e.g., water cycle, carbon cycle, seasons.
	Differentiate between an organism and its environment.	Differentiate between interactions between organisms and between organisms and environment.	Describe the interactions and of organisms and the environment where they live.	Describe factors that might change the interaction of an organism and its environment.
	Understand that plants and animals have needs that must be met in order for them to survive.	Identify that adaptation is a change in structure, function, or behavior in response to environmental factors and that plants and animals are interdependent.	Explain the interdependence of plants, animals, and environment and how adaptation influences survival.	Suggest adaptations that might increase survival in the face of changing environmental conditions.

Science Achievement Level Descriptors

EARTH AND SPACE SCIENCE	Identify Earth as a planet. Name the seasons and at least one weather characteristic of each season.	Describe seasons in terms of precipitation and temperature patterns in the area where the student lives.	Identify Earth as a planet and describe its seasonal weather patterns of precipitation and temperature.	Explain differences in weather patterns around the Earth as a result of seasonal changes.
	Recognize that Earth's surface changes.	Identify a change of Earth's surface features due to a slow or a rapid change.	Compare and contrast the changes in the surface of the Earth that are due to slow and rapid processes.	Suggest processes responsible for changes to Earth's surface.
	Identify that energy from the sun provides light and heat	Differentiate between weather and climate	Explain how the energy from the sun affects Earth's weather and climate.	Explain the influence of the tilt of the Earth and the Earth's orbital path on weather and climate.

Science Achievement Level Descriptors

SCIENTIFIC INQUIRY – GRADE 5

	Does Not Yet Meet	Nearly Meets	Meets	Exceeds
	Plan a simple investigation based on a testable question.	Based on observations, identify testable questions.	Based on observations and science principles, identify questions that can be tested.	Link observations and science principles to questions or hypotheses that can be examined through scientific investigation.
	Match measuring tools to their uses.	List the steps of a scientific investigation and identify possible tools you would need.	Design an experiment or investigation, and identify appropriate tools.	Design and conduct an investigation that uses appropriate tools and procedures.
	Collect and record data from a scientific investigation.	Identify data relevant to the question being tested.	Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.	Give reasons for the collection of multiple observations while conducting investigations or experiments.
	Use the data collected from a scientific investigation to explain the results and draw conclusions.	Summarize the results from a scientific investigation and use the results to respond to the question being tested.	Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.	Use patterns in data to communicate the results of an investigation using graphs, charts, maps, models, and oral and written reports.
	Explain why when a scientific investigation is repeated, similar results are expected.	Explain that scientific claims about the natural world use evidence that can be confirmed and support a logical argument.	Explain the reasons why similar investigations may have different results.	Propose changes in an investigation's procedure that will improve the accuracy of the data.

Science Achievement Level Descriptors

ENGINEERING DESIGN – GRADE 5

	Does Not Yet Meet	Nearly Meets	Meets	Exceeds
	Identify a problem that can be addressed through engineering design using science principles.	Recognize that some proposed solutions to a problem will not be feasible because of given criteria and constraints.	Using science principles, describe a solution to a need or problem given criteria and constraints.	Justify a proposed solution, based on science principles, criteria and constraints.
	Identify problems that have been solved through engineering design and the impact that has had on the way that people live.	Identify appropriate tools, materials, and resources needed to construct a prototype of a possible engineering solution.	Design a prototype of a proposed engineering solution and identify factors such as cost, safety, appearance, environmental impact, and what will happen if the solution fails.	Evaluate proposed engineering design solutions in relation to factors such as cost, safety, appearance, environmental impact, and likelihood of failure.
	Differentiate between intended and unintended consequences of inventions.	Identify uses or outcomes of an invention for which they were not designed.	Explain that inventions may lead to other inventions and once an invention exists, people may think of novel ways of using it.	Predict new innovations or applications resulting from an invention.

LOCAL ASSESSMENTS REQUIRED BY OAR 581-22-0615
ASSESSMENT OF ESSENTIAL SKILL

Local Performance Assessments
School districts and public charter schools that offer instruction at grades 3 through 8 or high school must administer annual local performance assessments for students in grades 3 through 8 and at least once in high school for the skill areas of writing, speaking, mathematics problem solving, and scientific inquiry. The purpose of the local performance assessment requirement is to ensure that students in grades 3 through high school are afforded opportunities to learn and to receive feedback regarding their progress toward meeting specific state standards throughout their years in public schools.

A local performance assessment is a standardized measure (e.g., activity, exercise, problem, or work sample scored using an official state scoring guide), embedded in the school district's or public charter school's curriculum that evaluates the application of students' knowledge and skills. Local performance assessments must be designed to closely align with state standards and to promote independent, individual student work.

School districts and public charter schools may either use a work sample scored using an official state scoring guide or a comparable measure adopted by the school district or public charter school to satisfy the local performance assessment requirement. *Appendix M – Requirements for Local Performance Assessments* of the 2011-12 Test Administration Manual provides guidance for those school districts and public charter schools choosing to use a work sample to satisfy this requirement.

