Translating Standards to Practice

A Teacher's Guide to Use and Assessment of the Alaska Science Standards

LEVEL 1, Ages 5–7

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LEVEL 1

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Introduction

Translating Standards to Practice: A Teacher's Guide to Assessment of the Alaska Science Standards were developed by Alaska educators and members of the business, native, and scientific communities to help promote scientific literacy and understanding for Alaska science students. As such, they were written to enhance, complement, and integrate the *Alaska Science Content Standards* and the *Alaska Standards for Culturally Responsive Schools* to further education in the sciences. These standards borrow heavily from the *National Science Education Standards* (NRC, 1995) as well as the *Benchmarks for Science Literacy* (AAAS, 1993) and are intended to help teachers provide students with an integrated and comprehensive understanding of science. Additionally, they were written to help enhance student understanding of Alaska culture, including the traditional and the scientific, and how they relate to one another. Teaching how the traditional and scientific relate to one another, through the use of *Translating Standards to Practice: A Teacher's Guide to Assessment of the Alaska Science Standards*, can provide an exciting and educational process that will invoke a sense of pride and self confidence in both students and teachers. The standards were developed collaboratively by the Alaska State Department of Education & Early Development and the Alaska Rural Systemic Initiative, with funding generously provided by the National Science Foundation.

Purpose

In 1994 the *Alaska Science Content Standards* were published with the goal of defining what students should know and be able to do in science by the time they complete their K–12 public education experience. These guidelines elaborate the expectations regarding student achievement and explain *how well* students should understand important scientific concepts and skills and how they relate to the environment around them. Corresponding assessments, supporting classroom ideas, and samples of student work were added to show how they might fit in a curriculum. These illustrate what *meeting the standard* may look like in the classroom. The sample assessments, which are in measurable terms, with a scoring guide, have been provided. The assessments can then be used to provide feedback to the students about how well they are meeting expectations. The assessments are also feedback to educators about how well their students are learning and how well they are meeting the *Alaska Science Content Standards*. It is important to note that these guidelines, assessments, and procedures were written illustratively—as ideas—not mandates. It should also be understood that this document is intended to help provide guidance to districts through the examples provided as they make choices regarding which standards to focus on at various benchmark age levels, as well as what *aspects* of the standards are focused on and when. The standards were written to reflect the diversity and richness of Alaska that makes teaching Alaskan students so exciting. Therefore, teachers may use them as guidelines for writing their own performance assessment activities or simply as examples to better understand particular aspects of the content standards at benchmark age levels. The standards were written to provide ideas relating to the wisdom of the cultural traditions of the Elders as well as the technological advances of the scientific community, bridging the gap between science and cultural practices to make learning more fun and appealing.

About This Document

This document presents an expanded view of the content standards for Alaska students. Performance standard statements have been written at each benchmark age level (5–7, 8–10, 11–14, 15–18). However, this document is really a "sampler" as examples of the expanded performance assessments, corresponding procedures, scoring guides, and in a very few cases, sample mini-units (elaborated classroom units), are provided for only a portion of the *Alaska Science Content Standards*—A, B, C, and D. The schematic shown below and "definitions" of the components of the document illustrate how the document is organized. The electronic version can be accessed via the Alaska Native Knowledge Network website at http://www.ankn.uaf.edu. Cross references to other pertinent Alaska standards, as well as to the National Research Council's *National Science Education Standards* and the American Association for the Advancement of Science's *Benchmarks for Science Literacy*, have been provided to show connections and further illuminate the intention of the *Alaska Science Content Standards*.

This document does **not** provide a list of mandated understandings and skills. The content standards provide a broad overview of essential learnings. The four domains described in the A, B, C, and D statements are elaborated by the key elements and describe what we agree are essential to the discipline and should be learned by all students in Alaska. The specific dimension of the content standards that should be taught and the performance to show mastery are the choice of the district, community, school, or classroom, not the document. This document is a guide for making the choice at the local level.

Definitions

Content Standard
What Alaskans want students to know and be able to do as a result of their public schooling.

Key Element
An important focus within a content standard.

Performance Standard
An example of how students at a specific age level demonstrate proficiency and understanding of a content standard focus (key element).

Sample Assessment Idea
A potential task designed to assess a student's proficiency and understanding of a performance standard.

Expanded Assessment Idea
A sample assessment idea elaborated to include procedure, reflection and revision, and level of performance.

Procedure
Step-by-step instructions to guide the implementation of an expanded assessment idea.

Reflection and Revision
A final step of procedure, which represents a collection of brief ideas or methods, intended to strengthen, clarify, and improve student understanding and proficiency.

Level of performance
A task-specific scoring guide used to assess how well students meet the performance standard.

Frequently Asked Questions

Why was *Translating Standards to Practice: A Teacher's Guide to Assessment of the Alaska Science Standards* document written?

It was prepared to:

- elaborate the Alaska Science Content Standards to more fully explain what students need to know and are able to do;
- help guide curriculum development in schools and districts;
- provide sample developmentally appropriate activities for each standard;
- provide educators with innovative performance assessment activities.

What are Performance Standards?

Performance standards define the nature of the evidence and quality to which a student understands the content standards.

What makes performance standards different from content standards?

The content standards are designed to broadly define what scientific concepts, skills, and applications are to be taught in Alaska's schools, whereas these guidelines are more detailed definitions of how well students need to know the science and what they ought to be able to do with that knowledge.

What are performance assessments?

Performance assessments help define how well students:

- understand science;
- show what they can do;
- relate science to society;
- communicate knowledge

by providing performance opportunities for students to demonstrate their understanding.

Why should I use performance activities with my students?

- To document student progress in meeting the Alaska Science Content Standards.
- To help students become accountable for their learning.
- To provide opportunities for students to learn by "doing."
- To give students a variety of opportunities to show that they can "meet" the content standards.

What if I can't use a particular performance assessment in my classroom?

The performance assessments were written as sample suggestions. You may use them as models for writing your own performance assessment activities.

Acknowledgments

Performance Standards Writing Team

Kipi Asicksik
Bering Straits School District

Gary Bender
Fairbanks North Star
Borough School District

Linnea Burmeister
Nome City Schools

Lisa Buttry-Thomas
University of Alaska Fairbanks

Cheryl Cooper
Delta/Greely School District

Peggy Cowan
Juneau School District

Cynthia Curran
Matanuska-Susitna Borough
School District

Alan Dick
Alaska Rural Systemic Initiative

Dolly Garza
University of Alaska

David Gillam
Anchorage School District

Leslie Gordon
Fairbanks North Star Borough School District

Stephanie Hoag
Science and Mathematics Consortium For Northwest
Schools

Steven Jacquier
Southwest Region School District

Leona Kitchens
Alaska Rural Systemic Initiative

Bob Nanney
Anchorage School District

Harry Oyoumick
Bering Straits School District

Gail Raymond
Anchorage School District

Daniel Solie
University of Alaska Fairbanks

Sidney Stephens
University of Alaska Fairbanks

Amy Van Hatten
Alaska Rural Systemic Initiative

Donna York
Anchorage School District

Performance Standards Committee

Bernadette Alvanna-Stimpfle
Nome City Schools

Linnea Burmeister
Nome City Schools

Nancy Douglas
Juneau School District

Robin Dublin
Alaska Department of Fish and Game
Project Wild

Judy Hurlburt
Anchorage Public Schools

Esther Ilutsik
University of Alaska Fairbanks
Bristol Bay Campus

Elmer Jackson
Alaska Rural Systemic Initiative

Sharon John
Anchorage School District

Charles Kashatok
Lower Kuskokwim School District

Oscar Kawagley
Alaska Rural Systemic Initiative

Jackie Kookesh
Chatham School District

Angie Lunda
Juneau Borough School District

Chip McMillan
University of Alaska Fairbanks

Roger Norris-Tull
University of Alaska Fairbanks
Bristol Bay Campus

Rita O'Brien
Fairbanks North Star Borough School District

John Petersen
Fairbanks North Star Borough
School District

Larry Read
Independent Consultant

Margie Revet
Lower Kuskokwim School District

Thelma Saunders
Fairbanks North Star Borough School District

Cole Schaeffer
Cominco Alaska
Red Dog Mine

Roger Trottier
North Slope Borough Schools

Alaska Rural Systemic Initiative

Ray Barnhardt
Co-Director

Frank Hill
Co-Director

Oscar Kawagley
Co-Director

Dorothy Larson
Co-Director

Moses Dirks
Aleutian/Alutiiq Regional Coordinator

Leona Kitchens
Aleutian/Alutiiq Regional Coordinator

Teri Schneider
Aleutian/Alutiiq Regional Coordinator

Amy Van Hatten
Athabascan Regional Coordinator

Elmer Jackson
Inupiaq Regional Coordinator

Andy Hope
Southeast Regional Coordinator

Barbara Liu
Yupik Regional Coordinator

Alan Dick
Village Science Coordinator

Claudette Bradley
AISES Coordinator

Editing and Production

Megan Martin, Consultant
Science Education and Assessment

Patty Kreikemeier
Independent Consultant

Lisiana Hinojosa
SRI International

Paula Elmes
Alaska Native Knowledge Network

Sheri Gray
University of Alaska Southeast

Len Peterson
University of Alaska Southeast

Yeong Lu
University of Alaska Southeast

State Board of Education & Early Development Members

Susan Stitham, Chair
Lathrop High School

Roy Nageak
First Vice Chair

Mike P. Williams
Second Vice Chair

Lieutenant Colonel Mark Avery
Military Advisor

Jacob Fuller Student Advisor
Dimond High School

Paula Pawlowski

Ernie Hall

Sally Rue

Alaska Department of Education & Early Development

Richard S. Cross
Commissioner

Bruce Johnson
Deputy Commissioner

Barbara Thompson
Deputy Director

Cynthia Curran
Science Specialist

Performance Standard Review Teams

Anchorage

Barbara Bodnar
ADNR Division of Forestry

Traci Caves
Anchorage School District

Helen Cole
Matanuska-Susitna Borough
School District

Janice Heinrich
Building a Presence for Science

Trisha Herminghaus
C & I Science
Anchorage School District

Judy Hurlburt
C & I Science
Anchorage School District

Mia Jackson
The Imaginarium

Leona Kitchens
Alaska Rural Systemic Initiative

Peggy Kristich
Matanuska-Susitna Borough School District

Melody Mann
Matanuska-Susitna Borough School District

Naomi Mayer
Pacific Northern Academy

Ted Munsch
Alaska Pacific University

Harry O'Brien
USDA Natural Resources Conservation Service

Gail Raymond
Anchorage School District

Guy Sandlin
Lower Yukon School District

Donna Gail Shaw
University of Alaska Anchorage
School of Education

Emma Walton
National Science Teachers Association

Donna York
Anchorage School District

Fairbanks

Lisa Buttry-Thomas
University of Alaska Fairbanks

Jeff Drake
Geophysical Institute
University of Alaska Fairbanks

Lawrence Duffy
Institute of Arctic Biology—UAF

Linda Evans
Alaska Native Knowledge Network

Chip McMillan
University of Alaska Fairbanks
School of Education

John Morack
University of Alaska Fairbanks
Physics Department

Martha Robus Kopplin
Partners in Science
Fairbanks North Star Borough School District

John Peterson
University of Alaska Fairbanks

Carol Scott
North Pole Leadership Academy

Daniel Solie
University of Alaska Fairbanks

Elena Sparrow
University of Alaska Fairbanks
Plant, Animal & Soil Sciences Department

Performance Standard Review Teams, con't.

Juneau

Patty Brown
Haines Borough School District

Annie Calkins
Juneau School District

Charlotte Candalaria
Sitka Borough School District

Pat Harris
Auke Bay Lab

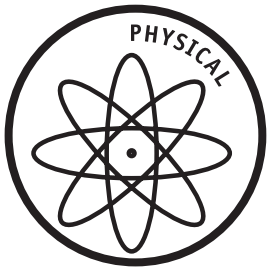
Stephanie Hoag
Science and Mathematics Consortium for Northwest Schools

Jody Marcello
Sitka School District

Joe Marcello
Sheldon Jackson College

Carolyn Mork
Sitka Borough Schools

Ernie Selig
Alyeska Central School



Alaska Science Content Standard A

Level 1, Ages 5–7

A student should understand scientific facts, concepts, principles, and theories.

Alaska Science Key Element A1

A student who meets the content standard should understand models describing the nature of molecules, atoms, and sub-atomic particles and the relation of the models to the structure and behavior of matter (Structure of Matter).

Performance Standard Level 1, Ages 5–7

Students use models to represent structures and identify different scale relationships

Sample Assessment Ideas

- Students use blocks to build models of fruits, vegetables, animals, and so on, to illustrate that objects may be made of small parts that do not resemble the final object.
- Students examine feathers, fur, and fish scales by eye, with a magnifying glass, and with a microscope; report observations in terms of similarities and differences; report how these things may be useful to the animal.

Expanded Sample Assessment Idea

- Students observe various kinds of fabric with a hand lens; describe what they have seen to an adult; create a model that shows their observations of the structure of the fabric.

Procedure

Students will:

1. Select a fabric (cotton, linen, wool, nylon mesh, burlap, etc.); observe the fabric with the naked eye; draw a picture of the fabric; describe the fabric to an adult.
2. Observe the fabric with a hand lens; draw a picture of the fabric; describe the fabric to an adult.
3. Observe the fabric with a microscope; draw a picture of the fabric; describe the fabric to an adult.
4. Design and build a model that represents the fabric observations (Useful craft materials might include paper, additional fabric samples, styrofoam, weaving materials, pipe cleaners, yarns, threads, ropes or strings of various diameter.)

Reflection and Revision

Describe how the model represents the observations. Describe similarities and differences in the various fabrics observed by classmates. What fabric would be good for soaking up water? For making a piece of fancy clothing? For carrying fish back to your house? What did you see in the magnified fabric that helped you decide?

Levels of Performance

Stage 4

Student work is complete, correct, and shows evidence of logical reasoning. The completed model is detailed and accurately represents several observations of the magnified fabric sample. Student explanations of the model and how the fabric can be used show multiple examples of transfer and extension of knowledge. They include several examples of similarities and differences in the fabrics examined by the class as well as detailed descriptions that relate the magnified view of fabric to its possible uses.

Stage 3

Student work shows evidence of logical reasoning but may contain minor errors or omissions. The completed model is detailed and represents observations of the magnified fabric sample. Student explanations of the model and how the fabric can be used show examples of transfer and extension of knowledge. They include at least one similarity and one difference in the fabrics examined by the class as well as a description of how the structure of a fabric relates to how it might be used.

Stage 2 Student work shows limited evidence of knowledge transfer or extension and may contain errors of science fact and reasoning. The completed model may contain evidence of skilled craftsmanship but may be incomplete, incorrect or lack detail.

Stage 1 The completed models and explanation are largely incomplete or incorrect and show little or no evidence of knowledge relating models and scaled structures to objects and their uses

Standards Cross-References

National Science Education Standards

Objects have many observable properties, including size, weight, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools such as rulers, balances, and thermometers. (Page 127)

Objects are made of one or more materials, such as paper, wood, and metal. Objects can be described by the properties of the materials from which they are made, and those properties can be used to separate or sort a group of objects or materials. (Page 127)

Benchmarks

Objects can be described in terms of the materials they are made of (clay, cloth, paper, etc.) and their physical properties (color, size, shape, weight, texture, flexibility, etc.). (Page 76)

Some kinds of materials are better than others for making any particular thing. Materials that are better in some ways (such as stronger or cheaper) may be worse in other ways (heavier or harder to cut). (Page 188)

Many of the toys children play with are like real things only in some ways. They are not the same size, are missing many details, or are not able to do all of the same things. (Page 268)

A model of something is different from the real thing but can be used to learn something about the real thing. (Page 268)

Alaska Science Key Element A2

A student who meets the content standard should understand the physical, chemical, and nuclear changes and interactions that result in observable changes in the properties of matter (Changes and Interactions of Matter).

Performance Standard Level 1, Ages 5–7

Students observe physical properties of substances and observe that a substance maintains many of the same properties whether it is big or small.

Sample Assessment Ideas

- Students use a magnifying glass to observe an object (piece of paper, wood); cut the object into smaller pieces; observe the smaller pieces under a magnifying glass; recognize and describe similarities
- Students observe and recognize the similarities in iron as it exists in different places (e.g. a nail, a guardrail, a hammer head); using hardness, reaction to a magnet, rusting over time or density tests

Expanded Sample Assessment Idea

- Students observe different shapes and sizes of candle wax; determine properties of candle wax.

Procedure

Students will:

1. Observe a variety of properties of the unlit candle eg. color, feel (hardness), does it float or sink in water? (density); describe and draw observations in journal.
2. Observe an adult light the candle; drip the wax into different shape molds (these can be made earlier as an art activity); remove wax from molds when wax cools and hardens.
3. Observe the new wax pieces using the same tests as above; record observation in journal.

Reflection and Revision

Think, discuss and report—what changes did the candle go through? Were the properties of the new small wax molds different from each other or from the original candle? What does this tell about the liquid and solid wax?

Levels of Performance

Stage 4 
Student work is complete, correct, and shows detailed evidence of knowledge related to physical properties of common substances Multiple journal entries accurately record all before and after melting observations of the candle wax (color, hardness, and density). Explanations of physical changes and physical properties are correct and show no evidence of misconceptions

Stage 3 
Student work shows evidence of knowledge related to physical properties of common substances. Multiple journal entries record most before and after melting observations of the candle wax (color, hardness, and density). Explanations of physical changes and physical properties may contain minor errors or omissions but show no evidence of misconceptions

Stage 2 
Student work is incomplete and shows limited evidence of knowledge related to physical properties of common substances Journal entries may be limited in number or show evidence of misconceptions related to the changes in the properties of candle wax after melting.

Stage 1
Student work is mostly incomplete or shows evidence of multiple misconceptions related to the physical properties, and physical changes of common substances

Standards Cross-References

National Science Education

Materials can exist in different states—solid, liquid, and gas. Some common materials, such as water, can be changed from one state to another by heating or cooling. (Page 127)

Benchmarks

Things can be done to materials to change some of their properties, but not all materials respond the same way to what is done to them. (Page 76)

Alaska Science Key Element A3

A student who meets the content standard should understand models describing the composition, age, and size of our universe, galaxy, and solar system and understand that the universe is constantly moving and changing (Universe).

Performance Standard Level 1, Ages 5–7

Students make observations of the daytime and nighttime sky over a period of time and chart the movement of objects.

Sample Assessment Ideas

- Students draw a picture that compares day and night positions of the sun and moon from a window in their homes.

Expanded Sample Assessment Ideas

- Students chart movements of the sun and the moon from the classroom.

Procedure

Students will:

1. Select a window in their classroom or school where they can identify the position of the sun and the moon.
2. Draw and label at least six pictures of the window with the changing position of the sun and the moon between the hours of 9 a.m. and 4 p.m.
3. Share pictures in class; discuss patterns and changes observed; identify east and west on the picture.
4. Consolidate the student work to create a sun and moon location chart for that day.

Reflection and Revision

What could you do to make your drawings a more exact picture of the location of the sun and the moon? Draw a picture that predicts where the sun and the moon will be at 5 p.m.

Level of Performance

Stage 4 — Student work is detailed and correctly labeled. Student work shows detailed evidence of extension of knowledge by correctly predicting location of the sun and the moon later in the day.

Stage 3 — Student work is detailed or correctly labeled. Student work shows some evidence of extension of knowledge by predicting location of the sun or moon later in the day.

Stage 2 — Student work is incomplete, incorrect or lacks detail. Student work shows limited evidence of extension of knowledge to a new situation. Student work contains inaccuracies or misconceptions about the movement of the sun and moon in the sky.

Stage 1 — Student work shows little or no evidence of understanding how the sun and moon move in the sky. Pictures may show craftsmanship but the work is mostly incomplete, incorrect, and contains misconceptions

Standards Cross-References

National Science Education Standards

An object's motion can be described by tracing and measuring its position over time. (Page 127)

Objects in the sky have patterns of movement. The sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The moon moves across the sky on a daily basis much like the sun. The observable shape of the moon changes from day to day in a cycle that lasts about a month. (Page 134)

The sun, moon, stars, clouds, birds, and airplanes all have properties, locations, and movements that can be observed and described. (Page 134)

Benchmarks

There are more stars in the sky than anyone can easily count, but they are not scattered evenly, and they are not all the same in brightness or color. (Page 62)

The sun can be seen only in the daytime, but the moon can be seen sometimes at night and sometimes during the day. The sun, moon, and stars all appear to move slowly across the sky. (Page 62)

The moon looks a little different every day, but looks the same again about every four weeks. (Page 62)

Alaska Science Key Element A4

A student who meets the content standard should understand observable natural events such as tides, weather, seasons, and moon phases in terms of the structure and motion of the Earth (Earth).

Performance Standard Level 1, Ages 5–7

Students observe natural events and identify patterns in the weather and the seasons.

Sample Assessment Ideas

- Students work with their classmates to chart the weather on a daily calendar
- Students identify the difference between day and night, summer and winter in their community.

Expanded Sample Assessment Idea

- Students keep a daily journal identifying weather patterns across seasons.

Procedure

Students will:

1. Learn weather-related words and phrases in English and Native languages, including terms to describe the weather (wind direction, wind speed, cloud type, cloud cover, temperature, seasons and so on).
2. Discuss the weather with Elders, including indigenous sayings related to the weather.
3. Take turns identifying weather conditions.
4. Draw or write observations on the classroom chart.
5. Continue to chart the weather with the class for several months.

Reflection and Revision

Use the weather chart to make a graph of the number of inside recess and outside recess days. What information from the weather chart did you use to help you decide if it was an inside recess day or an outside recess day? Draw a picture that predicts the weather for the following week. Explain how you used information in the weather chart to make your prediction.

Level of Performance

Stage 4 — Student work is complete and correct. Student uses appropriate terms in more than one language to describe the weather in detail. Student drawing, graph, and explanation are accurate and each shows evidence of higher-level thinking. Student explanation shows evidence of extension of knowledge through detailed predictions.

Stage 3 — Student work is generally correct, but may contain minor errors or omissions. Student uses appropriate terms in more than one language to describe the weather. Student drawing, graph, and explanation are accurate. Student's prediction is correct, but may lack detail.

Stage 2 — Student attempts to use more than one language to describe the weather, although several of the terms may be incorrect or inappropriate. Student drawing, graph, or explanation may be incomplete, incorrect, or lack detail. Student work may contain misconceptions and errors in science fact and reasoning.

Stage 1 — Although the work may be on topic, the student uses incorrect terms in one or both languages to describe the weather. Student drawing, graph, and explanation are largely incomplete, incorrect, and show little or no evidence of understanding weather and weather patterns.

Standards Cross-References

National Science Education Standards

Weather changes from day to day and over the seasons. Weather can be described by measurable quantities, such as temperature, wind direction and speed, and precipitation. (Page 134)

Objects in the sky have patterns of movement. The sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The moon moves across the sky on a daily basis much like the sun. The observable shape of the moon changes from day to day in a cycle that lasts about a month. (Page 134)

Benchmarks

The moon looks a little different every day, but looks the same again about every four weeks. (Page 62)

Some events in nature have a repeating pattern. The weather changes from day to day, but things such as temperature and rain (or snow) tend to be high, low, or medium in the same months every year. (Page 67)

Water can be a liquid or a solid and can go back and forth from one form to the other. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing. (Page 67)

Water left in an open container disappears, but water in a closed container does not disappear. (Page 67)

Alaska Science Key Element A5

A student who meets the content standard should understand the strength and effects of forces of nature, including gravity and electromagnetic radiation (Forces of Nature).

Performance Standard Level 1, Ages 5–7

Students show how objects can be moved without being touched, and how shadows are formed by light.

Sample Assessment Ideas

- Students demonstrate that they understand that objects fall to the ground if support is withdrawn.
- Students describe the pushing and pulling forces of magnets on one another and on different objects
- Students predict the direction and shape of a shadow of an object illuminated from one side by a lamp or by the sun.

Standards Cross-References

National Science Education Standards

Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object. (Page 127)

Electricity in circuits can produce light, heat, sound, and magnetic effects Electrical circuits require a complete loop through which an electrical current can pass (Page 127)

Magnets attract and repel each other and certain kinds of other materials (Page 127)

Benchmarks

The sun warms the land, air and water. (Page 83)

Things near the Earth fall to the ground unless something holds them up. (Page 94)

Magnets can be used to make some things move without being touched. (Page 94)

Alaska Science Key Element A6

A student who meets the content standard should understand that forces of nature cause different types of motion, and describe the relationship between these forces and motion (Motion).