Assessment of Proficiency in the Essential Skills
As part of the new graduation requirements, high school students must demonstrate proficiency in a set of Essential Skills, which are defined as process skills that cross academic disciplines and are embedded in the content standards. Starting with the graduating class of 2012, high school students must demonstrate proficiency in the Essential Skills of Reading. Students may demonstrate proficiency in these Essential Skills using any of the assessment options approved by the State Board of Education.

As of May 2009, the Oregon Assessment of Knowledge and Skills (OAKS) is one of the approved assessment options for the Essential Skills of Reading, Writing, and Mathematics. Another approved option for the Essential Skills of Writing, Speaking, and Mathematics is the completion of work samples scored locally using an official state scoring guide. *Appendix L – Requirements for Assessment of Essential Skills* of the 2011-12 Test Administration Manual provides guidance for those school districts and public charter schools choosing to use a work sample to satisfy this requirement.

The Assessment of Essential Skills Review Panel (AESRP), which consists of experts from school districts and post-secondary education institutions, reviews and recommends additions or changes to the list of approved assessment options. The AESRP bases its recommendations on evidence provided by the school districts, research organizations, and other experts that the proposed assessment option accurately measures the Essential Skill. The State Board of Education then makes the determination whether to adopt the AESRP's recommendations. ODE anticipates that the State Board of Education will approve additional assessment options based on recommendations from the AERSP in the coming months. In addition, the AESRP is developing a set of criteria for approval by the State Board of Education that school districts and public charter schools may use in developing local assessment options.

Appendices

The Appendices of this document includes ancillary materials provided to students to complete science testing; and additional assessment documents that deal with test construction, design and assessment.

Included in this section are:

Appendix A: Oregon Achievement Standards Summary

Appendix B: Target Cognitive Demand and Item Pool Distribution Goals for all Grades

Appendix C: Item Development Process

Appendix D: Life of and Item

ACHIEVEMENT STANDARDS

2011-12 Achievement Standards Summary

The charts below show the achievement standards (requirements to meet and exceed) for Oregon's Assessments of Knowledge and Skills (OAKS) by content area and grade or benchmark level. All students are required to take reading/literature and mathematics assessments in grades 3-8 and 11; in writing in grades 4, 7, and 11; and science in grades 5, 8, and 11. Assessments in social sciences are optional; however, they may be required by some districts or schools. For detailed assessment information, refer to the 2011-12 Test Administration Manual (www.ode.state.or.us/go/TAM). It provides timelines, options, and procedures that ensure both test reliability and validity from classroom to classroom, teacher to teacher, school to school, and district to district.

Grade 3	MEET	EXCEED
Reading/Literature	211	224
Mathematics	212	219
Writing, Speaking, Science, Social Sciences	No state test	

Grade 4	MEET	EXCEED
Reading/Literature	216	226
Writing • Composite Score • Minimum score in each trait • Conventions score	• 32 to 39* (out of 48) • 3 (out of 6) • Not doubled	• 40 to 48 (out of 48) • 4 (out of 6) • Not doubled
Voice and Word Choice are not included in the achievement standard. *A composite score of 28 to 31 points nearly meets the standard. Scores in this range indicate that the writing is close to meeting the standard and that local performance assessments could be used to provide a more comprehensive view of student proficiency in writing.		
Mathematics	219	227
Speaking, Science, and Social Sciences	No state test	

Grade 5	MEET	EXCEED
Reading/Literature	221	230
Mathematics	225	234
Science	226	239
Social Sciences #	215	225
# Optional state test; may be required by districts or schools.		
Writing, Speaking	No state test	

Grade 6	MEET	EXCEED
Reading/Literature	226	237
Mathematics	227	237
Writing, Speaking, Science, Social Sciences	No state test	

Grade 7	MEET	EXCEED
Reading/Literature	229	241
Writing • Composite Score • Minimum score in each trait • Conventions score	• 40 to 49* (out of 60) • 3 (out of 6) • Doubled	• 50 to 60 (out of 60) • 4 (out of 6) • Doubled
Voice and Word Choice are not included in the achievement standard. *A composite score of 35 to 39 points nearly meets the standard. Scores in this range indicate that the writing is close to meeting the standard and that local performance assessments could be used to provide a more comprehensive view of student proficiency in writing.		
Mathematics	232	242
Speaking, Science, and Social Sciences	No state test	

Grade 8	MEET	EXCEED
Reading/Literature	232	242
Mathematics	234	245
Science	235	247
Social Sciences #	231	241
# Optional state test; may be required by districts or schools.		
Writing, Speaking	No state test	