Performance Standard Level 1, Ages 5–7

Students observe and record changes in an object's position and motion when applying a push or pull.

Sample Assessment Ideas

- Students describe or demonstrate the pushes or pulls that can be used to move an object through a simple maze.
- Students explain the motions of a balance or teeter-totter in terms of the "weight" of objects placed on it.

Expanded Sample Assessment Idea

- Students build a game where marbles collide; measure the distance and direction (angle) of marbles that have collided.

Materials

Graph paper, tray with flat bottom, large sheets of paper, 12-inch diameter paper circles, marbles, ruler, marking pens

Procedure

Students will:

1. Cut a piece of paper large enough to fit snugly, yet lie flat, in the bottom of the tray. Remove the paper from the tray.
2. Fold a 12-inch diameter circle in half and firmly press the edge of the fold; fold in quarters, eighths and sixteenths; open the circle; refold along the same lines but in the opposite direction to help flatten the folds so they do not curl the edge of the circle
3. Put the circle in the middle of the tray paper; hold the circle flat with one hand and mark a dot on the tray paper each place a fold touches the tray paper; connect the opposite dots to create a design similar to this* (Each student should prepare one of these forms but can use teacher prepared tray papers for their additional trials.)
4. Put the tray paper back in the tray.
5. Place one marble in the tray at the center crossing point; place a second marble at the edge of the tray along another of the lines.
6. Mark the starting position of the second marble
7. Carefully roll the second marble so that it collides with the first marble
8. Mark the position of both marbles when they stop; remove the marbles from the tray.
9. Use a marking pen to draw and label the path of each marble.
10. Measure how far each marble went.
11. Repeat steps 4–10 using a new tray paper but keep the same position for the second marble
12. Repeat steps 4–11 using a new starting position for the second marble
13. Repeat steps 4–11 using a variety of marbles (2 large, 1 large and 1 small, marbles made of different materials, and so on).
14. Compare the results with others in class

Reflection and Revision

What caused the first marble to move after the collision? Did the repeat marble collision always get the same results as the first collision? What would happen if the two marbles were not the same size? If the marbles were not made of the same material? How can you tell how much push you gave to the second marble to start it moving? How could you change the game so that every marble got the same amount of push to start it moving? When you examine the class results, is there a pattern to the motion for different marbles?

Levels of Performance

Stage 4 
Student work is complete and shows detailed evidence of the transfer and extension of knowledge related to how a push or pull changes the position or motion of an object. The student creates at least four complete sets of marble path diagrams that are clearly labeled, tests several marble variations (size, material, starting position), and always includes the repeat experiment. The student examines class data, identifies and explains patterns of motion for different marbles, and designs a method to deliver a uniform push for each marble roll.

Stage 3 
Student work is complete and shows some evidence of the transfer or extension of knowledge related to how a push or pull changes the position or motion of an object. The student creates at least two sets of marble path diagrams that are labeled, tests several marble variations (size, material, starting position), and includes the repeat experiment although aspects of the diagrams may be unclear. The student examines class data, identifies patterns of motion for different marbles, and designs a method to deliver a similar push for each marble roll.

Stage 2 
Student work may be incomplete and show little evidence of knowledge related to changes in the position or motion of an object. The student creates marble path diagrams that are incomplete or lack labels. The student may attempt to design a method to deliver a similar push for each marble roll.

Stage 1 
Student work is mostly incomplete and contains misconceptions related to the position or motion of an object. Marble path diagrams, if included, are incorrect or not labeled. Attempts to design a method to deliver a push for each marble roll may be inappropriate to the game or not work.

Standards Cross-References

National Science Education Standards

The position of an object can be described by locating it relative to another object or the background. (Page 127)

An object's motion can be described by tracing and measuring its position over time. (Page 127)

The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull. (Page 127)

Benchmarks

Things move in many different ways, such as straight, zigzag, round and round, back and forth, and fast and slow. (Page 89)

The way to change how something is moving is to give it a push or a pull. (Page 89)

Alaska Science Key Element A7

A student who meets the content standard should understand how the Earth changes because of plate tectonics, earthquakes, volcanoes, erosion and deposition, and living things (Processes that Shape the Earth).

Performance Standard Level 1, Ages 5–7

Students observe and describe earth materials such as clay, silt, sand, rocks, and pebbles that exist in a variety of sizes, shapes, colors, and hardness.

Sample Assessment Ideas

- Students dig a hole; observe and describe the different earth materials they discover
- Students test soft and hard materials by hitting them against each other (Proper SAFETY precautions should be used.)

Expanded Sample Assessment Idea

- Students classify a collection of rocks based on a variety of criteria.

Procedure

Students will:

1. Each collect at least five different local rocks and bring their collection to class
2. Make a list of characteristics most commonly used to describe the rocks.
3. Sort the five rocks in their collections according to one characteristic (for example, color, size, shape, hardness, or other student-selected category); describe the groups formed by this sort, record results in journal.
4. Sort the five rocks in their collections according to a new characteristic; describe the groups formed by this sort; record results in their journals
5. In groups of three, sort and describe the combined rock collection in at least three different ways; describe the groups of rocks they made each time they used a new characteristic to sort them; record results in journal.

Reflection and Revision

What characteristic was easiest to use to categorize the rocks? Why?

Level of Performance

Stage 4

Student work is complete, and shows evidence of logical reasoning. Student work shows detailed evidence of ability to sort and describe earth materials using multiple characteristics The student sorts and describes rocks using three different characteristics Each sort cycle includes a description of the rock groupings made using that particular characteristic Student work describes in detail the sorting and information analysis processes used to sort and group earth materials.

Stage 3

Student work, while generally correct, may contain minor errors and omissions Student work shows evidence of ability to sort and describe earth materials using several characteristics The student sorts and describes rocks using at least two different characteristics Most sort cycles include a description of the rock groupings made using that particular characteristic Student work describes the sorting process and analyzes the information collected during the sorting process

Stage 2 Student work contains errors and omissions. Student work shows limited evidence of ability to sort and describe Earth materials. Student may not describe the sorting process or analyze information about the rocks.

Stage 1 Student work is largely incomplete or incorrect and shows little or no evidence of ability to sort or describe earth materials.

Standards Cross-References

National Science Education Standards

Earth materials are solid rocks and soils, water, and the gases of the atmosphere. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials, as sources of fuel, or for growing the plants we use as food. Earth materials provide all of the resources that humans use. (Page 134)

Soils have properties of color and texture, capacity to retain water, and ability to support the growth of many kinds of plants, including those in our food supply. (Page 134)

The surface of the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes. (Page 134)

Benchmarks

Chunks of rocks come in many sizes and shapes, from boulders to grains of sand and even smaller. (Page 72)

Change is something that happens to many things.(Page 72)

Animals and plants sometimes cause changes in their surroundings. (Page 72)

Alaska Science Key Element A8a

A student who meets the content standard should understand the scientific principles and models that describe the nature of physical, chemical, and nuclear reactions (Energy Transformations).

Performance Standard Level 1, Ages 5–7

Students observe and describe changes in matter and identify some changes that are easily reversible, and some that are not.

Sample Assessment Ideas

- Students describe how salt changes when they dissolve some in water then grow crystals back from solution.
- Students fold paper, cut holes in paper, and burn paper (Proper SAFETY precautions should be used); describe each change as reversible or non-reversible

Expanded Sample Assessment Idea

- Students melt ice cubes into water; freeze the water and re-melt the ice; boil the water and melt condensate

Procedure

Students will:

1. Observe and describe ice cubes in a journal or during an oral discussion.
2. Melt ice cubes; observe and describe the resulting water in a journal.
3. Freeze the water; observe and describe the "new" ice cubes with a partner
4. (Teacher does this) Boil the water; observe the steam and discuss it with the class Is steam the same as fog or clouds? (NOTE: Yes, steam is seen when water vapor cools and condenses into tiny droplets)

Reflection and Revision

Draw a picture of how the water changed. Draw a picture that shows some other ways to change the form of the water. Draw a picture that shows how we could get the steam to return water to the beaker. Is the substance always water, even when it is solid ice or solid snow or water in a glass or water in a stream or water in a cloud or rain? Draw a picture that shows how water changes in the water cycle.

Levels of Performance

Stage 4

Student drawings show detailed evidence of knowledge about reversible changes that happen to water. Drawing #1 of the demonstration shows what happened during each step of the ice to water demonstration. Drawing #2 shows another way to change the form of water other than the process used in the classroom demonstration. Drawing #3 shows the three steps in the water cycle. Student explanation is correct, complete and shows evidence of logical reasoning.

Stage 3

Student drawings show evidence of knowledge about reversible changes that happen to water Drawing #1 of the demonstration shows what happened during the steps of the ice to water demonstration. Drawing #2 may show another way to change the form of water other than the process used in the classroom demonstration. Drawing #3 shows two steps in the water cycle Student explanation shows evidence of logical reasoning but may contain minor errors or omissions.

Stage 2 — Student drawings show limited evidence of knowledge about changes that happen to water. Drawings may contain evidence of skilled artwork but may be incomplete, incorrect or lack detail.

Stage 1 — Student drawings show little or evidence of knowledge about changes that happen to water. Drawings may be largely incomplete or incorrect and show little evidence of understanding.

Standards Cross-References

National Science Education Standards

Materials can exist in different states—solid, liquid, and gas. Some common materials such as water can be changed from one state to another by heating or cooling. (Page 127)

Benchmarks

Things can be done to materials to change some of their properties, but not all materials respond the same way to what is done to them. (Page 76)

Alaska Science Key Element A8b

A student who meets the content standard should understand the scientific principles and models that state whenever energy is reduced in one place, it is increased somewhere else by the same amount (Energy Transformations).

Performance Standard Level 1, Ages 5–7

Students observe that the sun warms the land, air and water

Sample Assessment Ideas

- Students examine and describe the effects of direct sunlight—measure the temperatures of water in sun and shade; exercise in the sun and in the shade; place white and dark colored objects in a sunny spot and feel the difference in temperature; compare the results when you repeat during another season.
- Students stand close to a hot stove or near a fire and describe what it feels like on the front and back of the body. Students then slowly rotate and describe how this experience is similar to objects warming in the sunshine and to the Earth as a whole

Expanded Sample Assessment Idea

- Students compile and report on temperatures near water and on land over the year

Procedure

Students will:

1. Discuss how best to get comparable information (same altitude, same time of day, and so on) to track weather patterns through the year
2. Identify the information to be collected, such as cloudiness, temperature, wind direction, chill factor, and so on.
3. Identify another classroom group (this might be an e-mail classroom elsewhere in Alaska) who will share and compare information for this activity.
4. Collect, compile and chart temperature reports at locations near water (lakes or ocean) and at distances further from the water

Reflection and Revision

Review information; look for patterns; discuss the patterns in terms of why the sun is heating the Earth differently at different locations and during different seasons

Levels of Performance

Stage 4
Student work is complete, correct and shows detailed evidence of the transfer and extension of knowledge relating to factors that influence the sun's heating of the Earth. Student collects data reliably, clearly organizes the data, and logically interprets the data to identify several weather patterns

Stage 3
Student work is mostly complete and shows evidence of the transfer or extension of knowledge relating to factors that influence the sun's heating of the Earth. Student collects and organizes data, and identifies patterns, though the work may contain minor errors, inconsistencies or omissions

Stage 2
Student work may be incomplete and shows limited evidence of knowledge relating to weather patterns and the factors that influence the sun's heating of the Earth. Student collects and organizes weather-related data but may be unable to identify any weather patterns

Stage 1	Student work is mostly incomplete and shows misconceptions relating to the weather. Student may collect limited amount of data but does not organize or interpret it in a meaningful manner.

Standards Cross-References

National Science Education Standards

The sun provides the light and heat necessary to maintain the temperature of the Earth. (Page 134)

Benchmarks

The sun warms the land, air, and water. (Page 83)

Alaska Science Key Element A8c

A student who meets the content standard should understand the scientific principles and models that state that whenever there is a transformation of energy, some energy is spent in ways that make it unavailable for use (Energy Transformations).