ACHIEVEMENT STANDARDS

High School	Achievement Standards for Oregon Statewide Assessments[1]		Oregon Assessment of Knowledge and Skills (OAKS) is one option to provide evidence of proficiency in Essential Skills.	
Subject Area	**Meets**	**Exceeds**	**Notes**	**Essential Skill**
Reading/Literature	236	247	Content of the 2011-2012 OAKS Reading/Literature Assessment is based on the Grade Level Content Standards adopted in 2002-2003.	Read and comprehend a variety of text
Writing • Composite Score • Minimum score allowed in any trait • Conventions score	• 40 to 49 (out of 60) • 3 (out of 6) • Doubled	• 50 to 60 • 4 (out of 6) • Doubled	*A composite score of 35 to 39 points nearly meets the standard. Scores in this range indicate that the writing is close to meeting the standard and that local performance assessments could be used to provide a more comprehensive view of student proficiency in writing. • Score on Voice and Word Choice traits are not included in the achievement standard.	Write clearly and accurately.
Mathematics	236	251	Content of the 2011-12 OAKS Mathematics test is based on the Content Standards adopted in 2009 for high school and 2007 for grades K-8.	Apply mathematics in a variety of settings
Science	240	252	Content of the 2011-12 OAKS Science test is based on the Content Standards adopted in 2009.	
Social Sciences	239	249	Optional State Assessment; content of the 2011-12 OAKS Social Sciences Assessment is based on the Content Standards adopted in 2001.	

Achievement Standards for Demonstrating Proficiency in Essential Skills for High School Diploma[2]

Essential Skill	OAKS Assessment	Required Scores	Other Options
Reading (Class of 2012 & beyond)	Reading/Literature	236 Meets 247 Exceeds	Other approved standardized test; Work samples
Writing (Class of 2013 & beyond)	Writing Performance Assessment	40 Meets 50 Exceeds	Work samples
Apply Mathematics (Class of 2014 & beyond)	Mathematics	236 Meets 251 Exceeds	Other approved standardized test; Work samples

[1] In future years, Achievement Standards may change for the purposes of accountability and earning a high school diploma.

[2] For purposes of demonstrating mastery of Essential Skills, students must meet the achievement standards in effect during their 8th grade year. However, students may use achievement standards adopted in their 9th through 12th grade years that are equal to or lower than the achievement standards approved as of March 1 of the students' 8th grade year. In addition, students may demonstrate proficiency in the Essential Skills using additional assessment options adopted in their 9th through 12th grade years.

ACHIEVEMENT STANDARDS

A Look at Work Samples as Required Local Performance Assessments (Grades 3 – 8 and High School)

Local Performance assessments evaluate the application of students' knowledge and skills. OAR 581-022-0615 Assessment of Essential Skills requires students to complete one or more local performance assessments for each assessed skill area per year in grades 3-8 and at least once in high school. The table below outlines the achievement standards for work samples scored with an official state scoring guide and used as a local performance assessment. For detailed assessment information refer to the 2011-12 Test Administration Manual at www.ode.state.or.us/go/TAM. It provides work sample guidelines, options, and procedures that help ensure both work sample reliability and validity from classroom to classroom, teacher to teacher, school to school, and district to district.

Skill Area (Official State Scoring Guide)	Grade	Achievement Standard for Purpose of Local Performance Assessment		Notes about Work Samples
		Meets (out of 6)	Exceeds (out of 6)	
Writing	Grade 3	3	4	Grade 3 students are not held to a standard in Sentence Fluency.
	Grades 4-8 and High School	4	5	Voice and Word Choice may be scored but are not required traits. Exemplars reflect expectations at each grade level.
Speaking	Grade 3	3	4	Grade 3 students are not held to a standard in Language.
	Grades 4-8 and High School	4	5	Exemplars reflect expectations at each grade level.
Mathematics Problem Solving[1]	Grades 3-8 and High School	4	5	Exemplars reflect expectations at each grade level.
Scientific Inquiry[2]	Grades 3-8 and High School	4	5	Separate Official scoring guides exist for each grade/band (Grade 3, Benchmark 2 (Grades 4-5), Benchmark 3 (Grades 6-8), and High School).

Related Web Links:
Official State Scoring Guides: www.ode.state.or.us/search/page/?id=32
Exemplars of scored work samples are currently found on subject-specific assessment pages linked from:
www.ode.state.or.us/search/page/?id=1307

[1] Revised mathematics problem scoring guide was adopted by the State Board of Education (May 19, 2011) for use beginning with the 2011-2012 school year.

[2] Revised scientific inquiry scoring guides and newly-developed engineering design scoring guides were adopted by the State Board of Education (May 19, 2011) for use beginning with the 2011-2012 school year.

ACHIEVEMENT STANDARDS

Using Work Samples to Assess Essential Skills for the Oregon Diploma

Essential Skills graduation requirements are determined based on when a student is first enrolled in grade 9, which is referred to as the cohort year. These requirements are applied to students earning either the regular or modified diploma. Students who entered grade 9 in the 2008-2009 school year (most of whom will graduate in 2012) are required to demonstrate proficiency in the Essential Skill of Reading. The remaining implementation timeline is described in the table below.

Work samples are one assessment option that high school students may use to demonstrate they are proficient in the Essential Skills. Regarding demonstration of proficiency in the Essential Skills, districts must:

- provide students with instruction in and multiple assessment opportunities to demonstrate proficiency in the Essential Skills for the purpose of earning a high school or modified diploma.
- allow students to use assessment options adopted in a student's 9th through 12th grade years.
- allow students to use achievement standards adopted in their 9th through 12th grade years that are equal to or lower than the achievement standards approved as of March 1 of the students' 8th grade year.