Performance Standard Level 1, Ages 5–7

Students observe that there are many ways to produce heat and other forms of energy.

Sample Assessment Ideas

- Students demonstrate and/or explain three ways to warm hands on a cold day.
- Students list several different forms of energy and identify a source for each in their home or community.

Standards Cross-References

National Science Education Standards

Heat can be produced in many ways, such as burning, rubbing, or mixing one substance with another. Heat can move from one object to another by conduction. (Page 127)

Electricity in circuits can produce light, heat, sound and magnetic effects. Electric circuits require a complete loop through which an electric current can pass. (Page 127)

Sound is produced by vibrating objects. The pitch of sound can be varied by changing the rate of vibrations. (Page 127)

The sun provides the light and heat necessary to maintain the temperature of the Earth. (Page 134)

Benchmarks

The sun warms the land, air, and water. (Page 83)

Alaska Science Key Element A9

A student who meets the content standard should understand the transfers and transformations of matter and energy that link living things and their physical environment from molecules to ecosystems (Flow of Matter and Energy).

Performance Standard Level 1, Ages 5–7

Students identify examples of living and non-living things in their environment and demonstrate understanding that things change over time

Sample Assessment Ideas

- Students grow a plant from a bulb (such as amaryllis, tulip, or iris); observe, measure, and draw accurate pictures to record the growth changes
- Students classify a variety of objects (or pictures) as living or non-living, as matter or energy.

Expanded Sample Assessment Idea

- Students care for a mealworm.

Procedure

Students will:

1. Provide food and water for their groups' mealworm.
2. Measure length and observe appearance of the mealworm at least twice a week.
3. Record measurements in science journal
4. Graph length change vs time.
5. Share results with rest of class; compare growth with the various mealworms

Reflection and Revision

Did all the mealworms grow the same amount?

Level of Performance

Stage 4 Student journal contains multiple, detailed entries related to animal changes Data is organized in a simple data table Length of animal is graphed using a simple bar graph to show changes over time Comparison of mealworms is extensive and accurate

Stage 3 Student journal contains multiple entries related to animal changes Data is grouped in a table Length of animal is graphed using a simple bar graph to show changes over time Descriptions and comparisons of mealworms may lack detail.

Stage 2 Student journal contains limited entries related to animal changes Data is incomplete, or is not or organized. Graphs, if present are incomplete Descriptions of mealworms lack detail and do not include comparisons

Stage 1 Student journal entries are largely incomplete

Standards Cross-References

National Science Education Standards

Organisms have basic needs For example, animals need air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met. The world has many different environments, and distinct environments support the life of different types of organisms. (Page 129)

All animals depend on plants Some animals eat plants for food. Other animals eat animals that eat plants (Page 129)

Benchmarks

Plants and animals both need to take in water, and animals need to take in food. In addition, plants need light. (Page 119)

Many materials can be recycled and used again, sometimes in different forms. (Page 119)

Alaska Science Key Element A10

A student who meets the content standard should understand that living things are made up mostly of cells and that all life processes occur in cells (Cells).

Performance Standard Level 1, Ages 5–7

Students use a hand lens to observe minute details of living things

Sample Assessment Ideas

- Students observe different parts of plants (leaves, flowers, roots) with a hand lens; make detailed descriptions of the appearance such as size and texture; draw magnified and unmagnified views of the object.
- Students observe different parts of animals (insect wings, mouthparts, legs, antennae), mammals (hair, toenails, fingernails), fish (scales, gills), or birds (feathers, beaks, claws); make detailed descriptions of the appearance; draw magnified and unmagnified views of the object.

Standards Cross-References

National Science Education Standards

Each plant or animal has different structures that serve different functions in growth, survival, and reproduction. For example, humans have distinct body structures for walking, holding, seeing, and talking. (Page 129)

Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do. (Page 138)

Benchmarks

Magnifiers help people see things they could not see without them. (Page 111)

Most living things need water, food, and air. (Page 111)

Alaska Science Key Element A11

A student who meets the content standard should understand that similar features are passed on by genes through reproduction (Heredity).

Performance Standard Level 1, Ages 5–7

Students identify similarities and differences between offspring and their parents

Sample Assessment Idea

- Students observe a litter of puppies; compare the young animals to each other and to their parents
- Students examine a portrait of a large family (or multigenerational family); list the features each child has in common with each parent. (NOTE: Use of a non-personal family portrait may reduce emotional turmoil in the classroom.)

Standards Cross-References

National Science Education Standards

Plants and animals closely resemble their parents. (Page 129)

Many characteristics of an organism are inherited from the parents of the organism, but other characteristics result from an individual's interactions with the environment. Inherited characteristics include the color of flowers and the number of limbs of an animal. Other features, such as the ability to ride a bicycle, are learned through interactions with the environment and cannot be passed on to the next generation. (Page 129)

The characteristics of an organism can be described in terms of a combination of traits. Some traits are inherited and others result from interactions with the environment. (Page 157)

Benchmarks

There is variation among individuals of one kind or within a population. (Page 107)

Offspring are very much, but not exactly, like their parents and like one another. (Page 107)

Alaska Science Key Element A12

A student who meets the content standard should distinguish the patterns of similarity and differences in the living world in order to understand the diversity of life and understand the theories that describe the importance of diversity for species and ecosystems (Diversity).

Performance Standard Level 1, Ages 5–7

Students sort plants and animals into groups using consistent criteria, and describe how some characteristics affect the survival of the plant or animal.

Sample Assessment Ideas

- Students sort 5-bean soup mix using their own criteria; draw and label how the beans were sorted; discuss how different students use different criteria.
- Student groups collect and sort fifteen animal pictures based upon similarities or differences; create a group poster to explain how the animals were sorted; discuss how different animals have different characteristics; discuss how the characteristics of an animal help it to survive in its environment.

Expanded Sample Assessment Idea

- Students will take a nature walk; observe plant and animal life; collect samples of local plants.

Procedure

Students will:

1. Discuss acceptable ways to collect plants before walk.
2. Form pairs.
3. Go on a walk accompanied by a knowledgeable adult who will help identify plants and animals
4. Take a plastic bag with them and collect at least three, but not more than five, different plants
5. Draw and label a picture of each plant collected in their science journal. Write the plant's native or familiar name.
6. Work with another pair of students (now each group of four has at least six to ten plants) sort the plant samples based upon the group's chosen criteria. (This process repeats with groups of eight, and so on until the whole group is together)

Reflection and Revision

What additional ways could you sort and classify the plants that you observed? What special characteristic do some plants have that others do not? What special characteristics help each plant to survive in its environment?

Level of Performance

Stage 4 — Student work is complete, and shows evidence of logical reasoning. Student collects and classifies four or five plants using three or more attributes (color, size, shape, use, and so on). Drawings are correctly labeled and show correct color, size, and shape for each plant that was collected and classified. Student shows several ways that plants can be organized (in addition to the sorting criteria used in class), and describe several examples of plant adaptation.

Stage 3 — Student work is complete, but may contain minor errors or omissions Student collects and classifies three plants using three or more

attributes (color, size, shape, use, and so on). Drawings are labeled and show color, size, and shape for several of the plants that were collected and classified. Student describes one way that plants can be organized (in addition to the sorting criteria used in class), and describe at least one plant adaptation.

Stage 2 Student work is incomplete or incorrect. Student collects at least two plants and attempts to classify them using some plant attributes (color, size, shape, use, and so on). Drawings show color, size, or shape for one plant that was collected. Student may attempt to describe how to organize plants using a new attribute or may repeat a description of the method used in class. Descriptions of plants and plant adaptations may include misconceptions

Stage 1 Student work is largely incomplete and incorrect.

Standards Cross-References

National Science Education Standards

Each plant or animal has different structures that serve different functions in growth, survival, and reproduction. For example, humans have distinct body structures for walking, holding, seeing, and talking. (Page 129)

Plants and animals have life cycles that include being born, developing into adults, reproducing, and eventually dying. The details of this life cycle are different for different organisms. (Page 129)

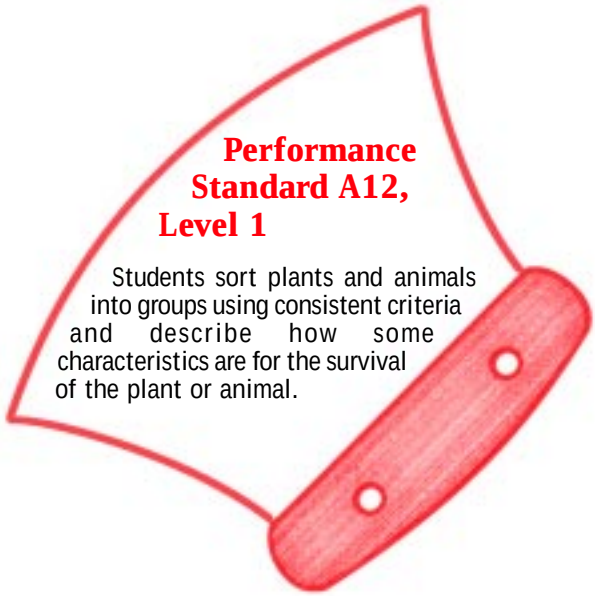
Benchmarks

Some animals and plants are alike in the way they look and in the things they do, and others are very different from one another. (Page 102)

Plants and animals have features that help them live in different environments (Page 102)

Stories sometimes give plants and animals attributes they really do not have (Page 102)

Mini-Unit: Nature Trails



Performance Standard A12, Level 1

Students sort plants and animals into groups using consistent criteria and describe how some characteristics are for the survival of the plant or animal.

Alaska Science Content Standard Key Element

A student who meets the content standard should distinguish the patterns of similarity and differences in the living world in order to understand the diversity of life and understand the theories that describe the importance of diversity for species and ecosystems.

Cross-Reference

Additional Content and Performance Standards: B1, B4, Math C1, Cultural Standards A5, D2

Key Concepts and Skills

- There are similarities and differences in plants
- Plants are classified by different attributes
- Students can use the processes of science including observation, classification, and communication.

Timeline

2 weeks or longer.

Abstract

This unit focuses on skills of observation and classification that need to take place over and over again in a child's primary education. After observing, collecting, and classifying plants found along nature trails, Students will communicate their findings with their classmates and teacher. Before this mini-unit takes place, students should have previous experiences with sorting and classifying.

Materials

- ✔ Science journal
- ✔ Hand lens
- ✔ Small plastic bag
- ✔ Clip board
- ✔ Chart paper
- ✔ Pencils, colored pencils, markers

Activities

1

Class will take a nature walk. Prior to going on the walk, students draw what they think they will see, hear, touch, or smell on their walk. Back in the classroom after the walk, students draw what they did see, hear, touch, or smell during the walk. They share their favorite thing drawn and put it on chart paper. Hang in classroom.

Embedded Assessment

Teacher checks the student's science journals when back in the classroom.

2

Go on a sound walk. Listen for man-made sounds. Create a sound map in their science journal by doing the following activity. Each student finds a place to sit or stand where they are not looking at anyone else. Sit quietly for 2–3 minutes. In their science journal mark with an "X" where sound came from in relation to self (in front of, in back of, right, left, above). Then talk about which sounds were heard and where. Do the same sound activity again for 2 minutes. Discuss again.

3

Go on a sight walk outside. Ask a knowledgeable adult to accompany students and help identify plants, animals, and so on. (Try to include a scientist and an Elder knowledgeable in natural uses of plants.) Look for natural things. Do the following camera activity with a partner. One student is the camera, one student is the photographer. The photographer guides the camera (who has kept eyes closed), to the object(s) that the observer wants the camera to focus on. The photographer taps the camera's shoulder, which is the signal for the camera to open its lens (eyes) for a count of ten. Then the camera closes its lens and the pair take 2–3 more pictures. After the pictures are taken, the camera chooses one of the objects focused on and draws a picture with as much detail as possible. Partners switch roles. After both partners are done, find the area the picture was drawn from and observe how much they remembered. Back in the classroom use pictures for a sorting activity.

Expanded Sample Assessment Idea

Students will take a nature walk; observe plant and animal life; collect samples of local plants.