At the high school level, students may use work samples to fulfill both the local performance assessment and the Essential Skills requirements.

The table below describes the achievement standard for work samples scored for the purpose of demonstrating proficiency in the Essential Skills with regard to conferring a high school diploma.

Essential Skill	Number and Types of Work Samples	Scoring Guide	First Implementation	Achievement Standard for Purpose of Conferring High School Diploma (Cut Scores)
Read and comprehend a variety of text	2 total work samples: at least one must be informative the second may be informative or literary	Official Reading Scoring Guide	Students who entered grade 9 in 2008-2009	Total score of 12 (6-point scale) across 3 traits with no trait lower than a 3; score of 5 or 6 on all traits to exceed.
Write clearly and accurately	3 total work samples: one expository one persuasive one narrative sample	Official Writing Scoring Guide	Students who entered grade 9 in 2009-2010	Score of 4 (6-point scale) to meet in each of the 4 required traits; score of 5 or 6 to exceed.
Apply mathematics in a variety of settings	2 total work samples: One each from two of these: algebra geometry statistics	Official Mathematics Problem Solving Scoring Guide	Students who entered grade 9 in 2010-2011	Score of 4 (6-point scale) to meet in each required trait; score of 5 or 6 to exceed.

Target Cognitive Demand and Item Pool Distribution by Difficulty

Oregon recognizes the importance of Cognitive Demand as part of test specification. To that end, we are implementing a strategy to overtly incorporate a test design process that includes the three dimensions of content, difficulty and Depth of Knowledge.

- The first step in the process was convening content panels to ask for their determination as to the appropriate allocation of Cognitive Demand, given the newly adopted content standards.
- The second step was to analyze the gap between the Cognitive Demand and Level of Complexity of all items in the current pools against the content panel's recommendations.
- The third step involved engaging item writers to write items to fill in the critical gaps. These items were reviewed and field tested through our standard processes.

The three Level of Complexity levels to be addressed are:

- Recall: Item requires a student to recall a fact, information or procedure.
- Skill/Concept: Item requires a student to use a skill or concept, including thinking that requires two or more steps.
- Strategic Thinking: Item requires a student to use reason, develop a plan or use a sequence of steps.

Target Cognitive Demand and Item Pool Distribution by Difficulty for Science

Grade 5	Target Item Pool Difficulty Distribution
Difficulty	
204-223	33%
224-231	33%
232-249	33%
Cognitive Demand	
Recall	25%
Skill/Concept	50%
Strategic Thinking	25%
RIT Range	204-249
Mean RIT	228

Grade 8	Target Item Pool Difficulty Distribution
Difficulty	
213-231	33%
232-240	33%
241-257	33%
Cognitive Demand	
Recall	20%
Skill/Concept	50%
Strategic Thinking	30%
RIT Range	213-257
Mean RIT	235

High School	Target Item Pool Difficulty Distribution
Difficulty	
213-233	33%
234-241	33%
242-258	33%
Cognitive Demand	
Recall	20%
Skill/Concept	50%
Strategic Thinking	30%
RIT Range	213-258
Mean RIT	237

APPENDIX C: ITEM DEVELOPMENT PROCESS

Oregon's item development process is consistent with industry practice and takes approximately two years, including writing, reviewing, and field-testing new items. Just as the development of Oregon's content and performance standards is an open, consensus-driven process, the development of test items and prompts to measure those constructs is grounded in a similar philosophy.

Item Writing

For the Knowledge and Skills (multiple-choice) tests and the Writing Performance Assessment, most item writing takes place during either onsite, remote and/or online item writing workshops, in which Oregon teachers across the five main content areas write and review items. The process remains the same regardless of workshop format.

Item writers are typically Oregon teachers who have received training in item construction, are familiar with test specifications, and have demonstrated skill in writing items that pass content and sensitivity panel review. Item writers receive professional development compensation for their time and travel expenses. Among other security precautions, ODE requires item writers to sign confidentiality forms assuring that they will work with the items in a secure manner.

All items are written to measure specific subdomains of the content standards at a variety of specified levels of cognitive complexity. Cognitive complexity is represented by the following classification, developed from Bloom's (1956) educational taxonomy:[1]