Procedure

Students will:

1. Discuss acceptable ways to collect plants before the walk.
2. Form student pairs; go on a walk accompanied by a knowledgeable adult who will help identify plants and animals.
3. Take a plastic bag with them and collect at least three, but not more than five, different plants.
4. Draw and label a picture of each plant collected in their science journal. Write the plant's native or familiar name.
5. Work with another pair of students (now each group of four has at least six to ten plants) sort the plant samples based upon the group's chosen criteria. (This process repeats with groups of eight, and so on until the whole group is together.)

Reflection and Revision

What additional ways could you sort and classify the plants that you observed? What special characteristics do some plants have that others do not? What special characteristic helps each plant to survive in its environment?

Level of Performance

Stage 4 — Student work is complete, and shows evidence of logical reasoning. Student collects and classifies four or five plants using three or more attributes (color, size, shape, use, and so on). Drawings are correctly labeled, and show correct color, size, and shape for each plant that was collected and classified. Student shows several ways that plants can be organized (in addition to the sorting criteria used in class), and describe several examples of plant adaptation.

Stage 3 — Student work is complete, but may contain minor errors or omissions. Student collects and classifies three plants using three or more attributes (color, size, shape, use, and so on). Drawings are labeled, and show color, size, and shape for several of the plants that were collected and classified. Student describes one way that plants can be organized (in addition to the sorting criteria used in class), and describe at least one plant adaptation.

Stage 2 — Student work is incomplete or incorrect. Student collects at least two plants and attempts to classify them using some plant attributes (color, size, shape, use, and so on). Drawings show color, size, or shape for one plant that was collected. Student may attempt to describe how to organize plants using a new attribute or may repeat a description of the method used in class. Descriptions of plants and plant adaptations may include misconceptions.

Stage 1 — Student work is largely incomplete and incorrect.

Standards Cross-References

National Science Education Standards

Each plant or animal has different structures that serve different functions in growth, survival, and reproduction. For example, humans have distinct body structures for walking, holding, seeing, and talking. (Page 129)

Plants and animals have life cycles that include being born, developing into adults, reproducing, and eventually dying. The details of this life cycle are different for different organisms (Page 129)

Benchmarks

Some animals and plants are alike in the way they look and in the things they do, and others are very different from one another (Page 102)

Plants and animals have features that help them live in different environments (Page 102)

Stories sometimes give plants and animals attributes they really do not have (Page 102)

Alaska Science Key Element A13

A student who meets the content standard should understand the theory of natural selection as an explanation for evidence of changes in life forms over time (Evolution and Natural Selection).

Performance Standard Level 1, Ages 5–7

Students describe organisms that once lived on Earth, but have completely disappeared.

Sample Assessment Ideas

- Students list three animals that no longer exist on Earth and three animals that now exist.
- Students watch a movie about prehistoric times. Pick out three things that are not true about our Earth today.

Expanded Sample Assessment Idea

- Students use an assortment of pictures or toys, to separate animals that no longer live on Earth from those animals that are now living on Earth.

Procedure

Students will:

1. Study pictures or toys of animals (some that currently live on Earth and some that no longer live on Earth).
2. In a group, sort the animals into those currently living on Earth and those no longer living on Earth.
3. Individually sort a subset of 5 animal pictures or toys into groups of those currently living on Earth and those no longer living on Earth; make a poster using the animal pictures; discuss why they choose to put the animals in each category.

Reflection and Revision

Given 4–5 new animal pictures or toys, how do you decide where they should be placed in the poster?

Level of Performance

Stage 4 — Student successfully sorts the animal pictures and the new set of animals.

Stage 3 — Student successfully sorts most of the animal pictures and the new set of animals.

Stage 2 — Student has limited success sorting the animal pictures or the new set of animals.

Stage 1 — Student has difficulty sorting animals pictures and new animals and most are incorrectly sorted.

Standards Cross-References

National Science Education Standards

An organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations (Page 129)

Benchmarks

Different plants and animals have external features that help them thrive in different kinds of places. (Page 123)

Some kinds of organisms that once lived on Earth have completely disappeared, although they were something like others that are alive today. (Page 123)

Alaska Science Key Element A14a

A student who meets the content standard should understand the interdependence between living things and their environments (Interdependence).

Performance Standard Level 1, Ages 5–7

Students identify those things which plants and animals need in order to survive and reproduce.

Sample Assessment Ideas

- Students bring pictures of their favorite local animals to class; draw pictures of different types of foods that those animals eat and places where those animals live.
- Students tell what would happen if a caribou was moved to the desert, or if a crocodile was moved to the Arctic.

Expanded Sample Assessment Idea

- Students collect pictures of the types of birds found in the local area; identify the foods eaten by these birds; group birds according to diet.

Procedure

Students will:

1. Collect pictures of at least three types of birds found in the local area.
2. Discover the types of food used by each bird through observation, reading, and discussion with parents and Elders.
3. Discuss types of food eaten by each bird.
4. In student groups of four, classify the birds according to diet using a Venn diagram.
5. As a class, discuss how the diets are different. Do these birds vary their diets according to season?

Reflection and Revision

What happens to this bird when the food becomes scarce?

Level of Performance

Stage 4 — Student work is complete, correct, detailed, and shows evidence of logical reasoning. Student demonstrates ability to group all of the birds according to diet and describe birds and their foods in great detail.

Stage 3 — Student work is complete, although minor inaccuracies may be present. Student demonstrates ability to group most of the birds according to diet and describe birds and food lists in some detail.

Stage 2 — Student work may be incomplete, show evidence of misconceptions or contain errors in science fact and reasoning. Descriptions of birds and food list are limited and student has difficulty grouping birds.

Stage 1 — Student work is largely incomplete, incorrect, shows little evidence of understanding and may contain major misconceptions.

Standards Cross-References

National Science Education Standards

Organisms have basic needs For example, animals need air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met. The world has many different environments, and distinct environments support the life of different types of organisms. (Page 129)

All animals depend on plants Some animals eat plants for food. Other animals eat animals that eat the plants (Page 129)

Resources are things that we get from the living and non-living environment to meet the needs and wants of a population. (Page 140)

Some resources are basic materials, such as air, water, and soil: some are produced from basic resources, such as food, fuel, and building materials; and some resources are non-material, such as quiet places, beauty, security, and safety. (Page 140)

The supply of many resources is limited. If used, resources can be extended through recycling and decreased use (Page 140)

Benchmarks

Animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting. (Page 116)

Living things are found almost everywhere in the world. There are somewhat different kinds in different places (Page 116)

Alaska Science Key Element A14b

A student who meets the content standard should understand that the living environment consists of individuals, populations, and communities (Interdependence).

Performance Standard Level 1, Ages 5–7

Students identify local animals that live together in groups

Sample Assessment Ideas

- Students describe the interactions within a population of local animals during mating season.
- Students brainstorm a list of animals that live in groups.

Expanded Sample Assessment Idea

- Students make a classroom bulletin board of local animals that live in groups

Procedure

Students will:

1. Identify different local animals that live in groups; discuss the type of group the animals live in (for example, female groups, mixed groups, groups with leaders, and so on). Collect pictures (from photographs, magazine, Internet) of these animals.
2. Post pictures on bulletin board to form groups of animals.

Reflection and Revision

How does living in a group affect the animal? Does this animal live in a group all the time? Do both sexes of these animals live in the group? Does the group have a leader? Group the animals you have studied in a Venn diagram.

Level of Performance

Stage 4 — Student collects multiple animal pictures and correctly identifies the animals and different group types

Stage 3 — Student collects multiple animal pictures and correctly identifies most of the animals.

Stage 2 — Student may collect multiple animal pictures but correctly identifies only one or two animals

Stage 1 — Student may collect an animal picture and identify it.

Standards Cross-References

National Science Education Standards

Human populations include groups of individuals living in a particular location. One important characteristic of a human population is the population density-the number of individuals of a particular population that lives in a given amount of space. (Page 140)

The size of a human population can increase or decrease. Populations will increase unless other factors such as disease or famine decreases the population. (Page 140)

Benchmarks

Animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting. (Page 116)

Living things are found almost everywhere in the world. There are somewhat different kinds in different places. (Page 116)

Alaska Science Key Element A14c

A student who meets the content standard should understand that a small change in a portion of an environment may affect the entire environment (Interdependence).

Performance Standard Level 1, Ages 5–7

Students listen to a story (from the past or present) that describes how a shortage or surplus of resources affects the survival of plants and animals.

Sample Assessment Ideas

- Students invite a parent or Elder to tell the class about the worst winter they have experienced, and the affect it had on local wildlife and plants
- Students describe the competing interests, both human and wildlife, during the local berry harvest.

Standards Cross-References

National Science Education Standards

An organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations (Page 129)

All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organism or other organisms, whereas others are beneficial. (Page 129)

Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad. Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans (Page 140)

Benchmarks

Animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting. (Page 116)

Living things are found almost everywhere in the world. There are somewhat different kinds in different places. (Page 116)

Alaska Science Key Element A15

A student who meets the content standard should use science to understand and describe the local environment (Local Knowledge).

Performance Standard Level 1, Ages 5–7

Students identify local landforms and resources

Sample Assessment Ideas

- Students name local landforms and landmarks (mountains, river systems).
- Students make a bulletin board or poster identifying local plants, animals, and the locations where they can be found.
- Students construct landforms out of clay or paper maché.

Standards Cross-References

National Science Education Standards

Organisms have basic needs. For example, animals need air, water, and food; plants require air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met. The world has many different environments, and distinct environments support the life of different types of organisms. (Page 129)

Plants and animals have life cycles that include being born, developing into adults, reproducing, and eventually dying. The details of this life cycle are different for different organisms. (Page 129)

All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants. (Page 129)

Earth materials are solid rocks and soils, water, and the gases of the atmosphere. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials, as sources of fuel, or for growing the plants we use as food. Earth materials provide many of the resources that humans use. (Page 134)

Weather changes from day to day and over the seasons. Weather can be described by measurable quantities, such as temperature, wind direction and speed, and precipitation. (Page 134)

Resources are things that we get from the living and nonliving environment to meet the needs and wants of a population. (Page 140)

Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad. Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans. (Page 140)

Benchmarks

Some events in nature have a repeating pattern. The weather changes some from day to day, but things such as temperature and rain (or snow) tend to be high, low, or medium in the same months every year. (Page 67)

Water can be a liquid or a solid and can go back and forth from one form to the other. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing. (Page 67)

Chunks of rocks come in many sizes and shapes, from boulders to grains of sand and even smaller. (Page 72)

Change is something that happens to many things. (Page 72)

Animals and plants sometimes cause changes in their surroundings. (Page 72)

Some animals and plants are alike in the way they look and in the things they do, and others are very different from one another. (Page 102)

Plants and animals have features that help them live in different environments (Page 102)

Stories sometimes give plants and animals attributes they really do not have (Page 102)

There is variation among individuals of one kind within a population. (Page 107)

Animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting. (Page 116)

Alaska Science Key Element A16

A student who meets the content standard should understand basic concepts about the theory of relativity, which changed the view of the universe by uniting matter and energy and by linking time with space (Relativity).

Performance Standard Level 1, Ages 5–7

There is no performance standard at this level.

Alaska Science Content Standard B

Level 1, Ages 5–7

A student should possess and understand the skills of scientific inquiry.

Alaska Science Key Element B1

A student who meets the content standard should use the processes of science; these processes include observing, classifying, measuring, interpreting data, inferring, communicating, controlling variables, developing models and theories, hypothesizing, predicting, and experimenting.

Performance Standard Level 1, Ages 5–7

Students observe and describe their world.

Sample Assessment Ideas

- Students closely observe an object (rock, flower, animal) closely with as many of the five senses as appropriate; list characteristics observed with each sense
- Students observe and predict sunrise from a specific site (for example; classroom window, playground) and chart data daily.

Expanded Sample Assessment Idea

- Students use a "teacher-created" scoring guide to classify a group for rocks and tell why the rocks were grouped in that manner

Procedure

Students will:

1. Collect rocks at home and school.
2. Divide into groups of two to three; take a group of 8–12 rocks and classify them by criteria of their groups choosing. This could include color, size, shape, texture, use, etc. Groups will share with each other the ways they classified the rocks. Each group will then go back and create a different way to classify their rocks. Each group should guess the other groups' new classification.
3. Draw how their group classified a rock for their choice and include details like color, shape, and size.
4. Discuss volunteers' pictures in circle group.

Reflection and Revision

Use comments about pictures and redraw their rock classification.

Level of Performance

Stage 4 — Student work is correct, complete, and appropriate. Student work includes detailed explanations of their two classification systems. There is no evidence of misconceptions or inaccurate descriptions; drawings have accurate colors and realistic size.

Stage 3 — Student work is generally correct, complete, and appropriate including two classification systems of rocks. Student explanations of classification systems are accurate. Drawings may show a few inaccuracies or unrealistic descriptions for the actual rocks.

Stage 2 — Student classifications are mostly appropriate, but there may be some misconceptions. Student cannot explain classifications. Drawings are incomplete. There is little evidence of elaboration or extensions.

Stage 1 — Student did not complete classifications and could not tell why. No drawings completed. There is no evidence of elaboration or extensions. There is evidence of misconceptions.

Standards Cross-References

National Science Education Standards

Employ simple equipment and tools to gather data and extend the senses In early years, students develop simple skills, such as how to observe, measure, cut, connect, switch, turn on and off, pour, hold, tie, and hook. Beginning with simple instruments, students can use rulers to measure the length, height, and depth of objects and materials; thermometers to measure temperature; watches to measure time; beam balances and spring scales to measure weight and force; magnifiers to observe objects and organisms; and microscopes to observe the finer details of plants, animals, rocks, and other materials. Children also develop skills in the use of computers and calculators for conducting investigations. (Page 122)

Use data to construct a reasonable explanation. This aspect of the standard emphasizes the students' thinking as they use data to formulate explanations. Even at the earliest grade levels, students should learn what constitutes evidence and judge the merits or strength of the data and information that will be used to make explanations. After students propose an explanation, they will appeal to the knowledge and evidence they obtained to support their explanations. Students should check their explanations against scientific knowledge, experiences, and observations of others. (Page 122)

Communicate investigations and explanations. Students should begin developing the abilities to communicate, critique, and analyze their work and the work of other students. This communication might be spoken or drawn as well as written. (Page 122)

Simple instruments such as magnifiers, thermometers, and rulers provide more information than scientists obtain using only their senses. (Page 123)

Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations. (Page 123)

Benchmarks

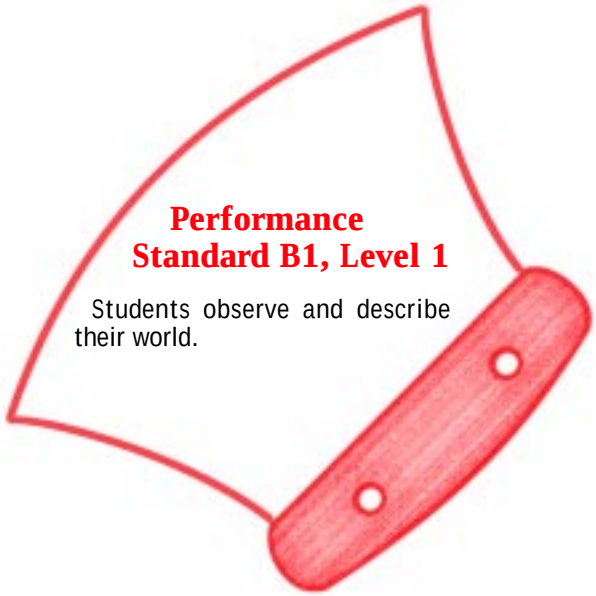
People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens. (Page 10)

Tools such as thermometers, magnifiers, rulers, or balances often give more information about things than can be obtained just by observing things without their help. (Page 10)

Describing things as accurately as possible is important in science because it enables people to compare their observations with those of others. (Page 10)

Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same question. (Page 298)

Mini-Unit: Rock On



Performance Standard B1, Level 1

Students observe and describe their world.

Alaska Science Content Standard Key Element

A student who meets the content standard should use the processes of science; these processes include observing, classifying, measuring, interpreting data, inferring, communicating, controlling variables, developing models and theories, hypothesizing, predicting, and experimenting.

Cross-Reference

Additional Content and Performance Standards: A7, Geography E1, Math A2, E2, E3.
Cultural Standards: D1, D5

Key Concepts and Skills

- There are similarities and differences in nature.
- Measurement can be done in a variety of ways.
- Students can use the processes of science including observation, classification, measurement, and prediction.
- Rocks come in many sizes and shapes

Timeline

This can take place over two or three weeks.

Abstract

Students observe and measure rocks in order to classify and infer usage from their characteristics

Materials

- ✔ Collection of rocks (local, purchased, or AMEREF Minerals Kit)
- ✔ Assorted materials to use when designing tools
- ✔ Equal-arm balances
- ✔ Chart paper
- ✔ Markers
- ✔ Graph paper (1" squares)
- ✔ Yarn or hoops
- ✔ Small plastic bears, unifix or wooden cubes, tiles, etc.
- ✔ White paper
- ✔ Hand lens or magnifiers

Activities

1

Teacher brings in a box of assorted rocks. Students play "20 Questions" about the contents of the box. After contents are guessed, the rocks are distributed among students and they observe the rocks using their eyes, hands, lenses or magnifiers. Ask students such things as how are they alike, how are they different, what words would you use to describe the rocks? Record responses on chart paper for class to see. Place rocks in a science center in the classroom.

2

Teacher has whole class gather around and places 16–20 assorted rocks in a pile on a piece of paper. Have a student choose an attribute such as small. Move all the small rocks into a pile, label it small, and draw a circle around it. Place the other rocks in a pile, draw a circle around it and label it not small. Keep dividing the piles using properties (shiny, not shiny; rough, not rough; heavy not heavy) until you have used all the rocks you started with. Give each student group (three to four students) 16–20 rocks. Ask them to create their own classification system. *This is an example of binary classification. (*As students are grouping their rocks, the teacher walks around with a checklist to assess how students are doing with their classifying skills. Any type of classification should be accepted as long as the student can justify it.)

3

Ask a student to choose 10 rocks that have several attributes and bring them from the science center to a place that has a Venn diagram set up (a Venn diagram can be created by using yarn or plastic hoops). Students gather around and together they will choose two rules to sort the rocks (like big and jagged). Write the rules on a folded piece of paper that can be placed in the circles. Students decide where to place the 10 rocks according to the rules. Ask students what they notice about the rocks in each circle. Guide them if necessary to the conclusion that some rocks fit both of the rules and should be placed in both circles. Ask how a rock could be in both circles at the same time. If students do not come up with moving the circles, begin to overlap them. Spend some time asking questions that lead to student understanding of the "intersection" of both circles. When students have an understanding, ask them to place the rocks according to the chosen rules. Repeat

this again and again choosing different attributes to use in sorting. (This is another opportunity for teachers to do a short check to find out at what level students can use a Venn diagram.)

"The edge of the rock look like a hill with a little valley."
C.B.

4

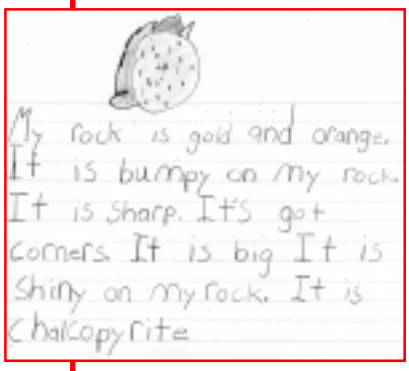
Students will look at specific attributes of rocks and use them to sequence the rocks (e.g., lightest to darkest; smallest to largest). Students begin with three rocks and then work up to using five rocks. Students use a gold dredge worksheet like the one below to draw their rock sequence

5

Give students graph paper with at least one-inch squares. Tell them to choose a rock and place it on the paper. Ask students how many squares big their rock is. Students choose three more rocks to repeat the procedure

6

Choose two or three students to come up in front of the class and hold two different size rocks. Ask which rock is heavier? How they can tell? Ask the students if they know of other ways to measure how much things weigh. (Hopefully they will come up with using balances). Provide students with an equal-arm balance and cubes, bears, tiles, etc., that they can measure. Students will weigh three to five different items and record their findings



J.A. describes her rock, using three attributes

7

Brainstorm ways that rocks could be used by people and animals. Chart the ideas given by the students. Invite community people to come into the classroom to discuss traditional uses of rocks (e.g., communication, tools, fishing, hunting, etc). Using their knowledge of rock characteristics, students investigate and design a tool using a rock. Display student work.

Expanded Sample Assessment Idea

Procedure

Students will:

1. Collect rocks at home and school.
2. Divide into groups of two to three; take a group of 8–12 rocks and classify them by criteria of their group's choosing. This could include color, size, shape, texture, use, and so on. Groups will share with each other the ways they classified the rocks. Each group will then go back and create a different way to classify their rocks. Each group should guess the other groups' new classification.
3. Draw how their group classified a rock of their choice and include details like color, shape, and size.
4. Discuss volunteers' pictures in circle group.

Reflection and Revision

Use comments about pictures and redraw their rock classification.

Level of Performance

Stage 4 Student work is correct, complete and appropriate. Student work includes detailed explanations of their two classification systems, and are detailed. There is no evidence of misconceptions or inaccurate descriptions; drawings have accurate colors and realistic size

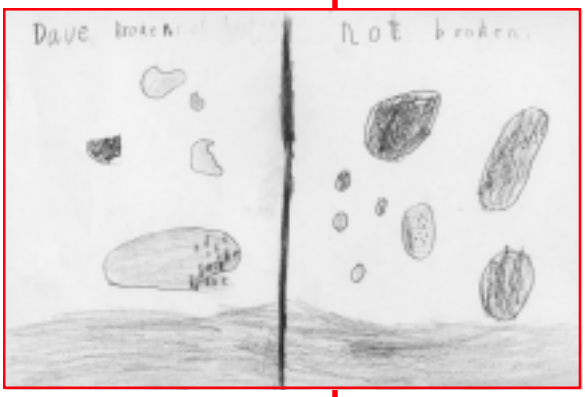
Stage 3 Student work is generally correct, complete, and appropriate including two classification systems of rocks. Student explanations of classification systems are accurate. Drawings may show a few inaccuracies or unrealistic descriptions of the actual rocks.

Stage 2 Student classifications are mostly appropriate, but there may be some misconceptions. Student could not explain classifications. Drawings are incomplete. There is little evidence of elaboration or extensions.

Stage 1 Student did not complete classifications and could not tell why. No drawings completed. There is no evidence of elaboration or extensions. There is evidence of misconceptions.

Standards Cross-References

National Science Education Standards



Employ simple equipment and tools to gather data and extend the senses. In early years, students develop simple skills, such as how to observe, measure, cut, connect, switch, turn on and off, pour, hold, tie, and hook. Beginning with simple instruments, students can use rulers to measure the length, height, and depth of objects and materials; thermometers to measure temperature; watches to measure time; beam balances and spring scales to measure weight and force; magnifiers to observe objects and organisms; and microscopes to observe the finer details of plants, animals, rocks, and other materials. Children also develop skills in the use of computers and calculators for conducting investigations. (Page 122)

Use data to construct a reasonable explanation. This aspect of the standard emphasizes the students' thinking as they use data to formulate explanations. Even at the earliest grade levels, students should learn what constitutes evidence and judge the merits or strength of the data and information that will be used to make explanations. After students propose an explanation, they will appeal to the knowledge and evidence they obtained to support their explanations. Students should check their explanations against scientific knowledge, experiences, and observations of others. (Page 122)

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Benchmarks

People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens. (Page 10)

Tools such as thermometers, magnifiers, rulers, or balances often give more information about things than can be obtained just by observing things without their help. (Page 10)

Describing things as accurately as possible is important in science because it enables people to compare their observations with those of others. (Page 10)

Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same question. (Page 298)

Alaska Science Key Element B2

A student who meets the content standard will design and conduct scientific investigations using appropriate instruments

Performance Standard Level 1, Ages 5–7

Students use appropriate measuring and observation instruments to explore the natural world around them.

Sample Assessment Ideas

- Students use a magnifying glass to observe an object (e.g., rock, bug, hair, skin, plant); draw a picture to describe how the object looks different compared to viewing with only their eyes
- Students weigh and measure a salmon or other meat before and after smoking in a smokehouse. Compare the data from before and after smoking.

Expanded Sample Assessment Idea

- Students investigate how a change in environment affects a plant's growth. Changes might include amount of light, water, soil type, etc.

Procedure

(Allow four weeks.)