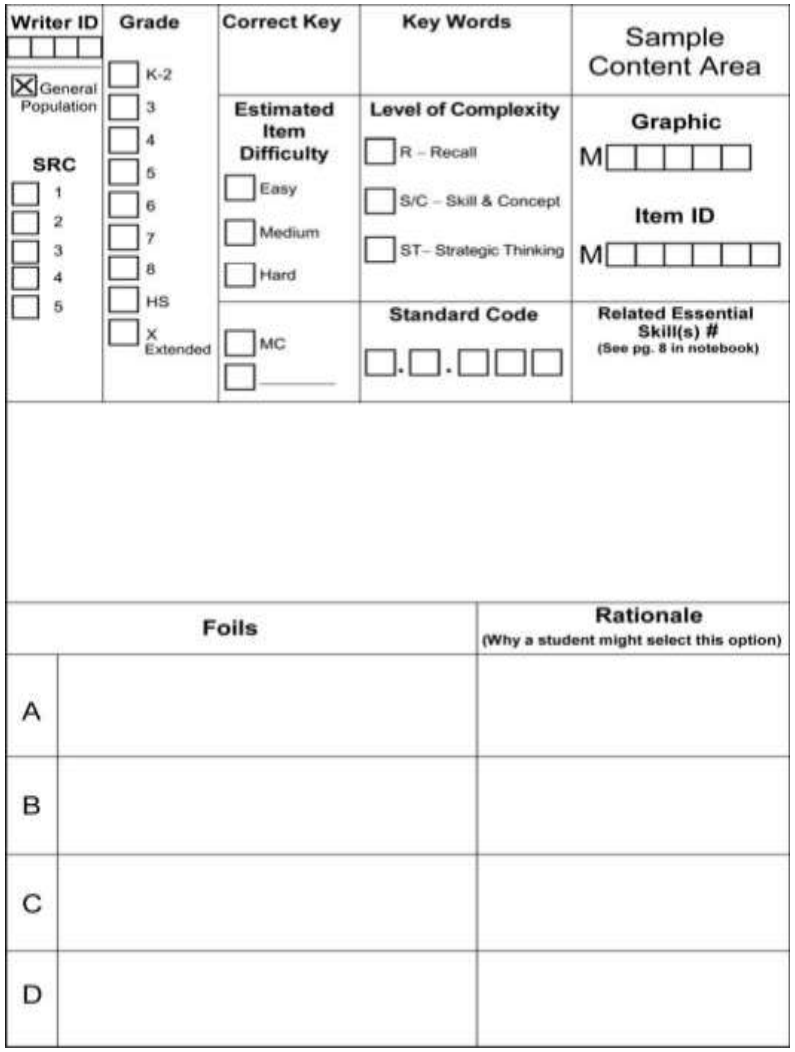
- **Recall:** Recall, label, or locate information; define or describe facts or processes.
- **Skill/Concept (Basic Application):** Use information or conceptual knowledge, often requiring two or more steps; summarize, classify, or explain information or processes; make predictions or generalizations; solve problems.
- **Strategic thinking:** Analyze, critique, compare or contrast; create new information; or organize presented information.
- **Extended thinking:** Make connections and extensions (exclusively assessed in the Writing Performance Assessment and local performance assessments).

During the item writing workshop, writers draft items, document rationale of distracters, and conduct peer reviews of each other's items. Examples of items are provided, and facilitators provide process guidance and additional review. Writers and reviewers evaluate the strength and clarity of the match between the drafted item and the standard it measures. All issues are worked out or solved multiple times by multiple

[1] Bloom, B. S. (ed.), Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: Handbook I: Cognitive domain*. New York: David McKay.

reviewers who verify that distracters are plausible, that answers are correct, and that each item has only a single correct answer.

Figure 1.
Sample Oregon Item Writing Form



Following item writing workshops, items are entered into the Item Tracking System (ITS). Oregon's original graphics are initially entered into the ODE's Comprehensive Item Management System (CIMS) and then transferred to ITS. Within ITS and CIMS, each item is given a unique item identification number to facilitate the monitoring and tracking of changes to and usage of the item throughout the review process and each item's history. ITS provides authorized users with access to each item's alignment and attributes, field-test results and use, response rationales, and previous versions.

Although item writing workshops may still occur annually, ODE has recently moved toward distributed item writing in which consistently strong item writers author additional items throughout the year. Items still go through the review process previously described. Item writers are trained on the use of secure item entry using ITS, and graphic drafts are scanned by the item writers and securely transmitted to ODE.

Committee/Panel Review

ODE convenes a series of advisory groups to advise ODE both on assessment-related policy and on item development. ODE seeks to ensure that membership on these advisory groups reflects the demographics of Oregon's student population. Each advisory group has approximately 15–35 members who serve three-year terms with one-third of the members rotating out each year and being replaced by new representatives. The following table describes the structure of these groups.

Structure of ODE Assessment-Related Advisory Groups

Committee/Panel	Number of Members	Meeting Frequency	Who Nominates Members?
Assessment Policy Advisory Committee	15–20	2-3 times a year	School districts, COSA, OSBA, OEA, ESDs, and OPTA
Sensitivity Panel	15–20	4–6 times a year	School districts, OEA, ESDs (application process)
English/Language Arts Content and Assessment Panel	35	4-6 times a year	School districts, OEA, ESDs, and self-nominate (application process)
Mathematics Content and Assessment Panel	35	4 - 6 times a year	School districts, OEA, ESDs, and self-nominate (application process)
Science Content and Assessment Panel	35	4- 6 times a year	School districts, OEA, ESDs, and self-nominate (application process)
Social Sciences Content and Assessment Panel	25	1 - 2 times a year	School districts, OEA, ESDs, and self-nominate (application process)
English Language Proficiency Content and Assessment Panel	35	1 – 2 times a year	School districts, OEA, ESDs, and self-nominate (application process)