Students will:

1. Each receive a newly potted plant.
2. Divide into three groups: Group 1 will water their plants one day per week. Group 2 will water their plants two days per week. Group 3 will water their plants three days per week (each group will use the same amount of water).
3. Record daily observations (amount of water added, changes in appearance, and measurements of height or diameter).
4. Develop their thoughts as to how and why their plants grew the way they did.
5. Make graphs comparing growth rates
6. Make predictions about what is needed to grow healthy plants.
7. Discuss what instruments they used for measuring the amount of light, water and plant growth. Discuss differences between the groups

Reflection and Revision

Record the optimum conditions for growing plants in their science journal.

Level of Performance

Stage 4 — Student work is complete, correct, and shows higher-order thinking skills and relevant knowledge. Measurements are accurate, instruments are chosen without teacher prompt and are used appropriately.

Stage 3 — Student work is generally complete and correct. Measurements are accurate and instruments are used appropriately. There may be some evidence of misconceptions or discrepancies between journal entries and actual observations

Stage 2 — Student work is mostly incomplete or incorrect. While an attempt was made to grow plants, measurements and observations are inaccurate or incomplete The student is able to choose correct measuring instruments following teacher prompts.

Stage 1 — Student work is incomplete and incorrect. Attempts to grow plants, if made, do not include measurements or recorded observations

Standards Cross-References

National Science Education Standards

Plan and conduct a simple investigation. In the earliest years, investigations are largely based on systematic observations (Page 122)

Employ simple equipment and tools to gather data and extend the senses. In early years, students develop simple skills, such as how to observe, measure, cut, connect, switch, turn on and off, pour, hold, tie, and hook. Beginning with simple instruments, students can use rulers to measure the length, height, and depth of objects and materials; thermometers to measure temperature; watches to measure time; beam balances and spring scales to measure weight and force; magnifiers to observe objects and organisms; and microscopes to observe the finer details of plants, animals, rocks, and other materials. Children also develop skills in the use of computers and calculators for conducting investigations (Page 122)

Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world. (Page 123)

Simple instruments such as magnifiers, thermometers, and rulers provide more information than scientists can obtain using only their senses (Page 123)

Benchmarks

People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens. (Page 10)

Raise questions about the world around them and be willing to seek answers to some of them by making careful observations and trying things out. (Page 285)

Alaska Science Key Element B3

A student who meets the content standard should understand that scientific inquiry often involves different ways of thinking, curiosity and the exploration of multiple paths.

Performance Standard Level 1, Ages 5–7

Students ask questions about the natural world.

Sample Assessment Ideas

- Students develop "I wonder" statements about snow
- Students generate a list of questions about their local environment to ask a guest scientist or local Elder

Standards Cross-References

National Science Education Standards

Ask a question about objects, organisms, and events in the environment. This aspect of the standard emphasizes students asking questions that they can answer with scientific knowledge, combined with their own observations. Students should answer their questions by seeking information from reliable sources of scientific information and from their own observations and investigations. (Page 122)

Communicate investigations and explanations. Students should begin developing the abilities to communicate, critique, and analyze their work and the work of other students. This communication might be spoken or drawn as well as written. (Page 122)

Benchmarks

When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right. (Page 10)

Raise questions about the world around them and be willing to seek answers to some of them by making careful observations and trying things out. (Page 285)

Alaska Science Key Element B4

A student who meets the content standard should understand that personal integrity, skepticism, openness to new ideas, creativity, collaborative effort, and logical reasoning are all aspects of scientific inquiry.

Performance Standard Level 1, Ages 5–7

Students collaborate to investigate the natural world.

Sample Assessment Ideas

- Students share observations while on a class field trip to investigate local plant and animal life
- Students observe, record, and discuss living and non-living components of their school.

Expanded Sample Assessment Idea

- Students work in groups to predict and test which objects float and which objects sink in water

Procedure

Students will:

1. Divide into small groups
2. Have access to a variety of measuring tools and large container of water with measurements on the side
3. Predict which objects will sink and which will float. Record predictions on a chart paper. Do not change predictions after observations are made.
4. Select items to put into the water one at a time
5. Record whether they sink or float.
6. Make a picture or word chart of the results and share with the whole class
7. As a class, discuss how the groups worked together, what new things they learned, and which charts would best to explain sinking and floating.

Reflection and Revision

Discuss how they would change their work from what they learned from others

Level of Performance

Stage 4 — Student work is complete, correct and shows evidence of elaboration, extension, collaboration and creative incorporation of the ideas of others.

Stage 3 — Student work is generally complete, correct and shows some evidence of elaboration, extension, collaboration or incorporation of the ideas of others.

Stage 2 — Student work may be incomplete or incorrect and shows some evidence of sharing of ideas, but limited evidence of collaboration or incorporation of the ideas of others.

Stage 1 — Student work, although incomplete, is on topic but shows no evidence of collaboration or sharing of ideas.

Standards Cross-References

National Science Education Standards

Ask a question about objects, organisms, and events in the environment. This aspect of the standard emphasizes students asking questions that they can answer with scientific knowledge, combined with their own observations. Students should answer their questions by seeking information from reliable sources of scientific information and from their own observations and investigations. (Page 122)

Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world. (Page 123)

Benchmarks

In doing science, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean. (Page 15)

Raise questions about the world around them and be willing to seek answers to some of them by making careful observations and trying things out. (Page 285)

Alaska Science Key Element B5

A student who meets the content standard should employ ethical standards, including unbiased data collection and factual reporting of results.

Performance Standard Level 1, Ages 5–7

Students differentiate between what they observe with their senses and what they interpret about those observations

Sample Assessment Ideas

- Students touch a dry sock and a wet sock; measure the temperature of each; report on whether or not they are the same temperature; discuss the accuracy of their interpretation.
- Students observe a bird, squirrel, or class pet; make a chart of their observations and interpret their behavior.

Expanded Sample Assessment Idea

- Students identify an object in a black box using only one sense; share observations with other students who used other senses; compare conclusions about the nature of the object using single vs multiple senses to observe

Procedure

Students will:

1. Divide into sensory groups: smell, touch, and hearing.
2. Explore objects (such as seaweed, jerky, mashed berries) using only one sense; no one will see or taste it.
3. Reorganize so that each new group contains a child who used a different sense. Repeat so that each group will have each sense represented.
4. Share the observations, try to identify the object, and differentiate between observations and inferences

Reflection and Revision

Determine what senses provided the most accurate inferences about the identification of the objects

Level of Performance

Stage 4 — Student work is complete, correct and shows evidence of elaboration and extension. Students report detailed observations and inferences and differentiation between the two.

Stage 3 — Student work is generally complete, correct and may show evidence of elaboration and extension. Students report observations and inferences and differentiation between the two though minor errors may be present.

Stage 2 — Student work may be incomplete or incorrect and shows limited evidence of ability to report observations, make inferences or differentiation between the two.

Stage 1 — Student work is mostly incomplete and incorrect. Student makes limited observations or is unable to use observations to identify the object in the black box.

Standards Cross-References

National Science Education Standards

Scientists make the results of their investigations public; they describe the investigations in ways that enable others to repeat the investigations. (Page 123)

Scientists review and ask questions about the results of other scientists' work. (Page 123)

Benchmarks

A lot can be learned about plants and animals by observing them closely, but care must be taken to know the needs of living things and how to provide for them in the classroom. (Page 15)

Alaska Science Key Element B6

A student who meets the content standard should employ strict adherence to safety procedures in conducting scientific investigations

Performance Standard Level 1, Ages 5–7

Students learn classroom safety procedures, identify consequences of unsafe behavior, and practice safe behavior in the classroom and laboratory.

Sample Assessment Ideas

- Students practice safety rules during classroom and laboratory activities
- Students identify features of the classroom that promote safety (eg., fire extinguisher, smoke detectors, no sharp edges, etc.); record observations on chart paper

Standards Cross-References

National Science Education Standards

Safety and security are basic needs of humans. Safety involves freedom from danger, risk, or injury. Security involves feelings of confidence and lack of anxiety and fear. Student understandings include following safety rules for home and school, preventing abuse and neglect, avoiding injury, knowing whom to ask for help, and when and how to say no. (Page 139)

Benchmarks

Choices have consequences, some of which are more serious than others. (Page 165)

Rules at home, at school, and in the community let individuals know what to expect and so can reduce the number of disputes. (Page 172)

Alaska Science Content Standard C

Level 1, Ages 5–7

A student should understand the nature and history of science.

Alaska Science Key Element C1

A student who meets the content standard should know how the words "fact," "observation," "concept," "principle," "law," and "theory" are generally used in the scientific community.

Performance Standard Level 1, Ages 5–7

Students will use observations to collect and identify facts.

Sample Assessment Ideas

- Students observe and record what birds choose from a variety of materials provided for them as potential food sources (e.g. wood chips, bird seed, bread, cotton balls, etc.)
- Students observe that some things around them happen consistently (water flows downhill, heating ice causes it to melt.)

Standards Cross-References

National Science Education Standards

Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations. (Page 123)

Benchmarks

Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same question. (Page 298)

Alaska Science Key Element C2

A student who meets the content standard should understand that scientific knowledge is validated by repeated specific experiments that conclude in similar results

Performance Standard Level 1, Ages 5–7

Students will compare observations and/or repeat observations to check for validity of results.

Sample Assessment Ideas

- Students observe unpainted structures made of wood (e.g., sheds, fences); discuss the occurrence of wood shrinkage.
- Students observe a phenomenon which repeats itself regularly (e.g., dropped ball bounces at a lower height with each successive bounce); compare results with other students for validation.

Standards Cross-References

National Science Education Standards

Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world. (Page 123)

Scientists make the results of their investigations public; they describe the investigations in ways that enable others to repeat the investigations (Page 123)

Scientists review and ask questions about the results for other scientists' work. (Page 123)

Benchmarks

When a science investigation is done the way it was done before, we expect to get a very similar result. (Page 6)

Science investigations generally work the same way in different places (Page 6)

Alaska Science Key Element C3

A student who meets the content standard should understand that society, culture, history, and environment affect the development of scientific knowledge

Performance Standard Level 1, Ages 5–7

Students recite a traditional story describing a scientific event.

Sample Assessment Ideas

- Students recite a traditional story lore describing the breaking up of the ice during spring.
- Students recite a traditional story that explains the salmon runs

Standards Cross-References

National Science Education Standards

Science and technology have been practiced by people for a long time. (Page 141)

Men and women have made a variety of contributions throughout the history of science and technology. (Page 141)

Benchmarks

Everybody can do science and invent things and ideas. (Page 15)

Alaska Science Key Element C4

A student who meets the content standard should understand that some personal and societal beliefs accept non-scientific methods of validating knowledge

Performance Standard Level 1, Ages 5–7

Students observe a phenonmenon and record a personal (non-scientific) belief about that phenomenon.

Sample Assessment Ideas

- Students observe the sky when the sun, moon and stars are not visible and state their opinion regarding what they see
- Students observe animal behavior and state their belief about reasons behind the behavior

Standards Cross-References

National Science Education Standards

People have always had questions about their world. Science is one way of answering questions and explaining the natural world. (Page 138)

Although men and women using scientific inquiry have learned much about the objects, events, and phenomena in nature, much more remains to be understood. Science will never be finished. (Page 141)

Benchmarks

Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same question. (Page 298)

Alaska Science Key Element C5

A student who meets the content standard should understand that sharing scientific discoveries is important to influencing individuals and society and in advancing scientific knowledge.

Performance Standard Level 1, Ages 5–7

Students work together to explore and share scientific discoveries about their environment.

Sample Assessment Ideas

- Students work together in teams to explore the playground environment; look for conditions that support a suitable habitat for living things; collectively share results with the class
- Students teams report on weather observations; as a class make predictions using the class data.

Standards Cross-References

National Science Education Standards

Communicate investigations and explanations. Students should begin developing the abilities to communicate, critique, and analyze their work and the work of other students. This communication might be spoken or drawn as well as written. (Page 122)

Scientists make the results of their investigations public; they describe the investigations in ways that enable others to repeat the investigations. (Page 123)

Scientists review and ask questions about the results for other scientists' work. (Page 123)

Benchmarks

In doing science, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean. (Page 15)

Alaska Science Key Element C6

A student who meets the content standard should understand that scientific discovery is often a combination of an accidental happening and observation by a knowledgeable person with an open mind.