Note. Oregon's Accommodations and Modifications Review Panel is not described here.
Source: http://www.ode.state.or.us/teachlearn/testing/dev/panels/structurecapanels.doc

Panel members commit up to 6 school days of service with an additional 3 or 4 days during the summer. However, panels will be convened remotely rather than in person as secure technology improvements allow distributed work. Although committee members on district contracts are not compensated for their service, they do receive travel reimbursement for committee travel of more than 70 miles, and substitute teachers are provided for service during the school year. When classroom teacher members work for ODE during non-contract time, they are compensated at an hourly wage as temporary employees

The Assessment Policy Advisory Committee consists of representatives from Oregon school districts, schools, and ESDs who are knowledgeable about assessment-related issues. The purpose of the Committee is to advise ODE on both the procedural and policy implications of Oregon's assessment system, as well as the feasibility of proposed improvements to Oregon's assessment system. Committee members provide input regarding the various elements of the state assessment system such as educational technology, electronic reporting, operational assessment issues, and test administration.

In addition to seeking advice on assessment-related policy, ODE requires that all items generated for use on Oregon statewide assessments must pass a series of rigorous reviews before they can be used in field and operational tests. All items go through both a content and a sensitivity review as part of the

item development process; only those items that measure the grade-level expectations and meet both overall quality and sensitivity criteria are carried forward to the field-test stage.

ODE Content and Assessment Panels exist for each of the content areas for which statewide tests are given: English/Language Arts (this panel reviews Writing and Reading/Literature assessment items), Mathematics, Science, Social Sciences, and English Language Proficiency.

Most members of these panels are classroom teachers, with some representation from higher education, district curriculum and assessment personnel, and related businesses. Criteria for panel selection include the following:

- Knowledge of Oregon's content standards and expertise in the subject area and its eligible content
- Teaching experience at the grade level or benchmark to which the individual will be assigned
- Geographical location to ensure that all regions of Oregon are represented
- Gender and ethnic diversity to ensure that the panel represents the diversity of Oregon's student population

Current item writers are not allowed to serve on item review committees. However, in some cases, content and assessment panel experts may be utilized as item writing facilitators.

Items are accepted, rejected, or modified by the Content and Assessment Panel to make sure they represent the constructs embodied in grade-specific content standards and test specifications. In addition to judgments of content relevance, the panels appraise the technical quality of items, looking for items that are free from such flaws as (a) inappropriate readability level, (b) ambiguity, (c) incorrectly keyed answers and distracters, (d) unclear instructions, and (e) factual inaccuracy. The panels for each content area use the following review process:

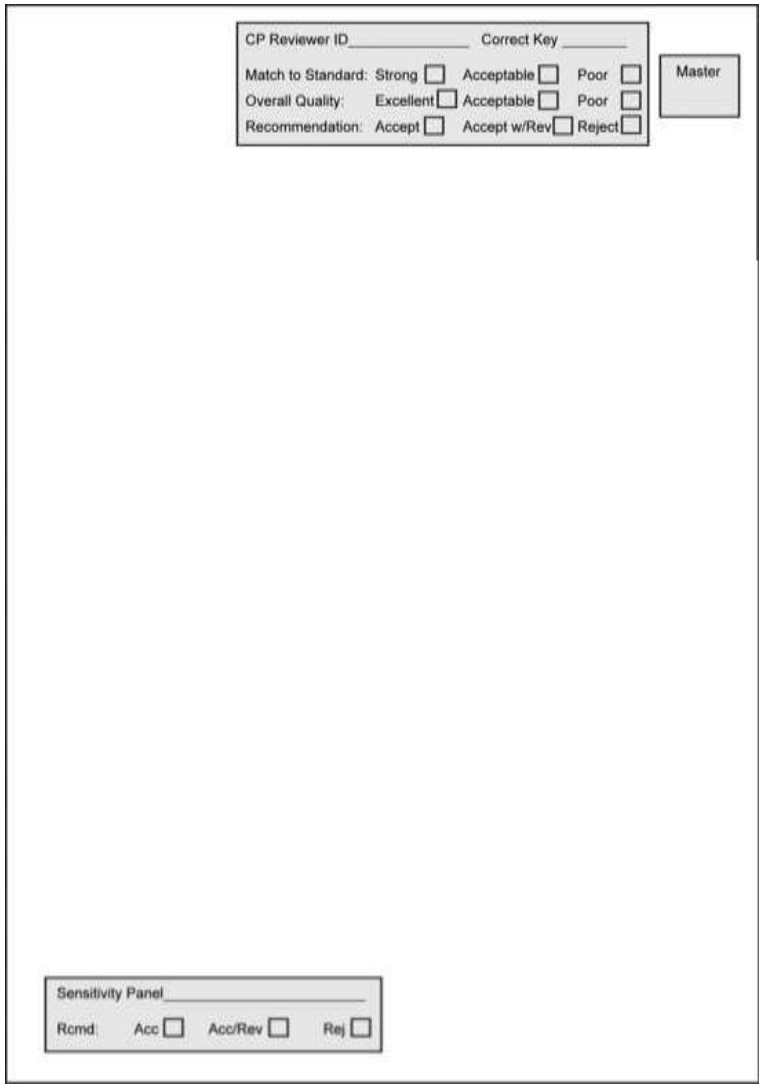
1. Three content panel members review each item independently and complete an Item Review Form (IRF) (figure 1) using a pre-assigned reviewer ID.

2. Then, the three content panel members review the item collectively, and item reviewers make a recommendation for each item on the IRF to either (a) accept the item as written, (b) accept the item with revisions, or (c) reject the item (sometimes an alternate question is offered that entails a simple revision).

3. When all three reviewers agree that an item should be accepted or rejected, no further discussion is needed. If one or more of the reviewers feel that an item should be revised, then they attempt to reach a consensus and produce a "master copy" of their recommendation. The same is true if one or two of the reviewers reject an item that another reviewer finds acceptable with or without revisions.

4. In most cases, recommendations are followed and revisions are made, or items are eliminated. The ODE assessment specialist can override the recommendation, but this occurs rarely and only for compelling reasons.

Figure 2.
Sample Oregon Content and Assessment Panel Item Review Form



The content panels perform specific checks on items to confirm that:

- the SRC and subcategory match.
- the key is correct.
- alternate valid interpretations making the distracters correct do not exist.
- the item is grade-level appropriate in content and reading levels.
- the item is of overall high quality (wording and grammar, graphic quality, curricular importance, etc).
- the identified level of difficulty (i.e., easy, medium, hard) is correct.
- Reading/Literature passages are appropriate in content and reading levels. Science and Social Sciences stimuli align to appropriate content and reading skills.
- the level of cognitive complexity (i.e., recall, skill/concept or strategic thinking) is appropriate to the item and correctly identified.

Following review by the content panel, and according to panel feedback, ODE assessment specialists edit and revise items in ITS in preparation for review by the Sensitivity Panel.

All items that pass review by the content specialist are next presented to the sensitivity panel. The sensitivity panel reviews convenes day-long meetings, four to six times a year. The panel reviews items from all grade levels and content areas for bias, controversial content, and overly emotional issues.

In general, the sensitivity panel ensures that items:

- present racial, ethnic, and cultural groups in a positive light.
- do not contain controversial, offensive, or potentially upsetting content.
- avoid content familiar only to specific groups of students because of race or ethnicity, class, or geographic location.
- aid in the elimination of stereotypes.
- avoid words or phrases that have multiple meanings.

Following the sensitivity panels and according to panel feedback, ODE assessment specialists edit and revise items in the ITS system.

EXPERT REVIEW

Next, ODE assessment specialists submit the new items for review by experts that have experience in the roles of item writer and content and assessment panel member. Expert reviewers add an additional quality control check for the online assessments. Experts have received extensive professional development in ITS to review items in a web-preview format providing the exact rendering provided in the online assessments. Experts review each item and confirm that:

- the key is correct.
- alternate valid interpretations making the distracters correct do not exist.
- the item is grade-level appropriate in content and reading levels.
- the item is of overall high quality (wording and grammar, graphic quality, curricular importance, etc).

Following the expert review in most cases, recommendations are followed and revisions are made, or items are eliminated. The ODE assessment specialist can override the recommendation, but this occurs rarely and only for compelling reasons.

FIELD TESTING

Once the items have been reviewed by the content and assessment panel, the sensitivity panel, and an expert reviewer, all Mathematics, Reading/Literature, Science, and Social Sciences test items are field tested. Field test items identified by the ODE assessment specialists are embedded in the operational tests by content area. As students take the operational tests, they also respond to approximately 5-8 field test items embedded in the test.

ODE then receives data files of the student responses, which ODE analyzes to determine whether the field test items are behaving as expected. The ODE assessment specialists eliminate those items which the data analysis indicate performed weakly. ODE assessment staff calibrate the difficulty level for those items that performed successfully in preparation for using the item operationally.

TRANSLATION OF ITEMS TO SPANISH

Concurrent with the field testing of items in English, all Mathematics, Science, and Social Sciences test items are translated into Spanish. All required grade-level and benchmark-level statewide tests for Mathematics and Science are offered in English-Spanish tests. English-Spanish tests are also available for Social Sciences. Stacked English-Spanish items are used on electronic tests. Side-by-side English-Spanish and English-Russian Paper/Pencil assessments are available in Mathematics and Science.

Following translation by ODE's translation vendor, the translated items are reviewed by ODE's Spanish- and Russian-speaking experts to ensure that each item accurately conveys the intent of the English text. While the procedure described below specifically addresses Spanish translation, ODE follows a similar procedure for translation of Paper/Pencil items into Russian.

The following linguistic guidelines are used by ODE's translation vendor and Spanish-speaking experts:

- Students are expected to have subject knowledge and use proper terminology/vocabulary for that subject. In other words, what is expected from English-speaking students is also expected from Spanish-speaking students.
- ODE uses formal Spanish (usted, not tú) for test items and includes proper verb conjugation.
- ODE strives to use Global Spanish language that will be interpreted and understood by all Spanish speakers from anywhere in the world. Global Spanish language includes words used worldwide by most Spanish speakers.