Performance Standard Level 1, Ages 5–7

Students share information about their world that they have learned though observation.

Sample Assessment Ideas

- Students describe how they learned to ride a bike, ride a sled, catch a fish, etc
- Students compare the number of teeth each student has lost.

Standards Cross-References

National Science Education Standards

Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations. (Page 123)

Benchmarks

People can often learn about things around them just by observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens. (Page 10)

Alaska Science Key Element C7

A student who meets the content standard should understand that major scientific breakthroughs may link large amounts of knowledge, build upon the contributions of many scientists, and cross different lines of study.

Performance Standard Level 1, Ages 5–7

Students examine inventions and describe the human efforts required to produce it.

Sample Assessment Ideas

- Students examine a traditional Tlingit halibut hook and modern circular hook; discuss which hook is easier to use to catch plastic fish; discuss how each hook is made
- Students pick a tool or machine from *How Things Work* by David McCauley; report its use to the class

Standards Cross-References

National Science Education Standards

Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world. (Page 123)

People have always had questions about their world. Science is one way of answering questions and explaining the natural world. (Page 138)

Benchmarks

Everybody can do science and invent things and ideas. (Page 15)

Alaska Science Key Element C8

A student who meets the content standard should understand that acceptance of a new idea depends upon supporting evidence and that new ideas that conflict with belief or common sense are often resisted.

Performance Standard Level 1, Ages 5–7

Students observe and discuss phenomena that conflict with common sense

Sample Assessment Ideas

- Students discover the answer to the question "When is a jar full?" Fill a jar with small rocks; ask the question, "Is the jar full?"; add gravel to jar and shake; ask, "Is the jar full?"; repeat process using sand and finally water.
- Students view, predict length, and then measure the true length of various optical illusions

Expanded Sample Assessment Idea

- Students describe their common-sense impressions regarding equal volumes of water placed in differently shaped containers; identify evidence that supports the idea that the volumes of water involved are equal.

Procedure

Students will:

1. Divide into teams
2. Observe containers of different shapes that contain (unbeknownst to them) equal volumes of water.
3. Describe their impressions about which containers contain the most and least water.
4. Arrange containers from perceived largest to smallest volumes of water.
5. Use a measuring container to establish that the volume of water in each container is equal to the volume in any other.
6. Pour the contents of containers back and forth between each other.

Refection and Revision

Discuss the evidence supporting the idea that the volumes of water in all containers were equal.

Level of Performance

Stage 4 — Student participates fully, makes accurate observations, demonstrates mastery of concepts and skills, clearly describes and communicates findings, and relates conclusions to other processes and concepts. Student participates fully in class discussion, clearly describes and communicates findings and concludes the activity without evidence of misconceptions regarding the volume of water.

Stage 3 — Student participates substantially, makes largely accurate observations, understands the concepts and skills, and effectively describes and communicates findings and conclusions. Student participates in class discussion, describes and communicates findings but may conclude the activity with minor misconceptions regarding the volume of water.

Stage 2 — Student participates, makes observations, grasps the concepts and skills, and attempts to describe and communicate findings and conclusions. Student is a reluctant participant in class

discussion and although an attempt is made to describe the findings, the student concludes the activity with misconceptions regarding the volume of water.

Stage 1 — Student minimally participates, gives inaccurate observations, does not grasp the concepts and skills. Student does not participate in class discussion or describe the findings and concludes the activity with major misconceptions regarding the volume of water.

Standards Cross-References

National Science Education Standards

Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations. (Page 123)

Benchmarks

When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right. (Page 10)

Alaska Science Content Standard D

Level 1, Ages 5–7

A student should be able to apply scientific knowledge and skills to make reasoned decisions about the use of science and scientific innovations.

Alaska Science Key Element D1

A student who meets the content standard should apply scientific knowledge and skills to understand issues and everyday events

Performance Standard Level 1, Ages 5–7

Students use science knowledge to describe everyday events

Sample Assessment Ideas

- Students tell why it is easier to make snowballs in the spring than in the winter
- Each student observes where the snow remains on the playground in the spring; give possible scientific explanations as to why the snow is still there.

Expanded Sample Assessment Idea

- Students test three sleds to determine which travels the greatest distance

Procedure

Students will:

1. Hold the sled at the top of an incline, another student rides the sled, and a third student at the bottom of the hill measures the distance. The same student should ride the sled for each trip down the incline.
2. Measure, record and graph the distance traveled by the sled. Repeat experiment with each sled.
3. Use simplified language to discuss friction, motion and force.
4. Relate this activity to another similar activity, such as sliding down the playground slide, and so on.

Reflection and Revision

Discuss factors other than the sled design that would increase the distance traveled by the sled. Repeat experiment using these factors.

Level of Performance

Stage 4
Student work is complete, correct, and contains evidence of elaboration, extension, higher order thinking skills, and relevant knowledge. Student actively participates with group to perform an accurate test that considers several factors that may affect the distance traveled by the sled.

Stage 3
Student work is generally complete and correct but may contain evidence of some inaccuracies or omissions. Student participates with group to perform an accurate test to determine the distance traveled by the sled. Multiple factors are not considered.

Stage 2
Student work may be incomplete or inaccurate. Student may be a reluctant group participant. The test may include three types of sleds but does not control the variables or make accurate measurements.

Stage 1
Student work is incomplete and inaccurate. Student does not participate in group task or participates in group sledding adventure rather than testing the sleds.

Standards Cross-References

National Science Education Standards

Use data to construct a reasonable explanation. This aspect of the standard emphasizes the students' thinking as they use data to formulate explanations. Even at the earliest grade levels, students should learn what constitutes evidence and judge the merits or strengths of the data and information that will be used to make explanations. After students propose an explanation, they will appeal to the knowledge and evidence they obtained to support their explanations. Students should check their explanations against scientific knowledge, experiences, and observations of others. (Page 122)

People have always had questions about their world. Science is one way of answering questions and explaining the natural world. (Page 138)

Some objects occur in nature; others have been designed and made by people to solve human problems and enhance the quality of life. (Page 138)

Benchmarks

People can often learn about things around them just by observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens. (Page 10)

Alaska Science Key Element D2

A student who meets the content standard should understand that scientific innovations may affect our economy, safety, environment, health, and society and that these effects may be short-term or long-term, positive or negative, and expected or unexpected.

Performance Standard Level 1, Ages 5–7

Students role-play and discuss the positive and negative consequences of a single scientific or technological event.

Sample Assessment Ideas

- Students role-play a small community where only one family has an automobile.
- Students discuss the positive and negative effects of mosquito repellent.

Standards Cross-References

National Science Education Standards

People have always had problems and invented tools and techniques (ways of doing something) to solve problems. Trying to determine the effects of solutions helps people avoid some new problems (Page 138)

People continue inventing new ways of doing things, solving problems, and getting work done. New ideas and inventions often affect other people; sometimes the effects are good and sometimes they are bad. It is helpful to try to determine in advance how ideas and inventions will affect other people. (Page 140)

Science and technology have greatly improved food quality and quantity, transportation, health, sanitation, and communication. These benefits of science and technology are not available to all of the people in the world. (Page 141)

Benchmarks

Tools are used to do things better or more easily and to do some things that could not otherwise be done at all. In technology, tools are used to observe, measure, and make things. (Page 44)

People, alone or in groups, are always inventing new ways to solve problems and get work done. The tools and ways of doing things that people have invented affect all aspects of life. (Page 54)

Alaska Science Key Element D3

A student who meets the content standard should recommend solutions to everyday problems by applying scientific knowledge and skills.

Performance Standard Level 1, Ages 5–7

Students propose and discuss solutions to simple problems.

Sample Assessment Ideas

- Students discuss possible solutions to reduce the mud brought into the classroom during the spring.
- Students propose ways to prevent a snowball brought in from the playground from melting.

Standards Cross-References

National Science Education Standards

People have always had questions about their world. Science is one way of answering questions and explaining the natural world. (Page 138)

Identify a simple problem. In problem identification, children should develop the ability to explain a problem in their own words and identify a specific task and solution related to the problem. (Page 137)

Propose a solution. Students should make proposals to build something or get something to work better; they should be able to describe and communicate their ideas. Students should recognize that designing a solution might have constraints, such as cost, materials, time, space, or safety. (Page 137)

Benchmarks

People, alone or in groups, are always inventing new ways to solve problems and get work done. The tools and ways of doing things that people have invented affect all aspects of life. (Page 54)

Alaska Science Key Element D4

A student who meets the content standard should evaluate the scientific and social merits of solutions to everyday problems

Performance Standard Level 1, Ages 5–7

Students describe simple technology used in everyday life.

Sample Assessment Ideas

- Students evaluate the effectiveness of different ways to keep their coats closed (e.g., Velcro, zipper, snaps, ties, etc.); chart their observations.
- Students describe ways to get to school (e.g., bus, bicycle, car, sled, etc.); chart their effectiveness.

Standards Cross-References

National Science Education Standards

Evaluate a product or design. Students should evaluate their own results or solutions to problems, as well as those of other children, by considering how well a product or design met the challenge to solve a problem. When possible, students should use measurements and include constraints and other criteria in their evaluations. They should modify designs based on the results of evaluations. (Page 137)

People have always had problems and invented tools and techniques (ways of doing something) to solve problems. Trying to determine the effects of solutions helps people avoid some new problems. (Page 138)

Tools help scientists make better observations, measurements, and equipment for investigations. Tools help scientists see, measure, and do things that they could not otherwise see, measure, and do. (Page 138)

People continue inventing new ways of doing things, solving problems, and getting work done. New ideas and inventions often affect other people; sometimes the effects are good and sometimes they are bad. It is helpful to try to determine in advance how ideas and inventions will affect other people. (Page 140)

Science and technology have greatly improved food quality and quantity, transportation, health, sanitation, and communication. These benefits of science and technology are not available to all of the people in the world. (Page 141)

Benchmarks

People, alone or in groups, are always inventing new ways to solve problems and get work done. The tools and ways of doing things that people have invented affect all aspects of life. (Page 54)

When a group of people wants to build something or try something new, they should try to figure out ahead of time how it might affect other people. (Page 54)

Alaska Science Key Element D5

A student who meets the content standard should participate in reasoned discussions of public policy related to scientific innovation and proposed technological solutions to problems.

Performance Standard Level 1, Ages 5–7

Students discuss how tools are used to observe, measure, and make things that help us.

Sample Assessment Idea

- Students describe a tool that they use: what the important characteristics the tool must have; what different jobs the tool can be used for; why each tool is best at doing its job; why different materials are used to make each part of the tool; what are some tools they use at home; their parents use at home; used every day; used only in one season; only used in the morning or evening.
- Students discuss their preferences using a spoon or a fork to eat peas.

Standards Cross-References

National Science Education Standards

People have always had problems and invented tools and techniques (ways of doing something) to solve problems. Trying to determine the effects of solutions helps people avoid some new problems. (Page 138)

People continue inventing new ways of doing things, solving problems, and getting work done. New ideas and inventions often affect other people; sometimes the effects are good and sometimes they are bad. It is helpful to try to determine in advance how ideas and inventions will affect other people. (Page 140)

Benchmarks

When a group of people wants to build something or try something new, they should try to figure out ahead of time how it might affect other people. (Page 54)

Alaska Science Key Element D6

A student who meets the content standard should act upon reasoned decisions and evaluate the effectiveness of the action.

Performance Standard Level 1, Ages 5–7

Students retell examples of consequences that have resulted from their actions.

Sample Assessment Ideas

- Students discuss why or why not to put their tongues on the metal playground equipment during the winter.
- Students discuss why they wear hats and mittens or gloves outside during cold weather. Discuss their past experience.

Standards Cross-References

National Science Education Standards

People continue inventing new ways of doing things, solving problems, and getting work done. New ideas and inventions often affect other people; sometimes the effects are good and sometimes they are bad. It is helpful to try to determine in advance how ideas and inventions will affect other people. (Page 140)

Humans depend on their natural and constructed environments. Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms. (Page 129)

Benchmarks

People, alone or in groups, are always inventing new ways to solve problems and get work done. The tools and ways of doing things that people have invented affect all aspects of life. (Page 54)

When a group of people wants to build something or try something new, they should try to figure out ahead of time how it might affect other people. (Page 54)