After the ODE Spanish reviewers complete a review of the newly translated items, extensive research is conducted by a small group of reviewers on any word that has not met group consensus. Every attempt is made to choose the most correct translation based upon grade level and cultural relevance. A variety of resources are used for selecting the proper translated words including: dictionaries from Mexico, South America and Spain (e.g. Diccionario Hispanoamericano de Dudas, Diccionario de Matemáticas), and ODE's list of translated terms for Science at http://www.ode.state.or.us/search/page/?id=517 and for Mathematics at http://www.ode.state.or.us/search/page/?id=500 .

ADDITIONAL EXPERT REVIEW OF ITEMS

On an annual basis, ODE assessment specialists review items from the field test pool for inclusion within the operational test. This level of review acts as an additional quality control for the online assessments. In addition, whenever ODE transitions to a different test delivery system, ODE submits all of its Reading/Literature, Mathematics, Science, and Social Sciences items for an additional level of expert review to ensure that all items appear consistently from year to year when presented to students.

ITEM USE AND RELEASE

Approximately every three years, ODE releases one sample test for each content area and grade-level and benchmark-level comprised of items used on previous test forms. These items are no longer secure and are taken out of the pool of eligible test items.

Released items are provided in the form of practice tests. Practice tests for Reading/Literature, Mathematics, Social Sciences, and Science are available on ODE's Website at http://www.ode.state.or.us/search/page/?id=1222 .

Sample Writing prompts are also available at http://www.ode.state.or.us/teachlearn/subjects/elarts/writing/assessment/usingsampleprompts.pdf

OFFICE OF ASSESSMENT & INFORMATION SERVICES
THE OREGON DEPARTMENT OF EDUCATION

The complete two-year Lifecycle of a Knowledge and Skills Item
Mathematics, Reading/Literature, Science, Social Sciences

1 Phase 1›Item Writing

SITES

A. Assessment staff schedules and coordinates item writing activities, and recruits Oregon teachers to construct items to be entered into an item database

WRITING

B. Item Writing: Teachers receive professional development training on item development, including a focus on standards alignment and item content and format. Items are written explicitly to measure Oregon academic content standards.

REVIEW

C. Teachers review items written by their peers.

ENTRY

D. After items are written, assessment staff enter items into a database.

Bank of POTENTIAL items

NEXT PHASE

2 Phase 2›Item Review

SORT

A. Assessment Specialist sorts and organizes items for review.

REVIEW

B. Subject Specific Content and Assessment Panels, consisting of Oregon teachers, review test items with respect to content validity and grade appropriateness.

EDIT

C. Assessment Specialist edits and revises items according to content panel feedback.

REVIEW

D. Sensitivity Panel reviews items in two-day meetings, generally held four times a year.

EDIT

E. Assessment Specialist edits and revises items according to Sensitivity Panel feedback.

Bank of REVIEWED items

NEXT PHASE

3 Phase 3›Field Testing

FIELD TEST

A. Assessment Specialist identifies items to be field tested.

EMBED

B. Field test items are embedded in an operational test.

TEST

C. Students complete operational tests with embedded field test items.

PROCESS

D. Data files of student responses are submitted to ODE for analysis.

Bank of FIELD items

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The complete two-year Lifecycle of a Knowledge and Skills Item
Mathematics, Reading/Literature, Science, Social Sciences

4 Phase 4›Data Analysis of Field Test Items

ANALYZE

A. Assessment staff generates psychometric data to determine if the item "behaves" as expected.

REVIEW

B. Assessment Specialist reviews data to determine which items should be "dropped" because of weak performance.

CALIBRATE

C. Assessment staff calibrate the difficulty of field test items that meet the successful criteria.

Bank of CALIBRATED items

NEXT PHASE

5 Phase 5›Test Construction

SELECT

A. Assessment Specialist selects items for operational testing.

RANGE

B. Assessment Specialist balances items across Score Reporting Categories (SRCs) (such as Geometry in Mathematics or Vocabulary in Reading/Literature) and range of difficulty according to test specifications.

CONSTRUCT

C. Assessment staff construct tests, online test pools,and finalize Administration Manual.

REVIEW

D. Assessment staff and expert reviewers proofread test items and stimuli for errors.

FINAL

E. Final Operational Tests and pools are prepared.

NEXT PHASE

6 Phase 6›Data Analysis of Operational Test Items

PRESENTED

A. Tests are sent to contractor for print distribution or delivery online.

SCORES

B. Students complete the operational test and receive instant scores when using online delivery.

TEST

C. Assessment staff analyze item statistics to verify the item performs as expected

PROCESS

D. Assessment staff analyze item statistics to make sure items are not biased against a particular subgroup (e.g., students with disabilities, ethnic groups, or gender).

TARGET

E. Item performance tables which describe how well each item performs are used to review items and pools of items to identify any additional items to be dropped.

Oregon Department of Education

255 Capitol St NE, Salem, Oregon 97310 (503) 947-5600